2024
ICCT

2024 International Conference on Clothing and Textiles

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Circular Economy:
Fashion Forward to Resilient Future

Date	· May 10 - 11, 2024
Venue	· International Convention Center, Jeju, Republic of Korea / On-Offline Hybrid

Host	· The Korean Society of Clothing and Textiles
Co-hosts	· The Japan Research Association for Textile End-Uses
	· Korea Federation of Textile Industries

Organizer	· Jeju National University
Co-organizers	· Human Ecology Research Center, Korea University
	· BK21 Education-Research Innovation Program for Human-Centered Technology, Hanyang University
	· College of Human Ecology, Seoul National University

Sponsors	· The Korean Federation of Science and Technology Societies
	· Korean Studies Information
	· Jeju Free International City Development Center
	· LG Electronics Inc.
	· Virtual Engineering Service Platform by DYETEC Institute
	· Korea Textile Trade Association
	· Jeju Special Self-Governing Province Development Corporation
	· Global Sae-A

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www.icct2024.org

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Welcome Address

Dear Members of the Korean Society of Clothing and Textiles (KSCT),

I am pleased to extend a warm invitation to you for the 2024 International Conference on Clothing and Textiles (ICCT), set to unfold on Jeju Island, Republic of Korea, on May 10-11. This year, we embrace the forward-thinking theme "Circular Economy: Fashion Forward to Resilient Future," a vital discourse that underscores the importance of sustainability and resource efficiency in shaping the future of fashion and textiles. The conference will kick off with an online joint symposium titled "Circular Fashion and Textile Science," in collaboration with the Japan Textile Consumption Society. This marks the continuation of our valued partnership with JRATEU, building on the foundations laid during our 2022 symposium. It's a testament to our commitment to fostering international collaboration and exchanging pioneering ideas within our community.

Following the symposium, we will feature the Graduate Student Research Competition, an established platform where emerging scholars present their cutting-edge research. The day will also include mentoring sessions aimed at guiding both students and young professionals as they navigate the pathways of their academic and industry careers.

The agenda for the second day is packed with compelling talks and presentations. We are honored to have three distinguished keynote speakers: Dr. Jung Ha-Brookshire, President of the International Textiles and Apparel Association; Dr. Huantian Cao, Professor in Textile Sciences at the University of Delaware; and Dr. Sandy Black, Professor at the London College of Fashion. They will offer their insights on the evolving dynamics of the textile and fashion sectors. Additionally, esteemed experts including Dr. Paloma Diaz Soloaga (Spain), Dr. Tracy Mok (Hong Kong), Dr. Anne-Marie Grundmeier (Germany), and Dr. Hang Liu (USA) will share the latest research trends, enriching our understanding and sparking innovative discussions.

The conference will also showcase poster presentations, oral research sessions, and special topic discussions, featuring a selection of significant studies, including the FTEX Best Papers.

I encourage you to take advantage of the networking opportunities at the conference, beginning with the pre-conference tour that delves into eco-dyeing techniques, followed by the welcome dinner. These events serve as the perfect backdrop for engaging discussions and forging meaningful connections within our dynamic community.

Your active participation is crucial to the success of ICCT 2024. This conference is not just a gathering of minds but a confluence of ideas, innovations, and collaborations that will drive the advancement of our field. I am confident that together, we can make a significant impact on the academic landscape and the future of the textile and fashion industries.

I eagerly await the opportunity to welcome you in person to Jeju Island for an event that promises to be both enlightening and inspiring. Let's come together to share, learn, and shape the future of our industry.

Warm regards,

Yoon-Jung Lee, Ph.D.
President, The Korean Society of Clothing and Textiles

Welcome Address
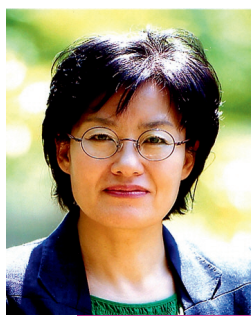
Dear participants of the 2024 ICCT from abroad and members of KSCT,

It is our honor to invite you to the 2024 International Conference on Clothing and Textiles (ICCT) hosted by the Korean Society of Clothing and Textiles (KSCT) in Jeju, which is known for effective eco-friendly business infrastructure.

The KSCT considers the urgent need for active discussion on effective strategies to transform the linear system of the fashion and textile industries to the circular system. The 2024 ICCT, with the theme of "Circular Economy: Fashion Forward to Resilient Future", will provide an invaluable opportunity to discuss innovative ideas and creative solutions to key issues of sustainable healthy growth of fashion and textile industries.

We are grateful for our keynote speakers (Dr. Jung Ha-Brookshire, Dr. Huantian Cao, and Professor Sandy Black) and guest lecturers who agreed to share their perspectives and insights into novel approaches and breakthroughs toward blueprint of resilient and sustainable fashion and textiles. They will discuss global and country-specific challenges, and opportunities which will inspire the conference participants to brainstorm solutions to issues of linear system of fashion and textile industries.

The research presentations which were selected through the rigorous review procedure, and a joint symposium with the Japan Research Association for Textile End-Uses, special topic sessions, concurrent sessions, and poster sessions, will allow the conference participants from 12 countries to build synergistic scholarly network and discuss possible solutions for resilient and healthy growth of the global fashion and textile industries.

Also, researchers from LG Electronics Inc., and Dyetec Inc. will present the research outcomes from their collaborations with academia through poster presentations and special exhibitions. Graduate student research competition, online presentations of best papers selected from publications in *the Fashion and Textiles,* and young scholar mentoring program will also foster information exchange by sharing impactful research achievements and new discoveries.

With confidence in the 2024 ICCT's potential to cultivate impactful synergy in the realm of sustainable fashion and textiles, we extend our heartfelt gratitude to the sponsors, members of the 2024 ICCT organizing committee, board members of KSCT, and research presenters who enthusiastically supported and contributed to the successful hosting of the event. We look forward to seeing you at the 2024 ICCT in Jeju from May 10th to May 11th, 2024.

Wecome and thank you for your active participation.

Sincerely,

Heesook Hong (Ph.D.), Heekang Moon (Ph.D.) & Heeju Park (Ph.D.)
Co-chairs, Organizing Committee of 2024 ICCT
The Korean Society of Clothing and Textiles

Congratulatory Address

Warm greetings from Jeju National University! I would like to extend my heartfelt congratulations on the opening of the 2024 International Conference on Clothing and Textiles (ICCT) organized by the Korean Society of Clothing and Textiles (KSCT)! It is my privilege to welcome esteemed professionals and leading scholars in the fields of fashion and textiles to Jeju.

I hope that the 2024 ICCT could establish a meaningful research network for all participants including researchers from overseas, members of the KSCT, and Jeju National University. Considering the increasing discussions on the idea of carbon net zero, the 2024 ICCT with the theme of "Circular Economy" will provide opportunities to brainstorm and discuss the strategies to overcome challenges that the fashion and textile industries are facing today. This in turn will enable the world to move forward to a more resilient and sustainable future. I believe that the 2024 ICCT will also create positive impacts on active collaboration for synergistic research and development through information exchange and professional networking.

In particular, I am pleased that the 2024 ICCT is being held in Jeju, as Jeju has rich natural resources including the UNESCO world natural heritage sites. Jeju has been known for its clean environment and eco-friendly business practices, which are strong Jeju potentials to grow as the icon and global hub of a successful circular economy with growing opportunities for new businesses in the near future. I hope that the 2024 ICCT could facilitate collaborative efforts which could be applied to unique cultural merits and abundant natural resources in Jeju for innovative research and development in fashion and textiles.

I would like to thank Dr. Yoon-Jung Lee (President of the KSCT), Dr. Heesook Hong, Dr. Heekang Moon, and Dr. Heeju Park (Co-chairs of Organizing Committee of 2024 ICCT), members of the KSCT, as well as all invited speakers and sponsors. I trust that this conference will be a great success. Thank you for your contribution to the 2024 ICCT!

Sincerely,

Eel-hwan Kim (Ph.D.)
President of Jeju National University

Congratulatory Address

I would like to congratulate members of the Korean Society of Clothing and Textiles and the conference participants on the opening of the 2024 International Conference on Clothing and Textiles (ICCT). As the CEO of Jeju Free International City Development Center (JDC), I am very pleased to join this conference together with you.

JDC is a national public corporation, founded in 2002 to turn Jeju Island, which is located in the center of Northeast Asia, into a free international city that is a base for free movement of people, products and capital. Our mission is to grow as the global leading company to establish Jeju as an iconic free international city through our core values: environmental stewardship, innovation toward the future, and mutual growth in collaboration with global partners. I hope the 2024 ICCT to be a meaningful opportunity for you, the leading scholars and experts in the fashion and textile industries to learn the mission of JDC.

The theme of the 2024 ICCT, "Circular Economy: Fashion Forward to Resilient Future" conveys a very important message to all of us. I believe that this conference will let us speculate and brainstorm how we can initiate positive impacts on the fashion and textile industries for sustainable and healthy growth.

Jeju is the symbol of diversity, inclusivity, and sustainability, which are aligned with the core values of JDC. In this sense, the fact that the 2024 ICCT is held in Jeju, is very meaningful not only to the conference participants but also to members of JDC. I believe that the beautiful and abundant natural resources as well as rich cultural heritage in Jeju, will inspire you. I am confident that your knowledge, experience, and innovative ideas shared at the 2024 ICCT will play an outstanding role in leading the global fashion and textile industries to the sustainable and bright future. I hope this conference to be a space for meaningful scholarly discussion and networking for synergistic collaborations in the near future. I trust that your contribution to the 2024 ICCT will pave the way for circular economy of healthy and bright future.

I hope you to enjoy your time in Jeju by exploring the unique culture and natural beauty of Jeju. Thank you!

Sincerely,

Young-Chul Yang (Ph.D.)
Chairman & CEO of Jeju Free International City Development Center

Congratulatory Address

I would like to extend my sincere congratulations to the Korean Society of Clothing and Textiles on hosting the 2024 International Conference on Clothing and Textiles.

As an academic organization with the longest history in Korea's clothing industry, KSCT has made significant contributions to the advancement of academic studies since its foundation in 1976. With strenuous endeavors for advancement, KSCT has also turned itself into an academic organization leading the development of the clothing industry. Taking this opportunity, I would like to convey my deepest gratitude to the executives and members of KSCT for their dedicated efforts contributing to the development and academic growth of the textiles and fashion industry with advanced research and creative ideas in tune with the fast changes in our times.

Academicians and industry practitioners from around the world gathered here in 2024 ICCT which takes place under the theme of "Circular Economy." At a time when climate change and environmental issues are causing a sense of crisis across the globe, I expect this conference will serve as a valuable opportunity for us to explore paths to a sustainable future for the textiles and fashion industry and take away insights.

Korea Federation of Textile Industries launched the "Sustainability & Circularity in Textiles(SCT) Forum" last year to create a circular economy ecosystem for the textiles and fashion industry. We work with prominent experts by running research groups for diverse purposes, such as institutional reform, circular ecosystem, carbon neutrality, and eco-design, and play a pivotal role in connecting the upstream and downstream sectors to support the textiles and fashion industry make a transition into a sustainable circular economy.

In addition to this academic conference, we also work with KSCT on industry-academia-research collaboration projects and scholarship programs to share domestic and overseas industry trends and promote networking. Moving forward, we will throw our full support to KSCT, so it will serve as a cornerstone and catalyst for research and development of the textiles and fashion industry and promote cooperation among industry, academia, research institutes and the government, whereby the textile and fashion industry can take another leap forward.

Through speeches by world-renowned pundits, the joint symposium with the Japanese clothing society, and sharing of creative research outcomes by new academic scholars, ICCT will suggest future directions for the industry.

I expect we will have meaningful and proactive academic exchanges through the 2024 ICCT taking place in Jeju in this beautiful season. This conference will hopefully prove to be another success story and I wish continuous development of KSCT.

Chairman Byung Oh Choi
Korea Federation of Textile Industries

Congratulatory Address

Distinguished members of the Korean Society of Clothing and Textiles,

It is with great respect and admiration that I address you today. I am honored to address you as Youngsoo Kim, the Director of LG Electronics Living Solution R&D Lab. As we embrace the onset of spring, a season brimming with renewed energy and vitality, I find great pleasure in connecting with you all. First and foremost, I extend my heartfelt congratulations on the occasion of the 4th International Conference on Clothing and Textiles (ICCT) this year.

Despite the ongoing challenges posed by the COVID-19 pandemic and other environmental concerns such as infectious diseases and fine dust pollution, it is imperative that we remain steadfast in our commitment to addressing the critical issues impacting our health and environment. In the face of global climate crises and environmental challenges, I am of the firm belief that now, more than ever, academia and industry must unite in solidarity, aligning ourselves with international currents of change.

Under the theme of 2024 ICCT, "Circular Economy: Fashion Forward to Resilient Future," we gather to exchange diverse perspectives and ideas about the future trajectory of the fashion industry. May this conference serve as a platform for fruitful discussions and collaborations aimed at building a circular economy within the fashion sector, paving the way for a more sustainable and resilient future.

At LG Electronics, we are dedicated to pushing the boundaries of innovation in fashion and technology, striving to improve the quality of life for all. I extend my sincerest gratitude to the esteemed experts and scholars in the fields of Fashion & Textiles, whose depth of knowledge and experience continue to inspire progress and drive our collective endeavors forward. Furthermore, I am delighted to showcase the outcomes of our collaboration between LG Electronics and the clothing industry, unveiling products that embody the latest technological advancements developed through joint research endeavors.

I would like to express my deepest appreciation to Dr. Yoon-Jung Lee (President of the KSCT) and organizing Committee of 2024 ICCT for providing this esteemed platform for exchange and collaboration. Looking ahead, LG Electronics remains committed to partnering with the Korean Society of Clothing and Textiles as we work together toward a brighter future, marked by eco-friendly material innovation, sustainable production practices, and the establishment of a circular economy within the fashion and textile sectors. Through our offerings of products and services rooted in Environmental, Social, and Governance (ESG) principles, we strive to realize our vision of "Better Life for All."

In closing, I extend my best wishes for the continued growth and prosperity of the KSCT, and I eagerly anticipate our continued collaboration in shaping a future defined by progress and innovation.

Thank you.

Kim Young Soo
Vice President/Laboratory Leader of LG Electronics Living Solution R&D Lab.

Organizing Committee

Role	Name	Affiliation
Co-chairs	**Hong, Heesook**	Jeju National University, KOREA
	Moon, Heekang	Pai Chai University, KOREA
	Park, Heeju	Cornell University, USA
Committee Members	**Lee, Yoon-Jung**	Korea University, KOREA
	Kim, Minjeong	Indiana University, USA
	Lee, Kyu-Hye	Hanyang University, KOREA
	Lee, Yuri	Seoul National University, KOREA
	Park, Soonjee	Yeungnam University, KOREA
	Baek, Eunsoo	Hanyang University, KOREA
	Choi, Sun Young	Konkuk University, KOREA
	Ki, Chung-Wha	Hong Kong Polytechnic University, Hong Kong
	Kim, Soon-Young	Jeonbuk National University, KOREA
	Kim, Sungmin	Seoul National University, KOREA
	Koo, Sumin Helen	Yonsei University, KOREA
	Lee, Seungsin	Yonsei University, KOREA
	Lim, Hye-Won	University of Leeds, UK
	Park, Minjung	Ewha Womans University, KOREA
	Park, Juyeon	Seoul National University, KOREA
	Son, Suyoung	Kyungpook National University, KOREA
	Song, Hwa Kyung	Kyung Hee University, KOREA
	Youn, Chorong	Pusan National University, KOREA
	Yun, Changsang	Ewha Womans University, KOREA
	Yi, Eunjou	Jeju National University, KOREA

Science Committee

Name	Affiliation
Park, Sunmi	Konkuk University, Korea
Choi, Hee Eun	Seoul National University, Korea
Song, Hwa Kyung	Kyung Hee University, Korea
Kim, Kyoung Sun	Mokpo National University, Korea
Lee, Jeong Yim	Pai Chai University, Korea
Park, Minjung	Ewha Womans University, Korea
Woo, Hongjoo	Yonsei University, Korea
Sung, Heewon	Gyeongsang National University, Korea
Lee, Ha Kyung	Chungnam National University, Korea
Lee, Eun-Jung	Kookmin University, Korea
Choi, Mi Young	Duksung Women's University, Korea
Kim, Jie yurn	Honam University, Korea
Lee, Hyun-Hwa	Inha University, Korea
Ro, Juhyun	Chungnam National University, Korea
Lee, Yoonkyung	Pusan National University, Korea
Chun, Jaehoon	Seoul National University, Korea
Lee, Yhe-Young	Korea University, Korea
Kim, Koh Woon	Duksung Women's University, Korea
Lee, Hye Won	The Catholic University of Korea, Korea
Kim, Se Jin	Changwon National University, Korea
Yang, Eun Kyoung	Yonsei University, Korea
Choi, Hyeong Yeol	Dong-A University, Korea
Lee, Sunhee	Dong-A University, Korea
Kim, Hee Eun	Kyungpook National University, Korea
Kim, Jooyoun	Seoul National University, Korea
Park, Yaewon	Yonsei University, Korea
Yi, Eunjou	Jeju National University, Korea
Han, Hyun Sook	Chungbuk National University, Korea
Kim, Inhwa	Dong-Eui University, Korea
Park, Jinhee	Incheon National University, Korea
Roh, Jung-Sim	Sangmyung University, Korea

Name	Affiliation
Kim, Hye Rim	Sookmyung Women's University, Korea
Yoo, Shinjung	Kyung Hee University, Korea
Lee, Seungsin	Yonsei University, Korea
Yang, Heesoon	Sangmyung University, Korea
Jung, Sojin	Kyung Hee University, Korea
Baek, Eunsoo	Hanyang University, Korea
Lee, Yuri	Seoul National University, Korea
Choi, Sooah	Dankook University, Korea
Jeon, Eunjin	Pohang University of Science and Technology, Korea
Fukazawa Takako	Kyoto University of Education, Japan
Lee, Ah Lam	Kyungpook National University, Korea
Son, Suyoung	Kyungpook National University, Korea
Kim, Sunwoo	Seoul National University, Korea
Youn, Chorong	Pusan National University, Korea
Kim, Ha Youn	Kunsan National University, Korea
Lee, Sae Eun	Pusan National University, Korea
Lee, Kyu-Hye	Hanyang University, Korea
Lee, Yejin	Chungnam National University, Korea
Park, Heeju	Cornell University, USA
Kim, Eun Young	Chungbuk National University, Korea
Hong, Yun Jung	Yonsei University, Korea
Koo, Sumin	Yonsei University, Korea
Lee, Jung Soo	Ewha Womans University, Korea
Park, Yongwan	Korean Institute of Convergence Textile, Korea
Yun, Changsang	Ewha Womans University, Korea
Lee, Sunyoung	Chungnam National University, Korea
Lee, Jungsoon	Chungnam National University, Korea
Moon, Heekang	Pai Chai University, Korea
Ju, Jeongah	Jeonju University, Korea
Lee, Yoon-Jung	Korea University, Korea

Programs

Circular Economy:
Fashion Forward to Resilient Future

Date: May 10~11, 2024
Venue: International Convention Center, Jeju, Republic of Korea / On-Offline Hybrid

Day 1: May 10, 2024 (Friday)

Time	Program & Activity	
9:30 ~ 10:30	**Registration** (Location: Ocean view, International Convention Center 5th floor)	
10:30 ~ 12:10	**JRATEU – KSCT Joint Symposium(Online)** "Circular Fashion and Textile Science" Co-Chairs: Dr. Su-Young Son, Kyungpook National University, Korea Dr. Takako Fukazawa, Kyoto University of Education, Japan	**Special Topic Oral Presentation Session 1(Online)** "Consumer Response to Market Dynamics" Chair: Dr. Minjeong Kim, Indiana University, USA
13:30 ~ 15:30	**Pre-conference Workshop : Eco-print Scarf Craft Workshop** (Location: Galjungi Corp. & Sosekchebon)	
15:30 ~ 17:00	**Graduate Student Research Competition(Online)** • Session 1. Clothing Science / Textile Science Chair: Dr. Changsang Yun, Ewha Womans University, Korea • Session 2. Fashion Marketing / Fashion Design Chair: Dr. Hongjoo Woo, Yonsei University, Korea	
17:00 ~ 20:00	**Reception & Welcome Dinner** (Location: Ocean view, International Convention Center 5th floor)	
20:00 ~ 21:00	**Young Scholar Mentoring** Chair: Dr. Heeju Park, Cornell University, USA (Location: Ocean view, International Convention Center 5th floor)	

Day 2: May 11, 2024 (Saturday)

Time	Program & Activity	
08:00 ~ 09:00	**Registration**	
	Plenary Session (8:30 ~ 11:40) (Location: Samda AB Hall)	
08:30 ~ 09:00	**KSCT Regular General Meeting**	Presider: Dr. HoJung Choo, Seoul National University, Korea
09:00 ~ 09:30	**Greetings** Dr. Yoon-Jung Lee (President, Korean Society of Clothing and Textiles, Korea) Dr. Heesook Hong (Co-chair, Organizing committee of 2024 ICCT, Korea) **Congratulatory Messages** Dr. Eel-hwan Kim (President of Jeju National University, Korea) Byung Oh Choi (Chairman of Korea Federation of Textile Industries, Korea) **Lee Heung Soo Distinguished Publication Award Ceremony**	Presider: Dr. Heekang Moon, Pai Chai University, Korea

Programs

Time	Program & Activity	
09:30 ~ 10:10	**Keynote Speech 1 :** **"Envisioning Textile and Apparel Research Agendas for Sustainable Future"** Dr. Jung Ha-Brookshire (Professor, University of Missouri, USA & President, International Textile and Apparel Association)	Presider: Dr. Heekang Moon, Pai Chai University, Korea
10:10 ~ 10:20	**Break**	
10:20 ~ 11:00	**Keynote Speech 2 :** **"Circular Textiles: Application of Cradle to Cradle and Green Engineering in Textile Product Development"** Dr. Huantian Cao (Professor, University of Delaware, USA)	Presider: Dr. Heeju Park, Cornell University, USA
11:00 ~ 11:40	**Keynote Speech 3 :** **"Fostering Sustainable and Circular Practices: the case of micro and small fashion businesses."** Prof. Sandy Black (Professor, London College of Fashion, UK)	
11:40 ~ 13:30	**Lunch** (Location: Ocean view, International Convention Center 5th floor)	
	Poster Presentations and Q&A (Location: 3rd Floor Lobby)	
	Special Poster Session & Exhibition **"Technology for Sustainable Clothing Care"** LG Electronics Inc. Chair: Dr. Jeongah Ju, Jeonju University, Korea (Location: 3rd Floor Lobby)	**FTEX winner session(Online)**

Special Lectures (13:30 ~ 14:50)	
Clothing & Culture (Location: Samda AB Hall)	**Textiles/Clothing Science & Technology** (Location: Rm 301)

Time	Clothing & Culture	Textiles/Clothing Science & Technology
13:30 ~ 14:10	**Special lecture 1** **"Fashion in motion: the evolution of the Spanish industry to achieve sustainability"** Dr. Paloma Diaz Soloaga (Professor, The Computense University, Spain) Presider: Dr. Yuri Lee, Seoul National University, Korea	**Special lecture 3** **"Computer Aided Fashion Intelligence – a bridge connecting the real & virtual worlds"** Dr. Tracy Mok (Professor, The Hong Kong Polytechnic University, HKSAR) Presider: Dr. Sungmin Kim, Seoul National University, Korea
14:10 ~ 14:50	**Special lecture 2** **"Sustainability in Textile Education – Meaning, Concepts and Evidence"** Dr. Anne-Marie Grundmeier (Professor, University of Education Freiburg, Germany) Presider: Dr. Miyoung Lee, Inha University, Korea	**Special lecture 4** **"Multifunctional Sensors for Smart Wearables"** Dr. Hang Liu (Professor, Washington State University, USA) Presider: Dr. Seungsin Lee, Yonsei University, Korea
14:50 ~ 15:00	Coffee Break	

Concurrent Sessions (15:00 ~ 16:30)						
Special Topic Oral Presentation Session 2 (online)	Special Topic Oral Presentation Session 3 (online)	Oral Session 1 (Rm 303)	Oral Session 2 (Rm 301)	Oral Session 3 (Samda AB Hall)	Oral Session 4 (Rm 304)	Oral Session 5 (Rm 302)
Human-Tech Synergy for Circular Economy in Fashion	Design Practice for Circular Economy	Clothing Science & Technology	Circular Fashion and Healthy Growth	Emerging Technologies and Consumer Behavior	New Fashion Design Method	Textile Science and Technology
Chair: Dr. Kyu-Hye Lee, Hanyang University	Chair: Dr. Yoo Jin Kwon, Korea National Open University	Chair: Dr. Hwa Kyung Song, Kyung Hee University	Chair: Dr. Heewon Sung, Gyeongsang National University	Chair: Dr. Minjung Park, Ewha Womans University	Chair: Dr. Yhe-Young Lee, Korea University	Chair: Dr. Sunhee Lee, Dong-A University

The above Concurrent Sessions block is in the **15:00 ~ 16:30** time slot.

Time	Program & Activity
16:30 ~ 17:00	**Graduate Student Research Competition & Best Paper Awards Ceremony** Presider: Dr. Yuri Lee, Seoul National University, Korea (Location: Samda AB Hall)

Keynote Speeches

Dr. Jung Ha-Brookshire
Professor, University of Missouri, USA &
President, International Textile and Apparel Association

"Envisioning Textile and Apparel Research Agendas for Sustainable Future"
Dr. Jung E. Ha-Brookshire isa professor and the Department Chair of Textile and Apparel Management at the University of Missouri. Prior to her time at MU, she worked as a sourcing manager in New York City for over 8 years, extensively traveling various countries in Asia and Central America. She received several awards, including Distinguished Scholar Award in 2021 from the International Textile and Apparel Association (ITAA), Kemper Excellence for Teaching Award in 2017, Fulbright Core Scholar award in 2015 from the US Department of State, and more. She has completed many grants, over $700,000. She has published over 70 manuscripts in peer review journals, 7 book chapters, and presented her research over 125 times at various venues. She is an author of a textbook, Global Sourcing in the Textile and Apparel Industry. She has consulted US Trade Representative and Department of Commerce for trade facilitations and capacity strengthening in Central America. She served as the Vice President of Operations (2015-2017) and the Vice President of Publications (2019-2021), and she is currently serving as the President (2024) for ITAA.
The areas of her research interests include moral responsibility of corporate sustainability, global supply chain and sourcing strategies, and sustainable production and consumption of textile and apparel. She utilizes both qualitative and quantitative research tools.

Dr. Huantian Cao
Professor, University of Delaware, USA

"Circular Textiles: Application of Cradle to Cradle and Green Engineering in Textile Product Development"
Huantian Cao is a Professor and Department Chair in the Department of Fashion and Apparel Studies at the University of Delaware (UD). Professor Cao's research interests include sustainable textile and apparel and functional textile and apparel. His scholarly contributions can be evidenced by numerous peer reviewed journal publications, editor reviewed articles, book chapters, refereed conference presentations, invited presentations, workshops, and webinar. Professor Cao has been the principal investigator (leading PI) of 18 research, teaching, and outreach projects funded by National Science Foundation (NSF), Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), Oklahoma Center for the Advancement of Science and Technology (OCAST), and the industry. He also served as a co-investigator in seven research projects funded by NSF, NASA, Office of Naval Research (ONR), Homeland Security Advanced Research Projects Agency (HSARPA), and EPA. The total grants Professor Cao has been involved with are approximately $5 million. The notable awards and professional recognitions Professor Cao received include U.S. EPA P3 (People, Prosperity and the Plant) Award (in 2011), ITAA Lectra Innovation Awards for Faculty Research (in 2005 and 2014), American Institute of Chemical Engineers (AIChE) Youth Council on Sustainable Science and Technology (YCOSST) Award (in 2011), ITAA Paper of Distinction Awards (in 2009 and 2018), and Clothing and Textiles Research Journal Most Cited Paper Award (in 2022).

Professor Sandy Black
Professor, London College of Fashion, UK

"Fostering Sustainable and Circular Practices: the case of micro and small fashion businesses."
Professor Sandy Black has extensive experience in both industry and academia. Prior to entering academia she was Design Director and MD of Sandy Black Original Knits selling innovative fashion knitwear and designer knitting yarn kits to prestigious outlets internationally. Her academic experience includes directing and developing academic programmes integrating fashion, textiles and business at both undergraduate and postgraduate levels. At London College of Fashion she developed and led the innovative MA Fashion Studies multi-disciplinary Masters programme for its first 8 years, expanding it to 12 named programmes.
Sandy Black is a key researcher in the UAL Centre for Sustainable Fashion. She researches and publishes on sustainability and fashion (including pioneering books in the field Eco Chic: The Fashion Paradox 2008 and The Sustainable Fashion Handbook 2012), on knitwear design and history (key books include Knitwear in Fashion 2002 and Knitting: Fashion, Industry, Craft 2012) and on the intersection of fashion and textiles with emerging technology. Current research focuses on the role of creative design entrepreneurship and new business models for sustainability, bridging research together with industry. Prof Black has a strong track record developing and leading pioneering collaborative research projects in fashion, funded by the UK Research Councils including Interrogating Fashion, Considerate Design for Personalised Fashion, FIREup (Fashion, Innovation, Research, Enterprise) and Fostering Sustainable Practices. Sandy is founder and now Editor-in-Chief of the journal Fashion Practice: Design, Creative Process and the Fashion Industry, published since 2009.
Prof Black has conducted academic review for many institutions and for governments. In 2014 and 2021 she was a member of the UK's national Research Excellence Framework(REF) assessment panels for Art and Design: History, Theory, Practice and was a panel member for similar national research assessment exercises in both New Zealand and Hong Kong in 2016 and 2020.

Special Lectures

Professor Paloma Díaz Soloaga
Professor, The Computense University, Spain

"Fashion in motion: the evolution of the Spanish industry to achieve sustainability"

Paloma Díaz Soloaga (Ph.D) is a professor of Intangible Assets applied to the Fashion industry at the Complutense University of Madrid, Spain, where she has taught classes on Branding, Corporate Reputation and Organizational Culture for more than 20 years. She has been a visiting professor at Harvard Business School, Fashion Institute of Technology in New York, University of California San Diego, Glasgow Caledonian University among other international universities.

Díaz Soloaga is the author of "Introduction to Organizational Culture" Ed. Síntesis, 2019; "Communication and Management of Fashion Brands" Ed. Gustavo Gili, 2014 among other books and she has published more than 45 academic articles, in addition to being a member of the Editorial Board of the Journal of Fashion Marketing and Management. Editor of the special issue of the Journal of Global Fashion Marketing Fashion and Films: stories of (miss)understanding in 2023. She also regularly collaborates with the media as an expert in fashion retail in Spain.

She has been the Spanish coordinator of SFES (Sustainable Fashion Entrepreneurship Skills) ERASMUS KA2 project and the Head of the Santander – UCM research on "New Dynamics into the Sustainable Fashion Industry: connecting Business, Brands and Consumers".

Professor Díaz Soloaga created the "Communication and Fashion Management" studies at Villanueva University in 2007 and was director from this year until 2016 and from then until today she remains Honorary Director. She received the National Fashion Industry Award from HM Queen Letizia of Spain in 2020.

As an academic expert in fashion films, she is a member of the Jury of the La Jolla International Fashion Film Festival, the Canadian International Fashion Film Festival and the Madrid Fashion Film Festival.

Dr. Anne-Marie Grundmeier
Professor, University of Education Freiburg, Germany

"Sustainability in Textile Education – Meaning, Concepts and Evidence"

Dr. Anne-Marie Grundmeier is Director of the Institute of Everyday Culture, Sport and Health including the Department of Fashion and Textiles and a full professor of fashion and textile sciences and their didactics at the University of Education Freiburg. Additionally, she holds a First State Examination and Diploma in Vocational Training from Leibniz University Hannover and a Second State Examination. Before her current position Dr. Grundmeier worked as research assistant at the Institute of Textile and Clothing Technology and Didactics at Leibniz University Hannover, as teacher at the German Masterschool for Fashion and as project manager at the Department for Vocational Training of the City of Munich.

At the University of Education, she is responsible for textile education in primary and secondary school, early childhood and special needs education and the study program M. Sc. Vocational Education Textile Technology and Clothing/Economics. Her research interests are fashion and textile sciences with an emphasis on Education for Sustainable Development (ESD), aesthetic and (inter-)cultural education, and vocational education. Her list of publications includes 5 monographs, 3 edited works and over 130 international journal articles, conference papers and book contributions. Due to her renowned experience and knowledge about textile developments and their suitability for daily use she has had a couple of appearances in German TV shows. Next to her professorship she is the chairperson of the university teachers' committee in the Federal Association for Textile Education in Germany. Her research and teaching won several awards including 2023 and 2022 Gold Medal Diploma of Honor for E-Learning at INVENTICA, Romania, 2013 Gender Prize by the University of Education Freiburg, 2012 Student Engagement Award for Fashion Project by the University of Education Freiburg, 2001 Award for Multimedia Fashion Education Project by the Federal Ministry of Education and Research, Germany, and by Deutsche Telekom, 1996 Advancement Award for Ph.D. by Wilhelm Lorch Foundation, Germany.

Special Lectures

Dr. Tracy P.Y. Mok
Professor, The Hong Kong Polytechnic University, HKSAR

"Computer Aided Fashion Intelligence – a bridge connecting the real & virtual worlds"

Dr. Tracy Mok is Associate Director of Research Centre of Textiles for Future Fashion and also an Associate Professor in the School of Fashion and Textiles (formerly the Institute of Textiles and Clothing) at the Hong Kong Polytechnic University. Her research interests include artificial intelligence, 2D and 3D computer-aided design, digital human modelling, cloth simulation, computer vision, and computer graphics in fashion applications. She has successfully secured 23 projects worth a total of HK$ 38 million, published over 140 research articles in world-leading and top-tier research journals, and held 1 trademark, 7 patents, 6 software copyrights, and 3 licenses. Her research's findings have received widespread recognition from both academia and business, having a significant impact on the fashion industry. With her support, her PhD graduate commercialized their research technology with a startup formed, securing venture investment of over 20 million RMB. With her achievement, she has won 14 prestigious international awards, including the Gold Medal of the 35th International Exhibition of Inventions of Geneva and the Silver Medal of the 1st Asia Exhibition of Inventions Hong Kong. Dr Mok has also committed herself to serving the education community as a fellow and executive member of the Hong Kong Institution of Textile and Apparel, a vetting committee member of the Create Smart Initiative for CreateHK of Hong Kong SAR government, a steering committee member of the Artificial Intelligence Special Committee of the China Textile Engineering Society, etc.

Dr. Hang Liu
Professor, Washington State University, USA

"Multifunctional Sensors for Smart Wearables"

Dr. Hang Liu is an associate professor in the Department of Apparel, Merchandising, Design and Textiles at Washington State University. She holds B.S. and M.S. degrees in Textile Engineering from China Textile University and a Ph.D. degree in Textile Sciences from the University of Georgia. She teaches textile science and product development related courses at both undergraduate and graduate levels. Her current research focuses on functional textile fiber development for smart wearables and textile waste recycling for high-value-added products. Dr. Liu has published 45 peer-reviewed journal articles in high ranking journals, including the Journal of Cleaner Production, Carbohydrate Polymers, Green Chemistry, Materials Today Chemistry, and Cellulose. As PI and co-PI, she received more than 12.6 million dollars in funding to support her research. Among this, more than 2.7 million dollars were awarded to her program from various federal, state, industrial, and foundation funding agencies. As an inventor, she holds 4 international patents in textile waste recycling. Dr. Liu received the Rising Star Award from the largest international textile and apparel organization (International Textile and Apparel Association) in 2020 and the most prestigious Early Career Award from the US National Science Foundation in 2022.

FTEX Best Paper Awardees

Prof. Kyung-Hee Choi
Hansung University, Korea

"3D Dynamic Fashion Design Development Using Digital Technology and its Potential in Online Platforms."

Dr. Kyung-Hee Choi is a full professor at Hansung University's School of Global Fashion Business in South Korea. Her current research delves into interdisciplinary and forward-thinking fashion design, exploring human-computer interaction, emerging digital technologies, and sustainability, encompassing both scholarly research and creative scholarship. Her expertise lies in dynamic and transformable fashion design, modular design processes, and customized fashion platforms. She has extensively published on integrating tangible garments with virtual 3D rendering and implementing sustainable practices into the apparel redesign process through digital technology.

Previously, Dr. Choi focused on aesthetic and cultural perspectives in fashion and product development. She holds degrees from Seoul National University and the University of the Arts London. Dr. Choi has received international recognition, including awards such as the ESRAP Best Paper Award (2018), the Atexinc Award for Excellence in Marketable Textile Design (2019), and the Award for Outstanding Marketable Design (2023), as well as the International Design Award (2018) and A' Design Award (2019).

She serves as an editorial member for The Korean Society of Clothing and Textiles and The Korean Society of Fashion Design and as an ad-hoc reviewer for journals, including the Journal of the Textile Institute, Fashion & Textiles, and International Journal of Fashion Design, Technology, and Education. Dr. Choi has been supported by grants from the National Research Foundation of Korea and the Seoul Government.

May 10 (Fri.), 2024
10:30~12:10 KSCT-JRATEU Joint Symposium (Online)

Oral Session

Co-Chairs: Dr. Su-Young Son, Kyungpook National University
Dr. Takako Fukazawa, Kyoto University of Education

No.	Title	Author	Affiliation
JK-01	MEASUREMENT OF STRAIN DISTRIBUTION ON JACKETS WITH DIFFERENT ADHESIVE INTERLININGS DURING ARM MOVEMENT	KyoungOk Kim*† Hitomi Yamaguchi Masayuki Takatera	Shinshu University, Japan Shinshu University, Japan Shinshu University, Japan
JK-02	RELATIONSHIPS BETWEEN FOOT TEMPERATURE AND PSYCHOLOGICAL RESPONSES IN COLD ENVIRONMENTS FROM 0°C TO -12°C FOR DEVELOPING ACTIVE-HEATING SMART FOOTWEAR	Heeyoung Ju*† Joo-Young Lee	Seoul National University, Korea Seoul National University, Korea
JK-03	PANTYHOSE TO RELIEVE MUSCLE ACTIVITY WHEN WEARING HIGH-HEELS	Tamaki Mitsuno*†	Shinshu University, Japan
JK-04	BRASSIERE USAGE DURING SLEEP AMONG YOUNG AND MIDDLE-AGED JAPANESE FEMALES	Kazue Okamoto-Mizuno*† Yukari Yuasa Haruka Suzuki	Wayo Women's University, Japan Wayo Women's University, Japan Wayo Women's University, Japan
JK-05	PHYSICAL PROPERTY OF 3D PRINTED STRUCTURE USING CARBON MATERIAL/THERMOPLASTIC POLYURETHANE COMPOSITE FILAMENT WITH VARIOUS 3D PRINTING PROCESSING CONDITIONS	Imjoo Jung† Sunhee Lee*	Dong-A University, Korea Dong-A University, Korea
JK-06	FOLKLORE TRADITIONS TO TREND: INCORPORATING LOCAL TEXTILE PROCESSING KNOWLEDGE WITH CONTEMPORARY FASHION	Shashiprabha Thilakarathne*† Sumith Gopura Ayesha Wickramasinghe	University of Moratuwa, Sri Lanka University of Moratuwa, Sri Lanka University of Moratuwa, Sri Lanka

* : Corresponding author
† : Presenter

May 10 (Fri.), 2024

10:30~12:10 Special Topic Oral Presentation Session 1
: Consumer Response to Market Dynamics (Online)

Chair: Dr. Minjeong Kim, Indiana University

No.	Title	Author	Affiliation
SO-01	APP ATTRIBUTES AND PERCEIVED VALUES DETERMINING CHINESE CONSUMERS' INTENT TO REUSE FASHION SHOPPING APPS	Yu Sun[†] Heesook Hong*	Shangqiu Normal University, China Jeju National University, Korea
SO-02	CONSUMER DETERMINANTS OF PLANT-BASED LEATHER PRODUCTS: A CONCEPTUAL MODEL	Gwia Kim*[†] Heekyeong Jo	Seattle Pacific University, USA North Carolina State University, USA
SO-03	AN INVESTIGATION OF CONSUMER RECEPTIVITY TO AI ADS VERSUS ARTWORK	Garim Lee*[†] Jinsu Park Hye-Young Kim	Indiana University, USA University of Minnesota, USA University of Minnesota, USA
SO-04	CUSTOMER EXPERIENCE WITH LUXURY BRANDS: UNCOVERING LATENT TOPICS USING STRUCTURAL TOPIC MODELING	Youngdeok (Young) Lee*[†] Sejin Ha	University of Tennessee Knoxville, USA University of Tennessee Knoxville, USA
SO-05	INVESTIGATTING CONSUMER PERCEPTION OF PRICE, QUALITY, AND VALUE AS ANTECEDENTS OF ADOPTING WEARABLE TECHNOLOGY PRODUCTS AMONG GEN Z	Ui-Jeen Yu*[†]	Illinois State University, USA

* : Corresponding author

† : Presenter

May 10 (Fri.), 2024
15:30~17:00 Graduate Student Research Competition (Online)

Session 1. Clothing Science / Textile Science

Chair: Dr. Changsang Yun, Ewha Womans University

No.	Title	Author	Affiliation	Area
G-01	AUTOMATIC GENERATION OF ZERO-WASTE MARKER USING CONVENTIONAL PATTERNS	Seowon Heo[†] Jihyun Oh Hyeryeon Park Sungmin Kim*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea	Clothing Science & Technology
G-02	DEVELOPMENT OF LIFTING-ASSISTIVE PANTS DESIGNS TO PREVENT FROM MUSCULOSKELETAL DISEASE AND DISORDERS FOR SENIORS	Jinzhi Chen Ziying Liu Byungkwan Ko[†] Sumin Koo*	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea	Clothing Science & Technology
G-03	DEVELOPMENT OF 3D HUMAN MODELING SYSTEM CONSIDERING BODY SHAPE DIVERSITY	GyungIn Jung[†] Yeonghoon Kang Jiseon Ahn Sungmin Kim*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea	Clothing Science & Technology
G-04	PROPOSAL OF PRODUCT NAMES SEARCH BASED ON RESEARCH OF CASUAL HANBOK	Yujin Lee[†] Jungsoon Lee*	Chungnam National University, Korea Chungnam National University, Korea	Clothing Science & Technology
G-05	BOTTOM GARMENT PATTERNMAKING FOR KOREAN WOMEN IN THEIR 40S USING A VIRTUAL TRY-ON SYSTEM	Suyeon Je[†] A-mi Park Shuai Hou Chunhui Liu Rani Eom*	Jeju National University, Korea Jeju National University, Korea Jeju National University, Korea Jeju National University, Korea Jeju National University, Korea	Clothing Science & Technology
G-06	FOAMING CHARACTERIZATION OF LIGHTWEIGHT POLYLACTIC-ACID FILAMENTS WITH VARIOUS HEATING CONDITIONS	Dikshita Chowdhury[†] Sunhee Lee*	Dong-A University, Korea Dong-A University, Korea	Textile Science & Technology
G-07	MECHANICAL PROPERTY OF LIGHT WEIGHT POLYLACTIC ACID PREPARED BY MICRO FOAMING 3D PRINTING PROCESS WITH VARIOUS EXTRUDING TEMPERATURES	Ye-Eun Park[†] Sunhee Lee*	Dong-A University, Korea Dong-A University, Korea	Textile Science & Technology
G-08	HETEROSTRUCTURED PHOTOCATALYTIC FABRIC WITH Ag_3PO_4 AND NH_2-MIL-88B (Co/Fe) FOR ENHANCED CATALYTIC REACTIVITY	Jinwook Lee[†] Jooyoun Kim*	Seoul National University, Korea Seoul National University, Korea	Textile Science & Technology
G-09	SUSTAINABILITY OF CLOTHES DRYERS – FOCUSING ON MICROFIBER EMISSION, FABRIC DAMAGE, AND ENERGY CONSUMPTION: A REVIEW	Jeein Choi[†] Subin Lee Changsang Yun*	Ewha Womans University, Korea Ewha Womans University, Korea Ewha Womans University, Korea	Textile Science & Technology
G-10	THE CHARACTERISTICS OF CELLULOSE ACETATE AND POLYACRYLONITRILE NANOFIBERS UTILIZING IRON OXIDE	Jungsoon Lee* Dayae Kang[†]	Chungnam National University, Korea Chungnam National University, Korea	Textile Science & Technology

* : Corresponding author

† : Student presenter

Session 2. Fashion Marketing / Fashion Design

Chair: Dr. Hongjoo Woo, Yonsei University

No.	Title	Author	Affiliation	Area
G-11	BRAND CRISIS MANAGEMENT: EFFECTIVE RESPONSE STRATEGIES FOR SOCIAL MEDIA INFLUENCERS (SMIS) IN TRADEMARK INFRINGEMENT SITUATIONS	Seong Eun Kim[†] Song-yi Youn*	University of Missouri, USA University of Missouri, USA	Economics of Clothing & Textiles/Fashion Business
G-12	THE EFFECTS OF CLOTHING DONATION MOTIVATION ON BEHAVIORAL INTENTIONS RELATED TO CLOTHING DONATION THROUGH EMOTIONS	Myeong Su Oh[†] Hanna Kim*	Chungnam National University, Korea Chungnam National University, Korea	Economics of Clothing & Textiles/Fashion Business
G-13	THE EFFECT OF BRAND-AVATAR IMAGE CONGRUITY ON PURCHASE INTENTIONS FOR VIRTUAL ITEMS OF FASHION BRANDS	Hyoun-Young Huh[†] Yoon-Jung Lee*	Korea University, Korea Korea University, Korea	Economics of Clothing & Textiles/Fashion Business
G-14	WHAT GLOBAL CSR COMMUNICATION STRATEGIES ARE EFFECTIVE FOR APPAREL FIRMS? COMPARISON BY STRATEGIC ORIENTATION, CONTENT DOMAIN, AND OPERATIONAL PERSPECTIVE	Zhenghao Tong[†] Hongjoo Woo*	Yonsei University, Korea Yonsei University, Korea	Economics of Clothing & Textiles/Fashion Business
G-15	SECONDARY MARKET VALUATION OF CO-BRANDED LIMITED EDITIONS IN FASHION: A CASE STUDY FOCUSING ON SUPREME	Zihua Li[†] Yoon-Jung Lee*	Korea University, Korea Korea University, Korea	Economics of Clothing & Textiles/Fashion Business
G-16	THE EFFECT OF SUSTAINABLE FASHION STORYTELLING ON BRAND TRUST AND PURCHASE INTENTION -THE MODERATING EFFECT OF CONSUMPTION VALUE ON SUSTAINABILITY-	Soo-youn Lim[†] Yoon-Jung Lee*	Korea University, Korea Korea University, Korea	Economics of Clothing & Textiles/Fashion Business
G-17	LTNS (LOW TIME NO STEP): LIGHTWEIGHT TECH FOR CLOTHING RECOMMENDATION MODEL BASED ON YOLOv8 MODEL	Seunghun Jang[†] Junoh Lim Bongjun Choi*	Dongseo University, Korea Dongseo University, Korea Dongseo University, Korea	Economics of Clothing & Textiles/Fashion Business
G-18	TEXT MINING-BASED GPT APPROACHES FOR ANALYZING FASHION TRENDS	Jeongmin Lee[†] Jeonghoon Ha Bongjun Choi*	Dongseo University, Korea Dongseo University, Korea Dongseo University, Korea	Economics of Clothing & Textiles/Fashion Business
G-19	THE EFFECTS OF PERCEIVED VALUE OF UPCYCLED FASHION PRODUCT ON SATISFACTION AND WILLINGNESS TO PAY PREMIUM -FOCUSING ON THE MODERATING ROLE OF NORMATIVE SUSCEPTIBILITY-	Minjung Park* Juin Park[†] Jungmin Yoo	Ewha Wamans University, Korea Ewha Wamans University, Korea Duksung Women's University, Korea	Economics of Clothing & Textiles/Fashion Business
G-20	SHOPPING MOTIVATION OF SOLO CONSUMER FOR FASHION GOODS: SCALE DEVELOPMENT AND VALIDATION	Jilin Duan[†] Kyu-Hye Lee*	Hanyang University, Korea Hanyang University, Korea	Economics of Clothing & Textiles/Fashion Business
G-21	WHEN FASHION INFLUENCERS STEP INTO THE STORE: AN APPLICATION OF THE STEREOTYPE CONTENT MODEL	XIN YU[†] Kyu-Hye Lee*	Hanyang University, Korea Hanyang University, Korea	Economics of Clothing & Textiles/Fashion Business
G-22	USING OPEN AI TO SEE FASHION COLLECTIONS BEFORE ANYONE ELSE DOES	Yoonkyung Lee* Chaehi Ryu[†]	Pusan National University, Korea Pusan National University, Korea	Fashion Design & Cultural Study on Fashion

* : Corresponding author

† : Student presenter

May 11 (Sat.), 2024
Poster Session (Offline)

Poster Q&A 13:00~13:30
Chair: Dr. Chorong Youn, Pusan National University

Session 1. Clothing Science & Technology

No.	Title	Author	Affiliation
CST-P-01	DEVLOPING COMPRESSION PANTS: ANALYSIS OF CLOTHING PRESSURE VARIATIONS VASED ON DYNAMIC MOVEMENTS OF THE KNEE	Heejae Jin Hyojeong Lee*	Kongju National University, Korea Kongju National University, Korea
CST-P-02	DEVELOPMENT OF FUNCTIONAL SUMMER INNERWEAR FOR FEMALE SOLDIERS AND ITS EFFECTIVENESS	Okkyung Lee Yejin Lee*	Chungnam National University, Korea Chungnam National University, Korea
CST-P-03	QUANTIFYING AESTHETIC CHARACTERISTICS OF GARMENT STRUCTURE USING EYE-TRACKING TECHNIQUE	Jihyun Oh Gyungin Jung Seowon Heo Mingi Jeong Sungmin Kim*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
CST-P-04	DEVELOPMENT OF BULLETPROOF PLATE DESIGN SYSTEM FOR FEMALE	Yeonghoon Kang Gyungin Jung Jiseon Ahn Yoojeong Lee Sungmin Kim*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
CST-P-05	SUPERVISED MACHINE LEARNING FOR BODY SHAPE CLASSIFICATION	Uikyung Jung Chanmi Hwang Minyoung Suh*	University of Central Oklahoma, USA North Carolina State University, USA North Carolina State University, USA
CST-P-06	ANALYSIS OF UPPER BODY TYPES OF MEN AGED 19-27 FOR THE DEVELOPMENT OF ARMY UNIFORM	Soyoung Park Yejin Lee*	Chungnam National University, Korea Chungnam National University, Korea
CST-P-07	DESIGN AND DEVELOPMENT OF AN IOT SYSTEM FOR THE DETECTION OF SEAM PUCKER	Minsuk Kim Seong Jin Jang Seungju Lim*	Korea Institute of Industrial Technology, Korea Korea Institute of Industrial Technology, Korea Korea Institute of Industrial Technology, Korea
CST-P-08	A STUDY ON DEVELOPMENT OF MEN'S SUIT JACKET PATTERN WITH THE BODY TYPE FOCUS ON THEIR LATE 30S -FOCUSING ON VIRTUAL FITTING SIMULATION-	Chuyeon Suh* Kyung-hee Shin	Dong-A University, Korea Digital Fashion Space, Korea
CST-P-09	DEVELOPMENT OF ADAPTIVE CLOTHING DESIGN FOR POSTURE CORRECTION FOR SENIORS	Jiwon Chung Byungkwan Ko Jeong Eun Yoon Sumin Koo*	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea

No.	Title	Author	Affiliation
CST-P-10	A CASE STUDY: APPLYING PBL FOR IMPROVEMENT OF TECHNICAL DESIGN & PRODUCTION IN 'FASHION STUDIO' COURSE	Myung Hee Lee Kyung Ja Paek*	Pukyong National University, Korea Pukyong National University, Korea
CST-P-11	DEVELOPMENT OF MUSCLE-STRENGTH ASSISTIVE GLOVES FOR INDUSTRIAL WORKERS	Soah Park Yumin Cho Byungkwan Ko Dongun Lee Jeongmin Kim Dongjun Shin Sumin Koo*	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea
CST-P-12	KOREAN NATIONWIDE CROSS-SECTIONAL STUDY OF THE RISK FACTORS FOR SARCOPENIA OBESITY	Jongseok Hwang Seongyeong Kwak Bo Hyeon Kim Soonjee Park*	Yeungnam University, Korea Yeungnam University, Korea Yeungnam University, Korea Yeungnam University, Korea
CST-P-13	A COMPARATIVE STUDY ON BODY MEASUREMENTS BY AGE GROUP IN KOREA	Seongyeong Kwak Bo Hyeon Kim Jongseok Hwang Soonjee Park*	Yeungnam University, Korea Yeungnam University, Korea Yeungnam University, Korea Yeungnam University, Korea
CST-P-14	AGE-SPECIFIC FOOT MEASUREMENT COMPARISON ANALYSIS	Bohyeon Kim Seongyeong Kwak Jongseok Hwang Soonjee Park*	Yeungnam University, Korea Yeungnam University, Korea Yeungnam University, Korea Yeungnam University, Korea
CST-P-15	OPTIMAL SIZING STRATEGIES FOR ENHANCED FIT AND PRODUCTION/MANAGEMENT EFFICIENCY IN MEDICAL EXAMINATION CLOTHING	Yujin Hong Ye Eun Kim Heejae Lee Hee Eun Choi*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
CST-P-16	EVALUATION OF BENDING STRENGTH OF 3D PRINTING MATERIALS FOR LUMBAR SUPPORT BRACES	Seiyoung Park Dong-Eun Kim*	Ewha Womans University, Korea Ewha Womans University, Korea
CST-P-17	DEVELOPMENT OF PATIENT CLOTHING FOR WOMEN IN NURSING HOSPITAL BASED ON ZERO-WASTE CUTTING TECHNIQUE	Misoon Jin Soonjee Park*	Yeungnam University, Korea Yeungnam University, Korea
CST-P-18	A STUDY ON THE USE OF THE REPLICA METHOD FOR PATTERNMAKING EDUCATION IN THE CLOTHING DOMAIN FOR ADOLESCENTS	A-mi Park Suyeon Je Rani Eom*	Jeju National University, Korea Jeju National University, Korea Jeju National University, Korea
CST-P-19	THE BODY SHAPE CHARACTERISTICS OF MALE ADOLESCENT EARLY STUDENTS AND DEVELOPMENT OF VIRTUAL MODELS	Ji Eun Kim* Eunyoung Lee	Changwon National University, Korea Hannam University, Korea
CST-P-20	DEVELOPMENT OF SMART SPORTS SAFETY CLOTHING FOR ADOLESCENTS AND SMART SAFETY WORK CLOTHING FOR ADULTS	Soonja Park*	Inha University, Korea
CST-P-21	DEMAND FOR HEALTHCARE SMART SHOES ACCORDING TO DIABETIC SYMPTOMS	Heeyoung Ju* Joo-Young Lee	Seoul National University, Korea Seoul National University, Korea

No.	Title	Author	Affiliation
CST-P-22	A STUDY ON ANALYSIS OF ELECTRODE PAD AND WEARING EVALUATION OF COMMERCIALLY AVAILABLE EMS SMART CLOTHING	Sojung Lee	Korea Institute of Industrial Technology, Korea
		Hyelim Kim	Korea Institute of Industrial Technology, Korea
		Daeyoung Lim	Korea Institute of Industrial Technology, Korea
		Wonyoung Jeong*	Korea Institute of Industrial Technology, Korea
CST-P-23	EVALUATION OF 3D PRINTED WRIST BRACE BY MEASURING WRIST BENDING ANGLE AND CLOTHING PRESSURE	Heeran Lee*	Kumoh National Institute of Technology, Korea
		Dami Ryu	Kumoh National Institute of Technology, Korea
		Gyeong-ui Min	Kumoh National Institute of Technology, Korea
CST-P-24	A STUDY OF THE STATUS AND REVIEW OF AI CHATBOT SERVICES IN FASHION ACCESSORY BRANDS	Myeongseon Jeong	Jeju National University, Korea
		Uiseong Oh	Jeju National University, Korea
		Rani Eom*	Jeju National University, Korea
CST-P-25	DEVELOPMENT OF THE BODY TYPE MATRIX FOR OPTIMIZED MASS CUSTOMIZATION OF APPAREL PRODUCTION FOR VARIOUS BODY SHAPES	Jiyoung Choi	Seoul National University, Korea
		Hye Suk Kim	Seoul National University, Korea
		Hee Eun Choi*	Seoul National University, Korea
CST-P-26	DOMESTIC RESEARCH TREND ANALYSIS FOR ESTABLISHING A CLOTHING WEAR TEST EVALUATION SYSTEM APPLICABLE TO THE DIGITAL TWIN ENVIRONMENT -FOCUSING ON QUANTITATIVE FIT EVALUATION–	Heejae Lee	Seoul National University, Korea
		Young Yoon Bae	Seoul National University, Korea
		Hee Eun Choi*	Seoul National University, Korea
CST-P-27	EVALUATION OF WEAR COMFORT OF SPINAL SUPPORTS DEPENDING ON TYPES OF 3D PRINT MATERIAL	Heeran Lee*	Kumoh National Institute of Technology, Korea
		Hajeong Kim	Kumoh National Institute of Technology, Korea
		Gyeong-ui Min	Kumoh National Institute of Technology, Korea
		Dami Ryu	Kumoh National Institute of Technology, Korea
CST-P-28	A SURVEY ON THE SUSTAINABLILITY COURSES IN KOREAN UNIVERSITIES' CLOTHING/FASHION-RELATED DEPARTMENTS & GLOBAL FASHION SCHOOLS -FOCUSING ON BACHELOR'S DEGREE PROGRAMS OR HIGHER-	Kyong-Hwa Yi*	The Catholic University of Korea
CST-P-29	PROPOSAL ON CLOTHING EVALUATION CRITERIA FOR MOTION SUITABILITY OF FUNCTIONAL SLEEVE PATTERN USING VIRTUAL FITTING SYSTEMS	Heejae Lee	Seoul National University, Korea
		Hee Eun Choi*	Seoul National University, Korea

Session 2. Economics of Clothing & Textiles/Fashion Business

No.	Title	Author	Affiliation
ECTFB-P-01	MATERIALIM, ECONOMIC MOTIVES, AND LIFE SATISFACITON IN LUXURY FASHION CONSUMPTION	Jihyun Kim Vick* Jongeun Rhee Hae Won Ju	Kent State University, USA University of Wisconsin-Stout, USA Framingham State University, USA
ECTFB-P-02	THE IMPACT OF SOCIAL MEDIA FASHION INFLUENCER ATTRIBUTES ON PURCHASE INTENTIONS AMONG GENERATION Z CONSUMERS	Qingyang Liu* Yoon-Jung Lee	Korea University, Korea Korea University, Korea
ECTFB-P-03	AI SERVICES IN FASHION RETAIL: UNDERSTANDING PRIVACY PARADOX	Ishtehar Sharif Swazan Myrofora Jatho Li Zhao Song-yi Youn*	University of Missouri, USA University of Missouri, USA University of Missouri, USA University of Missouri, USA
ECTFB-P-04	SUSTAINABLE FASHION IN EDUCATION: A STUDENT PERSPECTIVE ON CHALLENGES IN THE RETAIL SECTOR	Song-yi Youn* Joohye Hwang	University of Missouri, USA Thomas Jefferson University, USA
ECTFB-P-05	WHEN A CELEBRITY ENDORSER GETS IN TROUBLE: THE EFFECTS OF BRANDS' RESPONSE TIME AND TYPE OF NEW ENDORSER ON BRAND ATTITUDE	Xiaohan Zhou Hyeji Kim Sojin Jung*	Kyung Hee University, Korea Kyung Hee University, Korea Kyung Hee University, Korea
ECTFB-P-06	THE IMPACT OF SELF-EXPRESSION THROUGH AVATAR DECORATION BEHAVIOR ON METAVERSE ACTIVITY INTENTION THROUGH PSYCHOLOGICAL IDENTIFICATION AND PLATFORM ENGAGEMENT	Mi Young Choi*	Duksung Women's University, Korea
ECTFB-P-07	ANALYZING THE SUSTAINABLE PRACTICES AND STRATEGIES IN FASHION: A CASE STUDY ON KERING	Hyunjung Lee MiKyung Kim Eunhyuk Yim*	Sungkyunkwan University, Korea Sungkyunkwan University, Korea Sungkyunkwan University, Korea
ECTFB-P-08	EXPLORING THE INFLUENCE OF GEOGRAPHICAL INDICATION AND FAIR TRADE KNOWLEDGE ON PURCHASE INTENTIONS: A BRAND EQUITY PERSPECTIVE IN FAIR TRADE HANDICRAFTS	Eunmi Lee Li Zhao* Song-yi Youn	University of Missouri, USA University of Missouri, USA University of Missouri, USA
ECTFB-P-09	THE EFFECTS OF INFORMATION MESSAGES AND ATMOSPHERE OF VR FASHION RETAIL SPACES ON ECO-FRIENDLY FASHION CONSUMPTION	Yujeong Won Youngho Sim Yuri Lee*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
ECTFB-P-10	EXPLORING HEDONIC AND UTILITARIAN ASPECTS THROUGH PERCEIVED WARMTH IN HUMAN-DESIGNED VS. AI-GENERATED FASHION	Dooyoung Choi Ha Kyung Lee*	Old Dominion University, USA Chungnam National University, Korea
ECTFB-P-11	EXPLORING CONSUMER PROFILES IN SOCIAL FASHION RESALE: UNDERSTANDING ENGAGEMENT BEHAVIORS, MOTIVATIONAL DRIVERS AND INNOVATIVENESS IN CIRCULAR AND GENERAL FASHION	Jisoo Park Miah Lee* Ha Youn Kim	Seoul National University, Korea Seoul National University, Korea Kunsan National University, Korea

No.	Title	Author	Affiliation
ECTFB-P-12	KOREAN ATHLEISURE BRANDS' INTERNATIONALIZATION: A CASE STUDY OF XEXYMIX, ANDAR, AND MULAWEAR	Minjoo Choi Yunjeong Han* Jina Kim Hongjoo Woo	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea
ECTFB-P-13	DEFYING THE DISPOSABLE CULTURE: THE CASE OF MENSTRUAL UNDERWEAR	Jiyoung Kim* Haejin Gam Jana Hawley	University of North Texas, USA University of North Texas, USA University of North Texas, USA
ECTFB-P-14	MATERIAL MATTERS: UNVEILING CONSUMER RESPONSES TO VEGAN FAUX FUR AND LEATHER IN FASHION ADVERTISING	Sunwoo Kim Chorong Youn* Songmee Kim	Seoul National University, Korea Pusan National University, Korea Hong Kong Polytechnic University, Hong Kong
ECTFB-P-15	UNDERSTANDING CHANGES IN US CONSUMERS' APPAREL SHOPPING BEHAVIOR IN THE POST COVID-19 USING SEMANTIC NETWORK ANALYSIS	Hye Jung Jung Chorong Youn Yun Jung Choi Heesoon Yang*	Chung-Ang University, Korea Pusan National University, Korea Mokpo National University, Korea Sangmyung University, Korea
ECTFB-P-16	THE IMPACT OF INFORMATION SOURCE CHARACTERISTICS ON CONSUMER BEHAVIOR IN LUXURY FASHION PRICE INCREASES	Hye Jin Lee Yuri Lee*	Seoul National University, Korea Seoul National University, Korea
ECTFB-P-17	A STUDY OF FASHION LIFELOGGING APP ADOPTION: APPLICATION OF THE UTAUT2 MODEL	Chanhee Kang Yujeong Won Yuri Lee Hakkyun Kim*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Sungkyunkwan University, Korea
ECTFB-P-18	METAVERSE AS ARTISTIC SPACE: THE IMPACT OF GENERATIVE ART IN VIRTUAL RETAIL STORES –THE MODERATING EFFECT OF BRAND TYPE–	Woo Bin Kim Jhovanna Vanessa Perez So-Yeon Yoon*	Cornell University, USA Cornell University, USA Cornell University, USA
ECTFB-P-19	A DEEP DIVE INTO PREEMPTIVE RETURN CONSIDERATION PURCHASING IN ONLINE FASHION SHOPPING	Jae Im Jang* Ho Jung Choo	Seoul National University, Korea Seoul National University, Korea
ECTFB-P-20	NAVIGATINIG SUSTAINABILITY: THE IMPACT OF ECO-LABELS ON CONSUMER DECISION-MAKING AND TRUST	Sumin Kim Kyu-Hye Lee*	Hanyang University, Korea Hanyang University, Korea
ECTFB-P-21	AM I A GOOD DESIGNER?: THE EFFECTS OF PERCEIVED INNOVATIVENESS ON PLEASURE AND SELF-EXPANSION IN THE AI-DRIVEN DESIGN PROCESS	Ha Kyung Lee* Dawool Jung	Chungnam National University, Korea Gachon University, Korea
ECTFB-P-22	EXPLORING MEDIA RICHNESS IN THE METAVERSE: THE ROLE OF RENDERING QUALITY AND AVATAR REALISM IN USER EXPERIENCE AND ENGAGEMENT	Namhee Yoon* Ha Kyung Lee	Korea University, Korea Chungnam National University, Korea
ECTFB-P-23	TO CLOSE THE LOOP: CASE ANALYSIS OF CIRCULAR ECONOMY ACTIVITIES IN THE FASHION INDUSTRY	Heewon Sung* Hye Rin Kim	Gyeongsang National University, Korea Gyeongsang National University, Korea

No.	Title	Author	Affiliation
ECTFB-P-24	AMPLIFYING CONSUMER–BRAND CONNECTIONS: EXPLORING STRATEGIC SERIES BRANDING IN THE FASHION INDUSTRY	Joon-Ho Seon Kyu-Hye Lee*	Hanyang University, Korea Hanyang University, Korea
ECTFB-P-25	WHAT DEFINES DIGITAL FASHION? UNVEILING INSIGHTS THROUGH INSTAGRAM DATA ANALYSIS	Byoungho Ellie Jin Suhyoung Ahn*	North Carolina State University, USA Yonsei University, Korea
ECTFB-P-26	THE EFFECTS OF CUSTOMER ORIENTATION OF FASHION BRAND SALESPERSON ON JOB RESULTS: FOCUSING ON THE MEDIATING EFFECT OF CORE SALES TASKS	Hyun-Jeong Oh*	Gwangju University, Korea
ECTFB-P-27	GENERATIONAL DIFFERENCES OF KOREAN CONSUMERS FOR THE PURCHASE BEHAVIOR OF FASHION PRODUCTS RELATED TO PRO-ENVIRONMENT AND ANIMAL ISSUES	Heesook Hong*	Jeju National University, Korea
ECTFB-P-28	UNDERSTANDING PRO-ENVRIONMENTAL BEHAVIORAL INTENTION PROMOTED BY VIRTUAL VERSUS HUMAN INFLUENCERS: THE MEDIATING ROLE OF EMPATHY	Jennifer (Yeeun) Huh* Ju Yeun Jang Do Yuon Kim	Texas Tech University, USA Hong Kong Polytechnic University, Hong Kong Gachon University, Korea
ECTFB-P-29	SUSTAINABLE STANDARDS, SITUATIONAL CHOICES: ECO-FRIENDLY LEATHER AND NORM ACTIVATION	Hyunjeong Rhee Naan Ju Sebin Lee Kyu-Hye Lee*	Hanyang University, Korea Dong-A University, Korea Hanyang University, Korea Hanyang University, Korea
ECTFB-P-30	INVESTIGATION OF CONSUMER ATTITUDES AND USAGE INTENTIONS TOWARDS FASHION RENTAL SERVICES	Jie yurn Kim*	Honam University, Korea
ECTFB-P-31	CONTINUOUS TRAINING OF ROUGH AND DETAILED MODELS FOR FASHION CLOTHING	Junoh Lim Woojin Choi Bongjun Choi*	Dongseo University, Korea Hong Kong Polytechnic University, Hong Kong Dongseo University, Korea
ECTFB-P-32	HOW YOUTUBE FRONT ADVERTISING AFFECTS CONSUMERS' PURCHASE INTENTIONS?	Suhyun Jeon Jihyun Kwak Yujin Jeong Jiyoon Lee Minjung Park*	Ewha Womans University, Korea Ewha Womans University, Korea Ewha Womans University, Korea Ewha Womans University, Korea Ewha Womans University, Korea
ECTFB-P-33	ANNOYING OR USEFUL?: CONSUMER LOYALTY TO ONLINE FASHION PLATFORM THROUGH BENEVOLENCE AND MALEVOLENCE BELIEFS TOWARD APP PUSH NOTIFICATIONS	Ha Kyung Lee Jaekyong Lee Minkyoung Jung Habin Kim Ho Jung Choo*	Chungnam National University, Korea Mokpo National Universtiy, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
ECTFB-P-34	UNVEILING SHEIN: EXPLORING STRATEGIES AND CHALLENGES IN E-COMMERCE INDUSTRY DEVELOPMENT	Peiyi Li Kyu-Hye Lee*	Hanyang University, Korea Hanyang University, Korea
ECTFB-P-35	IS BACKGROUND REALISM BENEFICIAL OR HARMFUL IN THE VIRTUAL INFLUENCER MARKETING?: BASED ON THE THEORY OF SOCIAL IDENTITY THREAT	Jeeweon Wee* Namhee Yoon Yoon-Jung Lee	Korea University, Korea Korea University, Korea Korea University, Korea

No.	Title	Author	Affiliation
ECTFB-P-36	UNDERSTANDING USER RESPONSES TO PROMOTED CONTENT OF SOCIAL MEDIA INFLUENCERS: A MACHINE LEARNING PERSPECTIVE	Kiyong Kwon Chaeheun Lee Sumin Kang Minju Kim Youngjae Kwon Jongwon Hwang Miah Lee*	Seoul National University, Korea University of Seoul, Korea Sejong University, Korea University of Seoul, Korea Kyunghee University, Korea Gangneung-Wonju National University, Korea Seoul National University, Korea
ECTFB-P-37	A COLLABORATION BEYOND FASHION: OO WEARS PRADA	Ji Yoon Kim Kyu-Hye Lee*	Hanyang University, Korea Hanyang University, Korea
ECTFB-P-38	A STUDY ON CONSUMERS' REACTION TO CELEBRITY-ENDORSED SNS ADVERTISING: USING SEMANTIC NETWORK ANALYSIS	Tae-Youn Kim Jeong Sook Ji*	Seowon University, Korea Korea University, Korea
ECTFB-P-39	EFFORTS BY DEVELOPING COUNTRY TO SECURE INTERNATIONAL COMPETITIVENESS IN THE GLOBAL TEXTILE MARKET: UZBEKISTAN	Khakimov Asadbek Naan Ju*	Dong-A University, Korea Dong-A University, Korea
ECTFB-P-40	NAVIGATING HMD TECHNOLOGY FOR FASHION: ADDRESSING CONSUMER CONCERNS AND EXPLORING APPLICATIONS	Naan Ju*	Dong-A University, Korea
ECTFB-P-41	CONSUMER KNOWLEDGE AND PERCEIVED RISK ON ATTITUDES AND PURCHASE INTENTIONS OF PHYSICAL FASHION PRODUCTS ON METAVERSE	Jihyeong Son*	Washington State University, USA
ECTFB-P-42	FUNCTIONALITY AND SUSTAINABILITY ON CONSUMER PURCHASE INTENTIONS FOR SPORTSWEAR	Juyoung Lee Jihyeong Son*	Mississippi State University, USA Washington State University, USA

Session 3. Fashion Design & Cultural Study on Fashion

No.	Title	Author	Affiliation
FDC-P-01	UNVEILING THE PERFORMATIVITY OF SEXUALITY AND GENDER IN SAM SMITH'S INSTAGRAM IMAGERY: A COMPARATIVE STUDY WITH LEIGH BOWERY'S WORKS	Huiryang Kim Min Hee Ye Eunhyuk Yim*	Sungkyunkwan University, Korea Sungkyunkwan University, Korea Sungkyunkwan University, Korea
FDC-P-02	CHARACTERISTICS OF LUXURY BRANDS' COLLABORATION: FOCUSED ON MEDIA REPORTS	Seung Hwan Kim Yhe-Young Lee*	Korea University, Korea Korea University, Korea
FDC-P-03	EVOLUTION OF FEMALE IMAGERY AND FEMININITIES IN YUEFENPAI NIANHUA	Hongyan Li Eunhyuk Yim* Aizhen Li	Xi'an Academy of Fine Arts, China Sungkyunkwan University, Korea Qingdao University, China
FDC-P-04	LUXURY FASHION BRANDS' COLLECTION VENUES AND CULTURAL APPROPRIATION	Seoyoung Choi* Jisun Lee Jisoo Ha	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
FDC-P-05	DEVELOPMENT OF LCA SERVICE DESIGN ADOPTED AI FOR SUSTAINABLE FASHION	Sunwoo Lee Ruobing Li Jee Hyun Lee Jeongmin Kho*	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea
FDC-P-06	CHINA'S NEW FASHION IDENTITY: EXPLORING BALANCE IN EXCHANGES WITH WESTERN FASHION	Luyue Zhang Eunhyuk Yim*	Sungkyunkwan University, Korea Sungkyunkwan University, Korea
FDC-P-07	FROM BLOGS TO INSTAGRAM: WHY DO FASHION INFLUENCERS SHIFT PLATFORMS?	Jiwon Lee Jisun Lee Jaehoon Chun*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
FDC-P-08	DEVELOPMENT OF CONVERTIBLE JACKET DESIGNS CONSIDERING THE THEORY OF STIMULUS-ORGANISM-RESPONSE	Liu Ziying Chen Jinzhi Byungkwan Ko Sumin Koo*	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea
FDC-P-09	RESEARCH ON THE AESTHETIC SENSE OF CLOTHING IN CONFUCIAN CULTURE AND ITS CONTEMPORARY VALUES	Wu Nan*	Shandong University of Technology, China
FDC-P-10	EVALUATING AFFECTIVE LEXICONS IN VIRTUAL FASHION DESIGN ELEMENTS: EMPHASIS ON COLORS AND TEXTURES	Eun Kyoung Yang* Jeong Min Kho Ruobing Li	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea
FDC-P-11	THE CULTURAL AND HISTORICAL SIGNIFICANCE OF THE COSTUME POLICY TO ÜRIYANGQAI(兀良哈) IN THE EARLY JOSEON DYNASTY –FOCUSING ON THE POLICY IN THE KING TAEJONG'S REIGN-	Jeong Choi*	Wonkwang University, Korea
FDC-P-12	SUSTAINABLE DESIGN PRACTICES AMONG FASHION DESIGNERS THROUGH ESG FASHION PROJECTS: FOCUSING ON SELF-EFFICACY AND SUSTAINABILITY	Hyunjoo Hur* Nayeon Kil	Seoul National University, Korea Seoul National University, Korea
FDC-P-13	ANALYSIS OF ITEM COMPOSITION WITHIN A FASHION COORDINATION DATASET: FOCUSING ON FASHION EMOTIONS	Nanghee Park Yoonmi Choi*	Chungnam National University, Korea Chungnam National University, Korea

No.	Title	Author	Affiliation
FDC-P-14	ANALYSIS OF PRODUCT CHARACTERISTICS AND CONSUMER REVIEWS OF KOREAN TRADITIONAL SHOES IN ONLINE SHOPPING MALLS USING TEXT MINING	Hee Young Kim*	Kyungin Women's University, Korea
FDC-P-15	HOW CLASSICAL MUSIC CAN INSPIRE FASHION DESIGN CREATION	Yoon Kyung Lee*	Pusan National University, Korea
FDC-P-16	MAKER OF FACE INLAID GLASS BEAD AND TRADITIONAL CLOTHING WEARING NECKLACES	Hyo Jeong Lee* Young Joo Na	Inha University, Korea Inha University, Korea
FDC-P-17	PROANA IN THE MEDIA FROM THE PERSPECTIVE OF JEAN BAUDRILLARD'S CONSUMER SOCIETY THEORY	Yewon Choe Jisun Lee Jaehoon Chun*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
FDC-P-18	CHARACTERISTICS OF THE GENDER FLUID FASHION ON INSTAGRAM	Seoyeon Min Jisun Lee Jaehoon Chun*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
FDC-P-19	TRANSVESTISM AND GENDER EXPRESSION: CHARACTERISTICS OF THE 21st CENTURY MALE CROSS-DRESSING	Zihua Li Yhe-Young Lee*	Korea University, Korea Korea University, Korea
FDC-P-20	ANALYZING FASHION EMOTION IMAGE EXPRESSION USING MIDJOURNEY: FOCUSING ON HOME WEAR EMOTIONS	Nanghee Park Yoonmi Choi*	Chungnam National University, Korea Chungnam National University, Korea
FDC-P-21	A STUDY ON THE STEP-BY-STEP PROCESS OF FASHION DESIGN IDEATION USING MIDJOURNEY	Nanghee Park Yoonmi Choi*	Chungnam National University, Korea Chungnam National University, Korea
FDC-P-22	VINTAGE CHARACTERISTICS DISPLAYED IN FASHION BRAND BODE	Kathleen Hanhee Kye Juhee Park*	Kookmin University, Korea Kookmin University, Korea
FDC-P-23	DESIGN DEVELOPMENT AND AESTHETIC DESIGN EVALUATION EXPERIMENT OF STRETCHABLE WORKWEAR FOR TWO-WHEELER DELIVERY WORKERS ON RAINY DAYS -FOCUSING ON KOREAN MEN IN THEIR 20S AND 30S-	Sujin Lim Jisoo Ha*	Seoul National University, Korea Seoul National University, Korea
FDC-P-24	AI INTEGRATION IN FASHION DESIGN EDUCATION: AN EXAMINATION OF AI-BASED TOOLS AND SUPPORT STRATEGIES	Hyosun An Minjung Park*	Ewha Womans University, Korea Ewha Womans University, Korea
FDC-P-25	A COMPREHENSIVE EXPLORATION OF MONGOLIAN TRADITIONAL COSTUME DESIGN	Gombojav Chuluunaa* Chuluunbaatar Battsetseg	Mongolian National University of Education, Mongolia Mongolian National University of Education, Mongolia
FDC-P-26	A STUDY ON TEXT PROMPTS FOR HANBOK IMAGE GENERATION IN GENERATIVE AI: FOCUS ON CIVITAI	Minji Kim Soon-young Kim*	Jeonbuk National University, Korea Jeonbuk National University, Korea
FDC-P-27	A COMPARATIVE ANALYSIS OF COLOR ATTRIBUTES IN LUXURY FASHION BRANDS ACROSS CREATIVE DIRECTOR TRANSITIONS	Yujin Kwon Jung Soo Lee*	Ewha Womans University, Korea Ewha Womans University, Korea

No.	Title	Author	Affiliation
FDC-P-28	DEVELOPMENT OF IMAGE EXPRESSION FOR FASHION DESIGN USING GENERATIVE AI	Yoonju Chung*	Konkuk University, Korea
FDC-P-29	DANAMIC DESIGN FOUNDATION TYPE OF SHAPE CHANGING FABRIC USING SHAPE MEMORY ALLOYS	Jongsun Kim*	Suwon Women's University, Korea
FDC-P-30	PHOTO-EDITING APP USAGE MOTIVATIONS	Jaehee Jang* Jisoo Ha	Seoul National University, Korea Seoul National University, Korea
FDC-P-31	FACTORS INFLUENCING SELF-PRESENTATATION ON SOCIAL MEDIA	Jaehee Jang* Jisoo Ha	Seoul National University, Korea Seoul National University, Korea

Session 4. Textile Science & Technology

No.	Title	Author	Affiliation
TST-P-01	TRADITIONAL NOMAD ECO-MATERIALS AND MODERN APPLICATIONS	Tumenkhishig Purevdorj* Bayarjargal Vanchinsyren* Uridynbish Sukhbaatar*	Mongolian National University of Education, Mongolia Mongolian National University of Education, Mongolia Mongolian National University of Education, Mongolia
TST-P-02	ANALYSIS OF MIDSOLE FOOT PRESSURE IN RUNNING SHOES WITH DIFFERENT 3D PRINTED BIONIC STRUCTURES	Li Jing Imjoo Jung Sunhee Lee*	Dong-A University, Korea Dong-A University, Korea Dong-A University, Korea
TST-P-03	ELECTRICAL OUTPUT PERFORMANCE OF 3D PRINTED TRIBOELECTRIC NANOGENERATORS WITH VARIOUS TYPE OF CARBON MATERIALS/THERMOPLASTIC POLYURETHANE FILAMENTS	Imjoo Jung Sunhee Lee*	Dong-A University, Korea Dong-A University, Korea
TST-P-04	IMPACT OF UV IRRADIATION ON TEXTILE FINISHING USING SPENT COFFEE EXTRACT	Kyung Hwa Hong* Ye Ra Yoo	Kongju National University, Korea Kongju National University, Korea
TST-P-05	IN-SITU FABRICATION OF CONDUCTIVE METAL-ORGANIC FRAMEWORKS ON COPPER MESH	Soyeon Jin Jaeseon Yoo Jooyoun Kim*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
TST-P-06	RESEARCH ON THE UTILIZATION OF FUNCTIONAL NATURALLY DYED FABRICS AS FASHION MATERIALS AND ECO-PRINTING APPLICATION	Sunghee Kim* Eunhah Wee	Chonnam National University, Korea Chonnam National University, Korea
TST-P-07	CORRELATION ANALYSIS OF MATERIAL, PATTERN, AND CLOTHING PRESSURE FOR THE VALIDATION OF 3D VIRTUAL CLTOTHING PRESSURE PREDICTION SYSTEM	Nam-Yim Kim Hyojeong Lee*	Kongju National University, Korea Kongju National University, Korea

No.	Title	Author	Affiliation
TST-P-08	PERFORMANCE EVALUATION OF THE NEW KOREAN CIVIL DEFENSE UNIFORM AT SIMULATED WORKING CONDITIONS: TEXTILE MATERIAL PROPERTIES AND WEAR TRIALS	Taeryn Kim Soyun Jeong HaEun Bang Junghwan Lee Yaewon Park* Eunju Ko	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea
TST-P-09	PERFORMANCE COMPARISON OF SILK FABRICS BETWEEN SILK LIKE FABRICS FOR HANBOK MODIFIED WITH DIFFERENT CROSS-SECTIONAL SHAPE -FOCUSED ON THE MECHANICAL PROPERTIES, HAND AND DRAPABILITY-	Sunyoung Lee Jungsoon Lee*	Chungnam National University, Korea Chungnam National University, Korea
TST-P-10	NATURAL FERMENTATION DYEING USING SPENT MUSHROOM SUBSTRATE OF SHIITAKE	Kyunghee Son*	Sunchon National University, Korea
TST-P-11	AN ECO-FRIENDLY MICROENCAPSULATION OF CITRUS UNSHIU OIL AND THEIR APPLICATION TO COTTON AND NYLON FABRIC FOR AROMA RELEASING AND ANTIMICROBIAL ACTIVITY	Wu Yue Eunjou Yi*	Jeju National University, Korea Jeju National University, Korea
TST-P-12	WHAT IS THE 'ICE BROCADE 氷錦' OF 'SERES' SILK PEOPLE	Youngjoo Na* Hyojeong Lee	Inha University, Korea Inha University, Korea
TST-P-13	STUDY ON THE SWELLING KINETICS OF CELLULOSE BASED SUPERABSORBENT POLYMER CROSSLINKED WITH HUMIC ACID	Hyeong Yeol Choi*	Dong-A University, Korea
TST-P-14	ENHANCED PIEZOELECTRIC PERFORMANCE OF POLY(VINYLIDENE FLUORIDE) NANOCOMPOSITE FIBERS LOADED WITH SILVER NANOWIRE AND ZINC OXIDE FOR ENERGY HARVESTING	Hyukjoo Yang Seungsin Lee*	Yonsei University, Korea Yonsei University, Korea
TST-P-15	THE EFFECT OF MODERN AUTOMATIC 'DADEUMIJIL' PROCESSING ON THE MORPHOLOGY AND SURFACE PROPERTIES OF RAW SILK FABRIC FOR HANBOK	Chaewon Jeon Jungsoon Lee*	Chungnam National University, Korea Chungnam National University, Korea
TST-P-16	A DECADE OF SHIFTING CONSUMER LAUNDRY NEEDS THROUGH TEXT MINING ANALYSIS	Habin Kim*	Sejong University, Korea
TST-P-17	MANAGEMENT OF TEXTILE WASTES AND THEIR SUSTAINABILITY: A REVIEW	Jiyul Lee Chung Hee Park Suhyun Lee* Changsang Yun*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Ewha Womans University, Korea
TST-P-18	INTERNAL STRUCTURE ANALYSIS OF CONDUCTIVE COMPOSITE THREADS USING X-RAY COMPUTED TOMOGRAPHY -FOCUSING ON CHANGES IN THE TWISTING CONDITIONS OF CONDUCTIVE YARN-	Hyelim Kim Soohyeon Roh Kosei Nakamura KyoungHou Kim Wonyoung Jeong*	Korea Institute of Industrial Technology, Korea Korea Institute of Industrial Technology, Korea Shinshu University, Japan Shinshu University, Japan Korea Institute of Industrial Technology, Korea
TST-P-19	USER EVALUATION OF HUMAN-TOUCH SMART ARMBAND FOR TELE-HAPTIC COMMUNICATION	Hanna Choi Shinjung Yoo*	Kyung Hee University, Korea Kyung Hee University, Korea
TST-P-20	AN OPTIMIZED MICROENCAPSULATION OF SEA BUCKTHORN FRUIT OIL USING MELAMINE-FORMALDEHYDE	Badmaanyambuu Sarmandakh Eunjou Yi*	Jeju National University, Korea Jeju National University, Korea

Special Poster Session: Technology for Sustainable Clothing Care

Chair: Dr. Jeongah Ju, Jeonju University

No.	Title	Author	Affiliation
SP-01	CAUSES OF MICROFIBER EMISSIONS DURING THE WASHING PROCESS	Yoojung Han Jungeun Lim Changsang Yun* Hyewon Kim	Ewha Womans University, Korea Ewha Womans University, Korea Ewha Womans University, Korea LG Electronics, Korea
SP-02	DUST REMOVAL VIA FABRIC MOVEMENTS WITHIN THE CLOTHING CARE SYSTEM	Dong Ju Yu Changsang Yun* Sang Wook Lee Minji Kim Seoyoun Kim	Ewha Womans University, Korea Ewha Womans University, Korea Ewha Womans University, Korea LG Electronics, Korea LG Electronics, Korea
SP-03	EFFECT OF STEAM IRONING ON WRINKLE RECOVERY OF VARIOUS FABRICS	Sunyoung Lee Jungsoon Lee* Sungho Song	Chungnam National University, Korea Chungnam National University, Korea LG Electronics, Korea
SP-04	STYLER-BUILT-IN HIGH-PRESSURE HANDY STEAMER DEVELOPMENT THROUGH STEAM QUALITY BASIC RESEARCH	Sunyoung Lee Jungsoon Lee* Seoyoun Kim Sungho Song	Chungnam National University, Korea Chungnam National University, Korea LG Electronics, Korea LG Electronics, Korea
SP-05	ANALYZING CONSUMER SEGMENTATION IN THE PERCEPTION OF SMART WASHING MACHINE TECHNOLOGY: A PRODUCT IMAGE-BASED APPROACH	Heekang Moon Sunwoo Kim* Sooyoung Oh	Pai Chai University, Korea Seoul National University, Korea LG Electronics, Korea
SP-06	DEVELOPMENT OF QUICK STEAM COURSE CONTROLLING MORAXELLA OSLOENSIS, A MAJOR BACTERIUM CAUSING LAUNDRY OFF-ODOR, TO ELIMINATE ODOR ORIGINATED FROM CLOTHES	Young-Mog Kim* Geum-Jae Jeong Young Ho Kim	Pukyong National University, Korea Pukyong National University, Korea LG Electronics, Korea
SP-07	EFFECT OF STEAM TREATMENT TO DEODORIZE THE INSIDE OFF-ODORS IN CLOTHES DRYER	Young-Mog Kim* Kyung-Jin Cho Youn-su Joo	Pukyong National University, Korea Pukyong National University, Korea LG Electronics, Korea
SP-08	THE ATTRIBUTES OF QUALITY CLASSIFICATION FOR MOBILE LAUNDRY SERVICES	Joo Hee Kang Jung-Min Han Yoon-Jung Lee* Yeonsu Joo	Gachon University, Korea Korea University, Korea Korea University, Korea LG Electronics, Korea
SP-09	THE IMPACT OF DRYER TUMBLING MOTION ON REDUCING SHRINKAGE OF CLOTHING	Jeongah Ju* Yongwan Park Minji Kim	Jeonju University, Korea Korea Institute of Convergence Textile, Korea LG Electronics, Korea
SP-10	COMPARISON OF CONSUMER LAUNDRY CARE BEHAVIOR IN SOUTH KOREA AND THE UNITED STATES BASED ON TYPES AND PRICE RANGE OF CLOTHING	Jeongah Ju* Byoungho Ellie Jin Joonyoung Shim Jooyeon Kim	Jeonju University, Korea North Carolina State University, USA Jeonju University, Korea LG Electronics, Korea
SP-11	CONSUMER RESPONSES TO PERSONALIZED LAUNDRY SOLUTIONS BASED ON CONSUMER LAUDRY VALUES: AN INVESTIGATIVE STUDY	Heekang Moon Chorong Youn* Sooyoung Oh	Pai Chai University, Korea Pusan National University, Korea LG Electronics, Korea
SP-12	STRATEGIC CONSUMER SEGMENTATION FOR PERSONALIZED SOLUTIONS IN CLOTHING CARE DEVICES: A MARKETING TOOL DEVELOPMENT STUDY	HeekangMoon Chorong Youn* Songmee Kim Sooyoung Oh	Pai Chai University, Korea Pusan National University, Korea Hong Kong Polytechnic University, China LG Electronics, Korea

May 11 (Sat.), 2024
15:00~16:30 Concurrent Sessions (On/Offline Hybrid)

Special Topic Oral Presentation Session 2
: Human-Tech Synergy for Circular Economy in Fashion (Online)

Chair: Dr. Kyu-Hye Lee, Hanyang University

No.	Title	Author	Affiliation
SO-06	VIRTUAL POSSESSIONS AND REAL CONNECTION: THE INFLUENCE OF PERCEIVED OWNERSHIP IN THE METAVERSE ON CONSUMER BEHAVIOR	Jinsu Park*†	University of Minnesota, USA
SO-07	CONSUMERS' PERCEPTION OF THIRD-PARTY CERTIFICATE HANGTAGS IN MOBILE SHOPPING BASED ON THE INFORMATION PROCESSING THEORY	Seong Eun Kim† Kyu-Hye Lee*	University of Missouri, USA Hanyang University, Korea
SO-08	EXPLORING THE IMPACT OF VULNERABILITY DISCLOSURES BY VIRTUAL INFLUENCERS ON CONSUMER PERCEPTIONS	Ying Qu† Zhihong Huang Eunsoo Baek* Rongren Jin Bora Choi	Hong Kong Polytechnic University, Hong Kong Hong Kong Polytechnic University, Hong Kong Hanyang University, Korea Hanyang University, Korea Hanyang University, Korea
SO-09	CUSTOM IMAGE SEGMENTATION USING YOLO-v8 TO EXTRACT REFERENCE POINTS OF PANTS' FRONT PANEL	Doyeon Kong*† Heeju Terry Park	Cornell University, USA Cornell University, USA
SO-10	ENHANCING FASHION DESIGN EDUCATION: A COMPREHENSIVE EXPLORATION INTO THE IMPACT OF OBJECT-BASED LEARNING ON STUDENT DEVELOPMENT	Hye-Won Lim* Elaine Evans†	University of Leeds, UK University of Leeds, UK
SO-11	STYLE THAT IS SUSTAINABLE: EXPLORING HOW FASHION DESIGN EDUCATION CAN ENHANCE PARTICIPANTS' AWARENESS OF SUSTAINABLE PRACTICES	Elizabeth Burton*† Kayleigh Parkes	Birmingham City University, UK Birmingham City University, UK
SO-12	SUSTAINABLE PEDAGOGY IN FASHION DESIGN: EXPLORING THE INTEGRATION OF UPCYCLING PRINCIPLES IN HIGHER EDUCATION	Hye-Won Lim*†	University of Leeds, UK

* : Corresponding author

† : Presenter

Special Topic Oral Presentation Session 3
: Design Practice for Circular Economy (Online)

Chair: Dr. Yoo Jin Kwon, Korea National Open University

No.	Title	Author	Affiliation
SO-13	AMERICAN CONSUMERS' PURCHASE INTENT OF FAUX LEATHER FASHION PRODUCTS: THE MEDIATING ROLE OF PERCEIVED MORAL INTENSITY	Heesook Hong* Yoo-Kyoung Seock[†]	Jeju National University, Korea The University of Georgia, USA
SO-14	DEMONSTRATION AND PROCESS FORMULATION THROUGH CAD SIMULATION FOR UPCYLING OF OLD SHIRT: A HOLISTIC APPROACH TOWARDS CIRCULAR FASHION	Sayoni Nath Anirban Dutta*[†]	National Institute of Fashion Technology, India Government College of Engineering and Textile Technology Serampore, India
SO-15	SUSTAINABLE AND CIRCULAR PRACTICES IN THE UK FASHION AND TEXTILE INDUSTRY	Anja Connor-Crabb*[†] Steven Toms Sophie Bulman Yue Guo Alessandra Vecchi Laura Solomon Amy Hulme	University of Leeds, UK University of Leeds, UK University of Leeds, UK University of Leeds, UK University of the Arts London, UK University of the Arts London, UK University of the Arts London, UK
SO-16	MINDFUL CONSUMPTION: CASE STUDIES OF CLOTHING SWAP AND REPAIR COMMUNITIES IN THE UK	Eunsuk Hur*[†]	University of Leeds, UK
SO-17	USING INDIGO SOY PASTE RESIST AND INDIGO DYE WITH SHIBORI TO UPCYCLE FABRICS AND ENHANCE STUDENT WELL-BEING THROUGH REFLECTVE PRACTICE	Elizabeth Burton*[†] Lucinda Holbrook-Hase	Birmingham City University, UK Birmingham City University, UK
SO-18	A STUDY OF MALE CORSET IN FASHION IN EUROPE FROM 1920 TO 2020	Zhiyi Zhang*[†]	University of Leeds, UK
SO-19	CRAFTING COLLABORATIVE DESIGN: CASE STUDIES IN CHINESE TRADITIONAL CRAFTS	Jianan Hu*[†] Eunsuk Hur Briony Thomas	University of Leeds, UK University of Leeds, UK University of Leeds, UK

* : Corresponding author
† : Presenter

Oral Session 1. Clothing Science and Technology (Offline)

Chair: Dr. Hwa Kyung Song, Kyung Hee University

No.	Title	Author	Affiliation
CST-O-01	DEVELOPMENT OF UNDERWEAR PANTS FOR WALKING ASSISTANCE CONSIDERING WEARABILITY	Jeong Eun Yoon[†] Yumin Cho Byungkwan Ko Jiwon Chung Soah Park Changhwan Kim Jesung Koh Sumin Koo*	Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Yonsei University, Korea Ajou University, Korea Ajou University, Korea Yonsei University, Korea
CST-O-02	APPLICATION OF NUDGE THEORY TO TEACHING TECH-HEAVY COURSES	Heeju Terry Park*[†]	Cornell University, USA
CST-O-03	DEVELOPMENT OF AN AUGMENTED REALITY (AR)-BASED LEARNING SYSTEM FOR INDUSTRIAL LOCKSTITCH SEWING MACHINES	Chanwoo Ryu[†] Hwa Kyung Song* Eun Joo Ryu	Kyung Hee University, Korea Kyung Hee University, Korea Ewha Womans University, Korea
CST-O-04	CO-DESIGN OF CUSTOMIZED WEARABLE SMART INNERWEAR WITH A CEREBRAL PALSY PATIENT	Sukyung Kang[†] Sung-Jin Park Young A Koh Juyeon Park*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
CST-O-05	FEASIBILITY OF CHATGPT IN GARMENT PATTERN MODIFICATION GUIDANCE	Amanda Knisely-Medina Jeyeon Jo*[†]	University of Georgia, USA University of Georgia, USA
CST-O-06	INTEGRATING USER NEEDS AND 3D TECHNOLOGIES INTO DESIGN OF WEARABLE ASSISTIVE FOOT SLEEVE FOR AN AGING PROFESSIONAL WOMAN WITH WALKING DISABILITY	So Hyun Lee[†] So-Hyun Lee Yuzi Luo Hyunjoo Kim Juyeon Park*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea

* : Corresponding author

† : Presenter

Oral Session 2. Circular Fashion and Healthy Growth(Offline)

Chair: Dr. Heewon Sung, Gyeongsang National University

No.	Title	Author	Affiliation
CFHG-O-01	CROSS-CULTURAL EFFECTS OF SIZE-INCLUSIVE FASHION ADVERTISING IN CORPORATED SOCIAL RESPONSIBILITY	Sunwoo Kim[†] Sujin Yang[*]	Seoul National University, Korea Sungshin Women's University, Korea
CFHG-O-02	DOES THE OTHER-BENEFIT APPEAL ALWAYS WORK IN SUSTAINABILITY ADVERTISING? EXAMINING INTERACTION EFFECTS WITH BRAND TYPES	Yoo-Won Min[*†] Jiwoon Kim Byoungho Ellie Jin	North Carolina State University, USA North Carolina State University, USA North Carolina State University, USA
CFHG-O-03	CIRCULAR BUSINESS MODEL IN THE FASHION INDUSTRY: AN EMPIRICAL INVESTIGATION OF THE RECOMMERCE STRATEGIES	Jiyoung Kim[*†] Sanjukta Pookulangara Iva Jestratijevic Scot Case Caroline Bowen	University of North Texas, USA University of North Texas, USA University of North Texas, USA National Retail Federation, USA University of North Texas, USA
CFHG-O-04	A CROSS-CULTURAL COMPARISON OF COLLABORATIVE CONSUMPTION: THE CASE OF FASHION SWAPPING	Sukyung Seo[*†] Chunmin Lang	University of Maryland Eastern Shore, USA Louisiana State University, USA
CFHG-O-05	THE EFFECT OF GEAR ACQUISITION SYNDROME ON CONSUMER PRIDE AND SUBJECTIVE WELL-BEING IN SPORTSWEAR	Jiyoung Hwang[†] Minjung Park[*]	Ewha Womans University, Korea Ewha Womans University, Korea

* : Corresponding author
† : Presenter

Oral Session 3. Emerging Technologies and Consumer Behavior(Offline)

Chair: Dr. Minjung Park, Ewha Womans University

No.	Title	Author	Affiliation
ETCB-O-01	BECOMING THE IDEAL SELF IN THE METAVERSE NAVIGATING SELF-EXPANSION IN CROSS-CULTURE PERSPECTIVES	Byoungho Ellie Jin Suhyoung Ahn*†	North Carolina State University, USA Yonsei University, Korea
ETCB-O-02	THE EFFECT OF ENCLOTHED AVATAR IDENTIFICATION IN THE METAVERSE ON IDENTITY AUGMENTATION AND PURCHASE INTENTION	Yu Sun† Ho Jung Choo*	Shangqiu Normal University, China Seoul National University, Korea
ETCB-O-03	CONSUMER RESPONSES TO FASHION RETAIL SERVICES USING INTERACTIVE RETAIL TECHNOLOGIES	Taeyoen Kim† Ho Jung Choo*	Seoul National University, Korea Seoul National University, Korea
ETCB-O-04	LEVERAGING USER COMMENTS FOR ENHANCED AND EFFICIENT PERSONALIZED FASHION STYLE SEARCH SYSTEMS: ADOPTING EMBEDDING TECHNIQUES	Joo Hee Kang Young Mi Kim SeungKyeong Choi† Yoon-Jung Lee*	Gachon University, Korea Hyundai Industry Vocational Training College, Korea DC Solutions, Korea Korea University, Korea
ETCB-O-05	BEYOND NEGATIVITY BIAS: AN ANALYSIS ON SENTIMENT ENTROPY IN E-WOM	Zhihong Huang† Eunsoo Baek*	Hong Kong Polytechnic University, Hong Kong Hanyang University, Korea

* : Corresponding author
† : Presenter

Oral Session 4. New Fashion Design Method(Offline)

Chair: Dr. Yhe-Young Lee, Korea University

No.	Title	Author	Affiliation
FDC-O-01	A COMPARATIVE STUDY ON THE FASHION DESIGN PROCESS UTILIZING SMART AND CONVENTIONAL TEXTILES: IMPLICATIONS FOR THE INDUSTRY AND EDUCATION	Shin Young Jang Chahong Chung† Jisoo Ha*	Gachon University, Korea Seoul National University, Korea Seoul National University, Korea
FDC-O-02	AN ANALYSIS OF CONSUMER SENSORY AND SENSIBILITY FACTORS FOR PLANNING CONDUCTIVE FABRIC CLOTHING	Sujin Park† Jisoo Ha*	Seoul National University, Korea Seoul National University, Korea
FDC-O-03	BEYOND BOUNDARIES: EXPLORING SPATIAL EXTENSIONS OF LUXURY FASHION BRANDS THROUGH TRANSMEDIA STORYTELLING	Chaeeun Hwang† Jisun Lee Jaehoon Chun*	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea
FDC-O-04	MOTIFS EXPLORATION WITH INSPIRATION OF THE THREE KINGDOMS OF KOREA APPLIED THROUGH SURFACE TEXTILE TECHNIQUES FOR GARMENT	Vanessa Yofania*† Sabrina Ilma Sakina	Institut Teknologi Bandung, Indonesia Institut Teknologi Bandung, Indonesia

* : Corresponding author
† : Presenter

Oral Session 5. Textile Science and Technology(Offline)

Chair: Dr. Sunhee Lee, Dong-A University

No.	Title	Author	Affiliation
TST-O-01	EVALUATION METHOD OF REMOVAL RATE ON PARTICLES ON THE FABRIC	Yoonkyung Cho[†] Sungmin Kim*	Incheon National University, Korea Seoul National University, Korea
TST-O-02	A NEW PARADIGM OF GARMENT CLEANING: CARBON DIOXIDE	Jiyu Lee*[†] Yeajin Cho Somin Lee Halim Lee Sungho Yoon Hoon Wee	Samsung Electronics, Korea Samsung Electronics, Korea Samsung Electronics, Korea Samsung Electronics, Korea Samsung Electronics, Korea Samsung Electronics, Korea
TST-O-03	EXPLORATION OF ABACA FIBER CHARACTERISTICS THROUGH WEAVING FOR CLOTHING	Kayla Thalusya Sandhiasti*[†] Sabrina Ilma Sakina	Institut Teknologi Bandung, Indonesia Institut Teknologi Bandung, Indonesia
TST-O-04	A COMPARATIVE STUDY ON THE DRYING MECHANISMS AND CHARACTERISTIC CHANGES OF FABRICS ACCORDING TO HEAT TRANSFER PRINCIPLES	Jiyul Lee[†] Shin Young Park Suhyun Lee* Jaeyong Cho Young Ho Ryu	Seoul National University, Korea Seoul National University, Korea Seoul National University, Korea Samsung Electronics, Korea Samsung Electronics, Korea
TST-O-05	A STUDY ON THE WEAVING TECHNIQUE OF KYUNG-GEUM(經錦) IN ANCIENT KOREA AND THE ETYMOLOGY OF SERICIN	Jisu Kim*[†]	Inha University, Korea

* : Corresponding author

† : Presenter

Registration

Conference Registration

The conference Registration includes:

· Access to day 1 & day 2 programs including all concurrent research sessions, keynotes, special lectures, joint symposia and most of event programs. (The Welcome Dinner and Pre-conference Workshop costs are excluded)
· Full online access to digital platforms including Zoom sessions and conference proceedings.

Full-Rate - KSCT Member	KRW 150,000	USD 150
Full-Rate - All Non Member (including students)	KRW 170,000	USD 170
Student Rate - KSCT Member	KRW 70,000	USD 70

Poster fee

Poster (1ea)	KRW 20,000	USD 20
Poster (2ea)	KRW 40,000	USD 40
Poster (3ea or more)	KRW 40,000	USD 40

Young Scholar Mentoring

Graduate students and post-doctoral researchers (within 7 years of obtaining their doctoral degree) are invited to Young Scholar Mentoring program. Please sign up for the mentoring program when registering for the conference.
· When: Friday, May 10, 2024, 8:00 pm
· Where: Ocean View, Booyoung Hotel
* If you would like to participate, please contact **ksct@ksct.or.kr**

Pre-Conference Workshop

· Program: Eco-print Wool Scarf Craft Workshop
· When: Friday, May 10, 2024, 13:30~15:30 pm
· Registration fee: USD 80 (KRW 80,000)
* If you would like to participate, please contact **ksct@ksct.or.kr**

Directions

Access to
ICC Jeju and Booyoung Hotel & Resort

From Jeju International Airport

From Jeju Internation Airport, you will reach ICC Jeju in approximately 40-50 minutes by car through Pyeonghwa-Ro Road. Limousine buses are also available every 15 minutes at the airport.

The airport limousines (No. 600) (Jeju International Airport ↔ Jeju International Convention Center)
· **Place** Limousine bus stop at the left side of the front gate (Samyoung Traffic No. 600)
· **Departure at the airport** First departure at 6am; Last departure at 10:40pm
· **Fare** Airport ↔ ICC Jeju \ 4, 500 (one way)
· **Service route**
 Airport → T.H.E Hotel and Vegas Casino Jeju → Entrance to the Yeomiji Botanical Garden → Hyatt Hotel →
 Shilla Hotel → Lotte Hotel → Hankook Condominium → **Jeju International Convention Center** →
 New Gyeongnam Hotel → Seogwipo KAL Hotel

Taxi (Jungmun - Jeju International Airport)
· Select the distance (long-distance or short-distance) at the taxi stop.
· When you go to the Center, it is all right to take a taxi at the long-distance stop.
· Since the taxi fare is fixed, please confirm the distance before taking a taxi
· Fare (Korean won) : About 30,000 won; Distance : 40km; Duration : 40-45 minutes

Rental car
· Advanced reservation is recommended if you plan to rent a car.
· Upon arrival, you can sign up for rental cars at the rent-a-car desk nearby airport exit.

Keynote Speeches

Envisioning Clothing and Textiles Research Agendas for a Sustainable Future

May 2024

Jung Ha-Brookshire, PhD

Fulbright Scholar
Department Chair and Professor
Textile and Apparel Management
University of Missouri
habrookshirej@missouri.edu

University of Missouri

Contexts

WHO WHAT WHERE WHEN WHY HOW

University of Missouri

Brief Self History – Circular Indeed!

o Grew up in a textile and apparel manufacturing city

o Saw the transformational impact that the textile and apparel manufacturing industry was making on my communities

o Moved to NYC after Seoul National University

o 7 years later, had a Déjà vu in El Salvador -- Became the benefactor of global sourcing

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Brief Self History

o Learned how to manage teams and divisions from MBA and how to conduct research from PhD

o Have been teaching how to source and navigate careers within the global supply chain

o Have been researching how to improve "human conditions" within the global supply chain

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My thoughts on Current Research and Education Strengths

Interdisciplinary Investigations

o Strong push/need for interdisciplinary collaboration

o Strong job markets and need for new talents

o Desire/need to take the next step

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My thoughts on Challenges in Research and Education in the US

o Restructuring of institutions or colleges

o A possible disciplinary identity loss

o Textiles and Apparel that "bond" us

o A potential to discover new opportunities

o Momentum to create a comprehensive voice for the next 100 years of the discipline

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Led to a New Model to Explain the Discipline …..

University of Missouri

Article

Envisioning the Clothing and Textile-Related Discipline for the 21st Century Its Scientific Nature and Domain From the Global Supply Chain Perspective

Jung E. Ha-Brookshire[1] and Jana M. Hawley[1]

Abstract
The Clothing and Textiles (C&T) discipline was established over a century ago within the Home Economics discipline. During the early 1960s, a major shift occurred within C&T, from domestic science to one focused on industry. This conceptual paper takes an updated approach to discuss the relevance and uniqueness of C&T at a time when universities face reorganization or adaptation. After reviewing the scientific nature of C&T, the authors defined C&T as the science of investigating the satisfaction processes of humans' clothing needs and wants. These satisfaction processes are described and classified by hypotheses, theories, generalizations, and/or laws, through scientific methods built from both logics of discovery and justification. Therefore, the authors argue that C&T are closely linked with human science units because of its ultimate goal –human satisfaction of clothing needs and wants. More importantly, the authors argue the clothing satisfaction processes occur through supply chain management, from history and forecasting to retailing and distribution, in the global marketplace. The global supply chain management framework of C&T offers homes to all types of research, creative, and educational activities that C&T scholars conduct every day, and demonstrates how each component is inter-linked with other components. Finally, visions for the future of C&T are offered if the model is adopted, and the authors suggest further conversations about the nature and domain of C&T.

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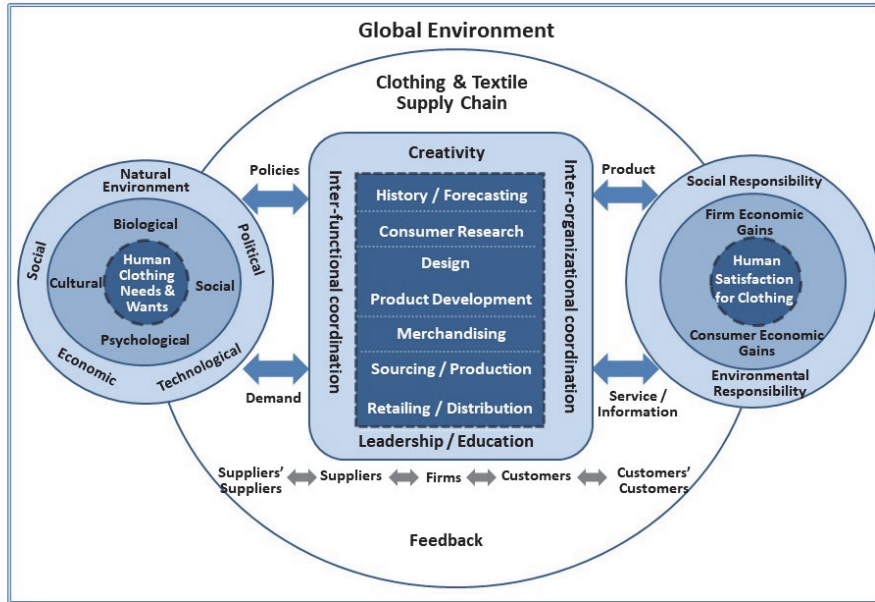
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Key Research Themes

- Branding and sourcing decisions based on consumer psychology

- Human dynamics within global fashion supply chains

- Business operation issues related to social capital

- Human empowerment and industry evolution

- The role and impact of compliance, causes and impact of supply chain disruptions

→ **Feedback Loop Make Us to Think/Plan/Execute CIRCULAR**

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Branding and sourcing decisions based on consumer psychology

Human dynamics within global fashion supply chains

46

○ Business operation issues related to social capital

○ Human empowerment and industry evolution

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O The role and impact of compliance/ causes and impacts of supply chain disruptions

New Research Agenda

→ The need for a new theory to explain sustainable consumption and production within the global supply chain

→ Moral responsibility theory of corporate sustainability and global supply chain (Ha-Brookshire, 2017)

Research Streams from the GSCM Model

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Moral Responsibility Theory of Corporate Sustainability

- ⊘ Corporation is a legal entity formed with state governmental approval to carry on business or other activities (TheLawDictionary.org)

- ⊘ Corporation is a legal person (Corporation Personhood; Law)

- ⊘ Human's moral responsibility – Perfect and Imperfect (Philosophy)

- ⊘ Therefore, a corporation have moral responsibility! (Moral Agent)

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Moral Responsibility Theory of Corporate Sustainability (MRCS)

O Necessary conditions for the implementation of corporate moral responsibility:

> ➤ Clear goals
> ➤ Well-defined structure
> ➤ All members' consistent behavior

➜ Truly Sustainable Corporation would emerge!

O If not, corporate hypocrisy may emerge and inconsistent corporate sustainability.

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Moral Responsibility Theory of Corporate Sustainability
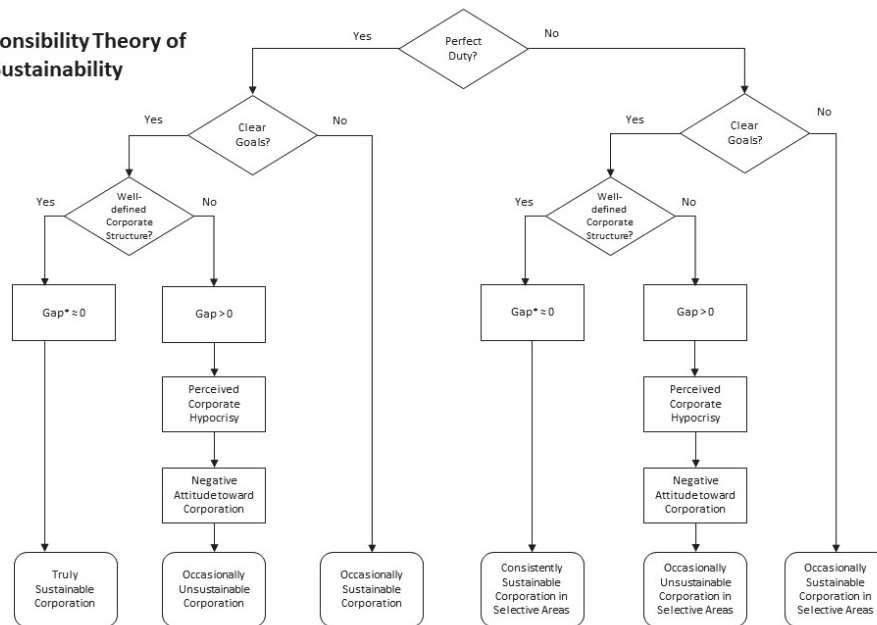
* Gap: The Gap between corporate sustainability goals and corporate members' sustainability-related behaviors

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Moral Responsibility Theory of Sustainable Supply Chain

○ The entire supply chain has to see corporations as moral agents.

○ With clear and convergent goals.

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Moral Responsibility Theory of Sustainable Supply Chain

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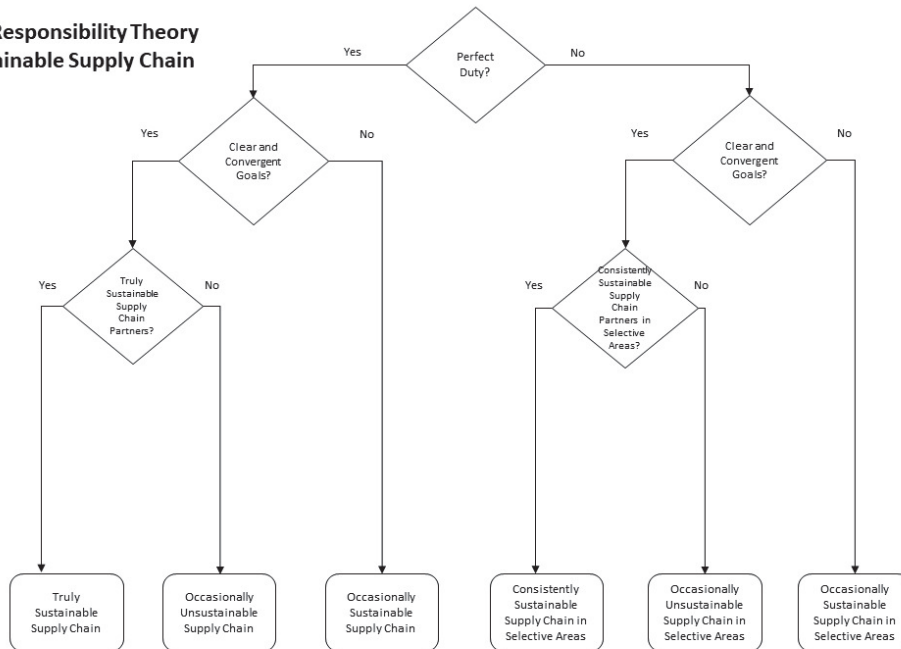
Key Research Themes

- Consumer perspectives on MRCS

- Employee perspectives on MRCS

- Firm/Educator perspectives on MRCS

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Consumer Perspectives on MRCS

Consumer Behavior

Consumer Versus Corporate Moral Responsibilities for Creating a Circular Fashion: Virtue or Accountability?

Clothing and Textiles Research Journal
1-20
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journals.sagepub.com/home/ctr

Chung-Wha (Chloe) Ki[1] and Jung E Ha-Brookshire[2]

Received: 6 April 2020 | Revised: 4 October 2020 | Accepted: 12 October 2020

DOI: 10.1002/bse.2675

RESEARCH ARTICLE | WILEY

Toward a circular economy: Understanding consumers' moral stance on corporations' and individuals' responsibilities in creating a circular fashion economy

Chung-Wha (Chloe) Ki[1] | Sangsoo Park[2] | Jung E. Ha-Brookshire[3]

Corporate Social Responsibility and Environmental Management
Corp. Soc. Responsib. Environ. Mgmt. 2017
Published online in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/csr.1414

Perfect or Imperfect Duties? Developing a Moral Responsibility Framework for Corporate Sustainability from the Consumer Perspective

Sojin Jung[1]* and Jung Ha-Brookshire[2]
[1]Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
[2]Textile and Apparel Management, University of Missouri, Columbia, MO USA

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Employee Perspectives on MRCS

Received: 17 March 2018 | Revised: 20 May 2018 | Accepted: 8 June 2018

DOI: 10.1002/bse.2196

RESEARCH ARTICLE

WILEY Business Strategy and the Environment

The moral responsibility of corporate sustainability as perceived by fashion retail employees: a USA-China cross-cultural comparison study

Stacy H.N. Lee[1] | Jung Ha-Brookshire[2] | Pui-Sze Chow[1]

Received: 6 June 2017 | Revised: 11 January 2018 | Accepted: 26 January 2018

DOI: 10.1002/csr.1510

RESEARCH ARTICLE

WILEY Corporate Social Responsibility and Environmental Management

The effect of ethical climate and employees' organizational citizenship behavior on U.S. fashion retail organizations' sustainability performance

Stacy H.N. Lee[1] | Jung Ha-Brookshire[2]

RESEARCH — Open Access

"We are watching you": investigation of consumer-employee perception gaps and the employee expectations-employer performance gaps

Stacy H. Lee[1], Sojin Jung[7] and Jung Ha-Brookshire[3]

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Firm/Educator Perspectives on MRCS

sustainability — MDPI

Article

Moral Education for Sustainable Development: Exploring Morally Challenging Business Situations within the Global Supply Chain Context

Jung Ha-Brookshire[1,*], Laura McAndrews[2], Jooyoun Kim[3], Charles Freeman, Jr.[4], Byoungho Jin[5], Pamela Norum[1], Melody L. A. LeHew[6], Elena Karpova[7], Lesya Hassall[8] and Sara Marcketti[8]

Journal of Cleaner Production
ELSEVIER — Volume 423, 15 October 2023, 138739

Assessing Chinese fashion organizations' change readiness for the circular economy (FashionReady4CE): Development and validation of FashionReady4CE scales

Chung-Wha Chloe Ki[a], Baolu Wang[b], Sze Man Chong[a], Ashley Chenn[a], Jung Ha-Brookshire[c]

Received: 25 March 2020 | Revised: 25 April 2020 | Accepted: 11 May 2020

DOI: 10.1002/csr.1970

REVIEW ARTICLE

Corporate Social Responsibility and Environmental Management WILEY

How fashion can achieve sustainable development through a circular economy and stakeholder engagement: A systematic literature review

Chung-Wha (Chloe) Ki[1] | Sze Man Chong[1] | Jung E. Ha-Brookshire[2]

sustainability — MDPI

Article

Sustainability as Social Contract: Textile and Apparel Professionals' Value Conflicts within the Corporate Moral Responsibility Spectrum

Rachel LoMonaco-Benzing[*] and Jung Ha-Brookshire

University of Missouri

More to be Done!

O Different views on corporate moral responsibility from the moral responsibility perspective:
- ➤ Consumers of the world
- ➤ Employees of the world
- ➤ Executives of the world
- ➤ Policy makers of different countries and the world
- ➤ NGOs
- ➤ Cross functional assessment within the firm
- ➤ Cross sectional assessment within the supply chain
- ➤ Cross cultural assessment on all above

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More to be Done!

O Hypothesis testing of the proposed theories
- O Cross functional assessment within the firm
- O Cross sectional assessment within the supply chain
- O Cross cultural assessment

O Need assessment of new policies to enforce and implement moral responsibility of corporation

O Strategies to close the gaps, if any, between corporate moral responsibility and practices

O And so much more!

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Challenge Ourselves!

O The time for business as usual is over.

O Need a new approach to tackle sustainability goals → Moral responsibility perspectives?

O How will the technology shape various aspects of sustainability? ethically, legally, morally, and circularly?

O The textile and apparel industry is best positioned to lead this new approach toward sustainability!

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Looking for Collaborators and Next Leaders!
Contact me if you want to talk with me more.
Anyone is welcome.

Jung Ha-Brookshire, Ph.D.
habrookshirej@missouri.edu

University of Missouri

UNIVERSITY OF DELAWARE

Circular Textiles:
Application of Cradle to Cradle and Green Engineering
in Textile Product Development

Huantian Cao, Ph.D.
Department of Fashion and Apparel Studies

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Textile facts

Global fiber production (in 2022)
- 116 million tonnes
- Average 14 kg per person

Textile wastes (U.S. in 2018)
- 17.03 million tons
- 5.8% of total municipal solid waste
- 14.7% recycled, 18.9% combusted with energy recovery
- 11.3 million tons (66.4%) were landfilled

Source: Textile Exchange "Materials Market Report" in 2023;
U.S. EPA "Advancing Sustainable Materials Management: 2018 Fact Sheet"

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Green Engineering and Cradle to Cradle

- Cradle to Cradle: what to do
  - Waste equals food
  - Use current solar income
  - Celebrate diversity
- Green engineering: how to do
  - 12 principles
  - Turn vision into reality
  - Builds on technical excellence, scientific rigor, and systems thinking

McDonough W., Braungart, M. (2002). Cradle to cradle: Remaking the way we make things, New York: North Point Press.

Anastas, P.T., Zimmerman, J.B. (2003). Design through the Twelve Principles of Green Engineering, Env. Sci. and Tech., 37, 5, 94A-101A.

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12 Principles of Green Engineering (Anastas and Zimmerman)

- Inherent rather than circumstantial
- Prevention instead of treatment
- Design for separation
- Maximize mass, energy, space, and time efficiency
- Output-pulled versus input-pushed
- Conserve complexity

- Durability rather than immortality
- Meet need, minimize excess
- Minimize material diversity
- Integrate local material and energy flows
- Design for "commercial afterlife"
- Renewable rather than depletion

3

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Principle 1: Inherent rather than circumstantial

- Designers need to strive to ensure that all material and energy inputs and outputs are as inherently nonhazardous as possible.
- Industrial trends
  - American Association of Footwear and Apparel (AAFA) Restricted Substances List

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Leather Tanning By Chromium

- About 90% of world's leather is chrome tanned
  - Introduced about 140 years ago
  - Regulation: discharge limit < 5ppm

- US hide and leather
  - In 1995, there were about 110 tanning facilities in the US
  - Now, hide is one major agricultural export in the US
    - 2023: $978 million

Source: US Department of Agriculture

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Other Tanning Methods

- Vegetable (polyphenol from plants)
  - Eg, sumac, oak
- Oil
  - Unsaturated oil
  - Animal brain
- Aldehyde
- Minerals
  - Al^{3+} salt
  - Ti^{4+} salt
  - Zr^{4+} salt

- Enzyme assisted vegetable tanning
  - Transglutaminase and quebracho extract
  - Increase shrinkage temperature
  - Obtain dark color

Cao, H., Scudder, C., Xu, W., Siron, L., & Wu, C. (2014, November). *Environmentally friendly leather tanning using enzymes*. Oral presentation at the 2014 ITAA conference, Charlotte, NC.

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Principle 2: Prevention instead of treatment

- It is better to prevent waste than to treat or clean up waste after it is formed.
- End of use garments cause lots of solid waste problem in landfill.
  - Every year 11.4 million tonnes of cotton waste generated worldwide

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Product development from cotton waste (waste = food)

- Collection of materials
  - Apparel products with 80% or higher cotton content that cannot be sold in Goodwill stores
  - Small amount of new cotton textiles (e.g., fibers and yarns)
- Disassembly and shredding
  - Non-textile materials were removed
  - Textile shredder (Taskmaster®)
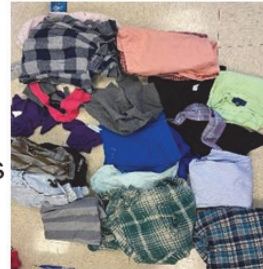
Cao, H., Cobb, K., Yatvitskiy, M., Wolfe, M., Shen, H. (2022). Textile and product development from end-of-use cotton apparel: A study to reclaim value from waste. *Sustainability, 14*, 8553.

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Textile Development

- Batting Development: carded on a Strauch Carding Machine
- Yarn Development
  - Pulling yarns from end-of-use knitwear garment
  - Cutting ¼ to 1-inch-wide strops from end-of-use textiles to create continuous "yarns"
- Confetti quilted
- Loop tufted

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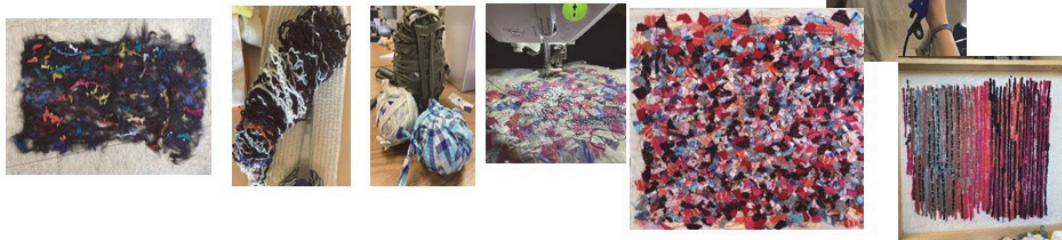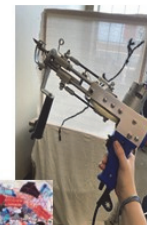
Results

- Fabric Development

Felted w/ scraps　　　　Felted w/ batt　　　　Tufted
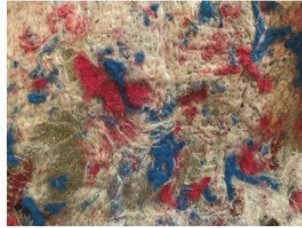
Confetti Quilted　　　　Woven

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Results

- Product Development

Cellphone cases and glasses case

Decorative fabric　　　　Hat

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Results

Handbag, backpack, makeup bag, tote bag

Garments

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Mulch Mats from Cotton Waste

SAMPLE 8: COTTON BLEND MM   SAMPLE 10: 100% COTTON MM   SAMPLE 12: COTTON BLEND SAMPLE 13: 100% COTTON MM   MM

NATURAL MM: JUTE BURLAP

CHEESECLOTH SAMPLES
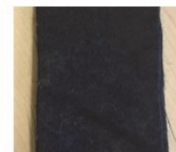
POLYOLEFIN MM

BLACK PLASTIC MM

Cao, H., Ludwig, K., Cobb, K., Scott, C., Jin, Y., Knight, B., Burrichter, M., Shen, H. (2023, November). *Development and Research of Sustainable Mulch Mats from End-of-Use Cotton Textiles.* Oral presentation at the 2023 annual conference of International Textile and Apparel Association, Baltimore, MD.

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Summer Weed Control Experiment

Control	2: about 100 3: about 50 4: 47
PP	2: 2 big weeds popping out of edges 3: 0 4: 3 weeds popping through edges
BP	2: 0 3: 0 4: 0
B	2: about 50 3: 36 4: 12
8	2: 0 3: 0 4: 0
10	2: 0 3: 0 4: 0

	CONTROL	PO	BP	B	8	10
WEEK 1						
WEEK 5						

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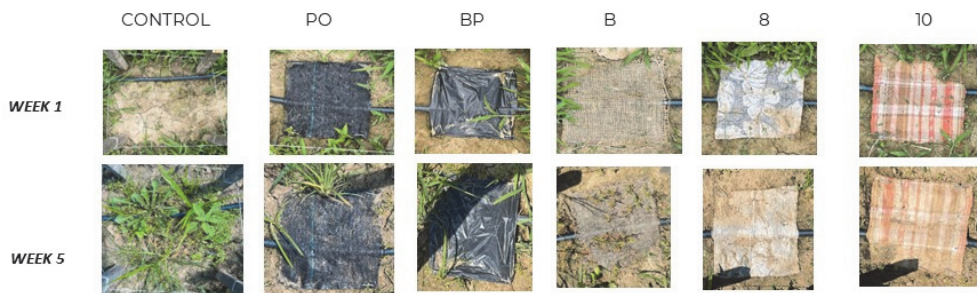
Biodegradation Experiments: Weight Loss Results

	6 weeks				10 weeks			
	1 (D)	2 (E)	3 (F)	Avg	1 (G)	2 (H)	3 (I)	Avg
PP	0%	0%	0%	0%	0%	0%	0%	0%
PE	0%	0%	0%	0%	0%	0%	0%	0%
Burlap	100%	49.8%	84.3%	78.1%	25.4%	57.7%	74.4%	52.5%
No 8	26.8%	24.9%	37.9%	29.8%	49.3%	38.1%	41.1%	42.8%
No 10	77.6%	32.3%	44.9%	51.6%	67.0%	63.0%	73.4%	67.8%

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Principle 3: Design for separation

- Separation and purification operations should be designed to minimize energy consumption and materials use.
- Economical and technical limitations in separating materials and components are among the greatest obstacles to recovery, recycle and reuse
  - Avoid permanent bonds two different materials

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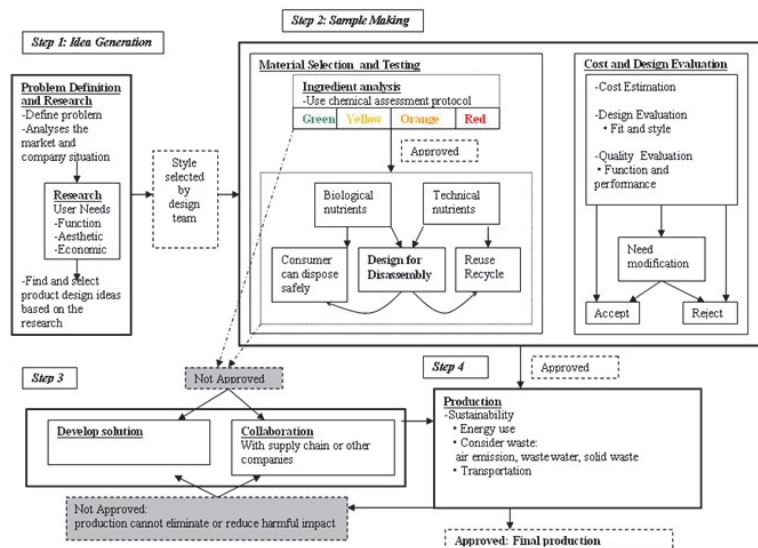
C2CAD Model

Figure 1. Revised C2CAD model for apparel design and production

Gam, H. J., Cao, H., Farr, C., & Heine, L. (2009). C2CAD: A sustainable apparel design and production model. *International Journal of Clothing Science and Technology, 21*(4), 166-179.

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Design for Disassembly

- Three critical stages suggested by Bogue (2007)
  - Selection and use of materials
  - Design of components and product architecture
  - Selection and use of joints, connectors, and fasteners

Bogue, R. (2007), "Design for disassembly: A critical twenty-first century discipline", *Assembly Automation,* 27(4), 285-289.

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Material Selection

- Material diversity in multi-component products should be minimized to promote disassembly and value retention.
- The jacket was designed with two main components
  - A natural outer shell (biological nutrients)
    - Cradle to cradle certified wool fabric by Pendleton Woolen Mills
    - Natural wood button
    - Organic cotton thread
  - A synthetic lining (technical nutrients)
    - Polyester satin fabric
    - Polyester thread
    - Polyester button

Inside of Jacket

Outer shell
Lining
Outer shell and lining assembly place

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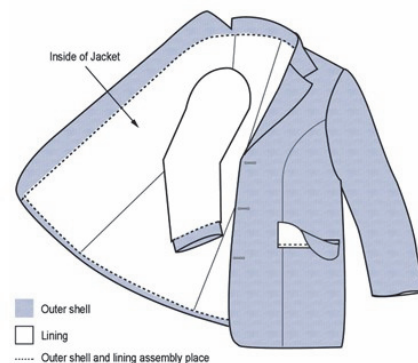
Jacket Design

- To minimize material use, contamination, and effort for disassembly
  - No buttons on the sleeves
  - No shoulder pads, sleeve headers, or chest pieces
  - No interfacing on collar and lapel
    - Use blind stitch on collar to replace fusible interfacing and get crispy appearance

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Joints Selection

- Use stitches to join biological nutrients shell and technical nutrients lining
- Test three types of stitches in accordance with ASTM method D 1683
  - There is no significant difference in stitch strength between big stitch (6 stitches/inch) and small stitch (10 stitches/inch)

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Jacket Prototype

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Disassembly

- Using big stitch (6 stitches/inch), disassembly time was significantly less (70 seconds vs. 210 seconds)

23

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Components after Disassembly

left — biological nutrients (wool fabrics, organic cotton threads, Tagua buttons)
right — technical nutrients (polyester fabrics, polyester threads)

Gam, H. J., Cao, H., Bennett, J., Helmkamp, C., Farr, C. (2011). Application of design for disassembly in men's jacket: A study on sustainable apparel design. *International Journal of Clothing Science and Technology, 23*(2/3), 83-94.

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Principle 6: Conserve complexity

- The amount of complexity that is built into a product is a function of expenditures of materials, energy and time
- High complexity should correspond to reuse
- Low complexity should be recycled or beneficial disposition
- End-of-life design decisions for recycle, reuse, or beneficial disposal should be based on the invested material and energy and subsequent complexity across all design scales

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Modular design: "Lego" clothing

Cao, H., Chang, R., Kallal, J., Manalo, G., McCord, J., Shaw, J., & Starner, H. (2014). Adaptable apparel: a sustainable design solution for excess apparel consumption problem. *Journal of Fashion Marketing and Management, 18*(1), 52-69.

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Principle 10: Integrate local material and energy flows

- Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.
- Products, processes and systems should be design to use existing framework of energy and material flows
- Consider the availability of energy and material for a product or process

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Textile and apparel: highly globalized industry

- According to the AAFA, the percentage of imported apparel in the U.S. market had amounted to 97.1% in 2022
- Problems from globalization
  - Carbon emission
    - Davis and Caldeira (2010) found that in 2004, 23% of global CO_2 emissions, or 6.2 gigatonnes CO_2, were emitted during the production of goods that were ultimately consumed in a different country.
    - Apparel imported to the U.S. accounted for 42 megatonnes embodied CO_2.
  - Toxic chemicals
    - consumers may not be concerned about pollution from industry in a different region.

Davis, S. J., Caldeira, K. (2010). Consumption-based accounting of CO2. *Proceedings of National Academy of Science, 107*(12), 5687-5692-94.

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"All sustainability is local" (McDonough and Braungart)

- Celebrate diversity
- Local materials have less effect on soil and water and often provide the most feasible solutions to local problems
- Local business bolsters local economies and promotes citizen awareness
- Goal of our project: to use natural, renewable, locally grown raw materials to develop textile garments and accessories

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From field to fashion: 20 miles

Cao, H., Scudder, C., Howard, C. Piro, K., Tattersall, H., Frett, J. (2014). Locally produced textiles: product development and evaluation of consumers' acceptance. *International Journal of Fashion Design, Technology and Education, 7*(3), 189-197.   30

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Principle 12: Renewable rather than depletion

- Material and energy inputs should be renewable rather than depleting.
- Depletion: finite substance used in a consumptive manner
  - Not sustainable and causing ongoing environmental damages
- Renewable: resources used in cycles
- Materials: petroleum-based feedstock vs renewable biomass feedstock
  - Eg, DuPont Sorona fiber

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Materials from renewable sources

- Renewable bio-based sources: soybean oil, palm seed oil, chicken feather

Product	Part	Materials will be used
Shoe	Upper	Organic cotton fabric and AESO/MLAU resin composite
	Lining	Organic cotton fabric
	Insole	Chicken feather quilted with organic cotton fabric
	Outsole	AESO/MLAU resin
	Heel	AESO/MLAU resin and chicken feather fiber/CB4-30 composite
Coat	Outer shell	Cradle to Cradle Environmentally Certified wool fabric
	Quilted lining	Chicken feather fiberfill quilted with organic cotton fabric

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Shoe and coat

- Evaluation results from wear test and survey
  - The renewable bio-based materials were wearable, versatile, and practical.
  - Improvements needed
    - Color of materials
    - Mechanical property of outer sole material
    - Apparel and footwear design and style

Cao, H., Wool, R., Bonanno, P., Dan, Q., Kramer, J., & Lipschitz, S. (2014). Development and evaluation of apparel and footwear made from renewable bio-based materials. *International Journal of Fashion Design, Technology and Education, 7*(1), 21-30. 33

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Development in Phase II

Cao, H., Wool, R., Sidoriak, E., Cook, H., & Gong, S. (2015, November). *Fashion prototypes made from environmentally friendly leather substitute (eco-leather)*. Poster presented at the 2015 ITAA conference, Santa Fe, NM.   34

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Mushroom mycelium biocomposite

- Develop biocomposite for fashion application using:
  - Mushroom mycelium
  - Agricultural waste
  - Textile waste

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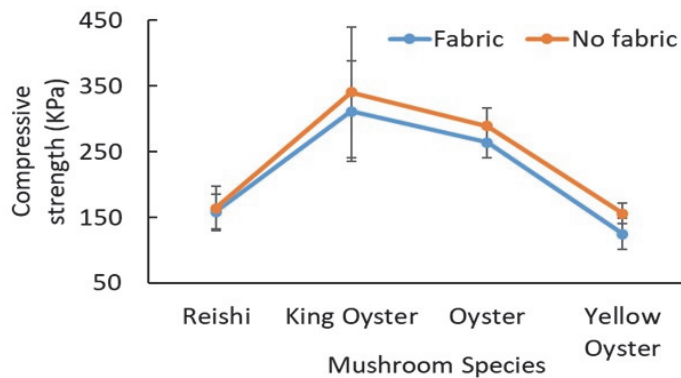
SEM
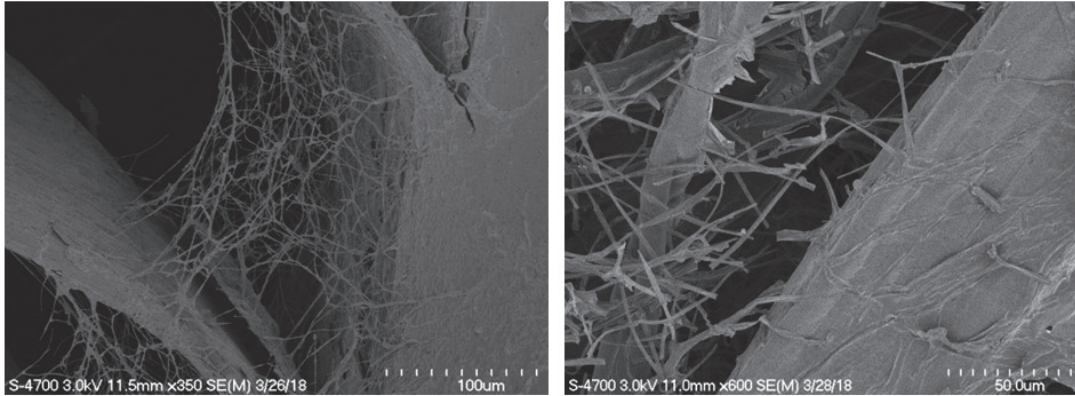
Reishi mycelia bond chicken feather

King oyster mycelia bond textile

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Findings

- King oyster species provided the highest mean compressive strength of 340 KPa (no fabric) and 311 KPa (with fabric).
- Based on Hessert et al. (2005), while walking
  - The maximum foot pressures for young and old adults were 329 and 222 KPa, respectively.
  - The mean foot pressures for young and old adults were 89 and 62 KPa, respectively.

Hessert, M. J., Vyas, M., Leach, J., Hu, K., Lipsitz, L. A., & Novak, V. (2005). Foot pressure distribution during walking in young and old adults. *BMC geriatrics, 5*(1), 8.

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Mushroom mycelium biocomposite for fashion products

Silverman, J., Cao, H., Cobb, K. (2020). Development of mushroom mycelium composites for footwear products. *Clothing and Textiles Research Journal. 38*(2), 119-133.

Tang, W., Silverman, J., Cobb, K., Cao, H., (2019). Mycelium afoot: fashion sustainable footwear. Juried design (undergraduate category), International Textile and Apparel Association, Cleveland, OH.

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Sustainability characteristics

Principle (12 Principles of Green Engineering)	Characteristics of the mycelium biocomposites
Inherent rather than circumstantial	Only safe materials will be used, including wastes from food production and natural textile materials
Prevention instead of treatment	Mycelium composites are compostable
Durability rather than immortality	Mechanical properties assure durability; mycelium composites are compostable
Meet needs, minimize excess	Shoe soles produced in molds, no solid waste
Integrate local material and energy floes	Locally available starting materials will mainly be used
Renewable rather than depletion	All starting materials are natural & renewable

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Acknowledgements

- The projects were supported by U.S. Environmental Protection Agency P3 Program grants SU832483, SU833517, SU834323, SU834707, SU836007, SU835511, SU839272; and Cotton Inc. grants 21-003, 22-665.

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Fostering Sustainable and Circular Practices:
the case of micro and small fashion businesses

ICCT 2024   Jeju, Korea 11th April 24

Prof Sandy Black
Professor of Fashion & Textile Design &
Technology
Centre for Sustainable Fashion
London College of Fashion,
University of the Arts London.

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centre for
sustainable fashion

ual: university
of the arts
london
london college
of fashion

Context

UK fashion designers are widely acknowledged as creative influencers on the world stage. Over 99% of UK businesses are small and medium enterprises (SMEs), but the majority of UK design-led fashion businesses are micro and small enterprises. Through innovative business models these values-led enterprises provide pioneering visions for the fashion industry.

"Micro and small independent fashion businesses have functioned as the 'research and development' for the wider fashion industry for many years, while they themselves struggle to survive. The Fostering Sustainable Practices project recognises these enterprises as key drivers for transformation of the fashion system."

Sandy Black
Principal Investigator, Centre for Sustainable Fashion

The Wicked Problem

Fashion is a global economic powerhouse – worth US$3 trillion but is among the top polluters of the planet

A structurally wasteful system - short fashion lifecycles create major environmental issues

Complex global supply chains mask ethical and social justice problems

Overconsumption and overproduction are endemic to the system

Solutions?
Systemic change and new business models
Circularity in material flows
Reduction in material throughput through e.g. made-to-order
Legislation

Circularity

Materials are not discarded but maintained in use as long as possible.

Materials are part of either a technical (synthetic) cycle or natural cycle. However, some hybrid materials are possible, turning natural into synthetic.

Strategies:
Create > use > recirculate > recreate > regenerate

Rent , share , swap , repair , reuse , repurpose , upcycle , recycle

Growth of clothing sales and decline in clothing utilisation since 2000

A New Textiles Economy, Ellen MacArthur Foundation 2017
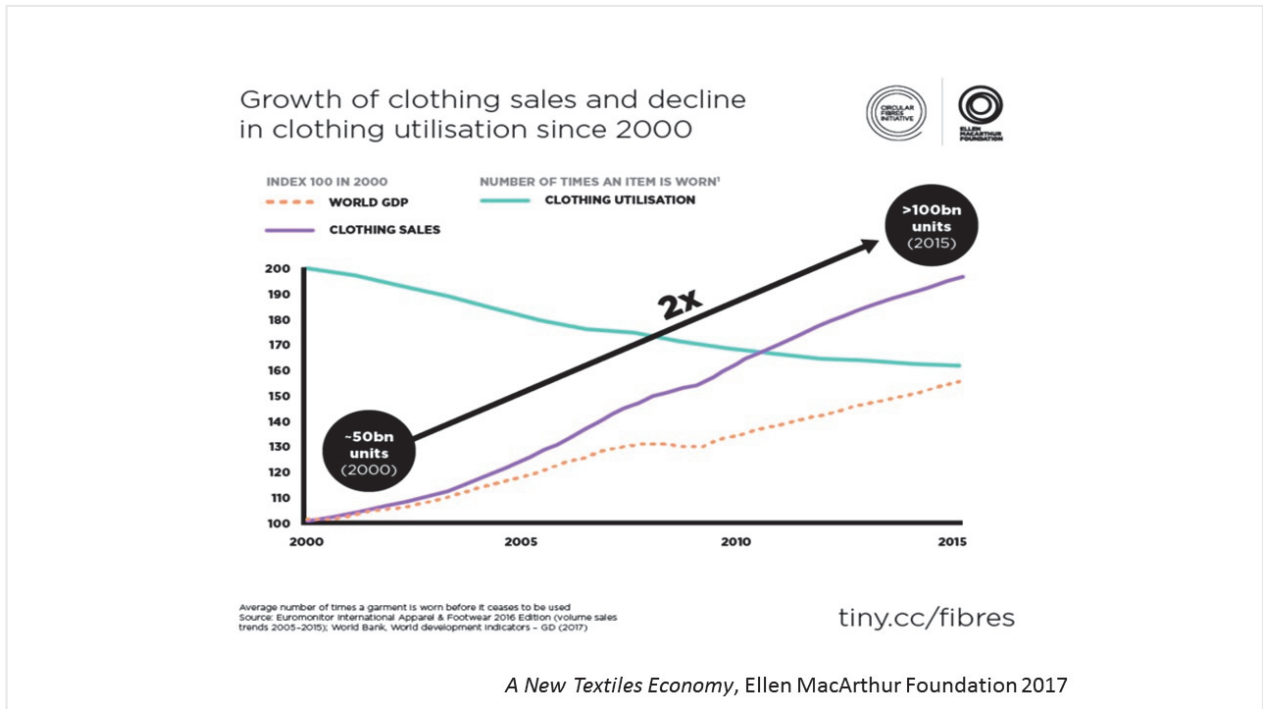
ISSUES

WATER — DIMINISHING RESOURCES — CLIMATE CHANGE — CHEMICALS

BIODIVERSITY — WASTE — CONSUMPTION — WELLBEING

Michelle Lowe-Holder accessories

FSP Project research themes

1. Designer visions, values, capabilities and processes

2. Business networks and collaborative ecosystems

3. Working practices, roles and trajectories

4. Entrepreneurship and business models fostering sustainable practices

Business model themes and examples

Fashion as a tool for social change

Consumer engagement, communication and education

Business models for transformation and circularity

Digital technology as an enabler of collaboration and sustainability

Fashion as a tool for social change - social enterprise models

Image: Bethany Williams

Image: Birdsong

ELVIS & KRESSE
Rescue, Transform, Donate
Fashion as a tool for social change

Image: Elvis & Kresse
Image: Elvis & Kresse

ELVIS & KRESSE
New Barns Farm - Wastewater and wetland system for self-sufficiency, new vineyard and conservation grazing

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Sabinna Reconnect Sets – the Lovers Set
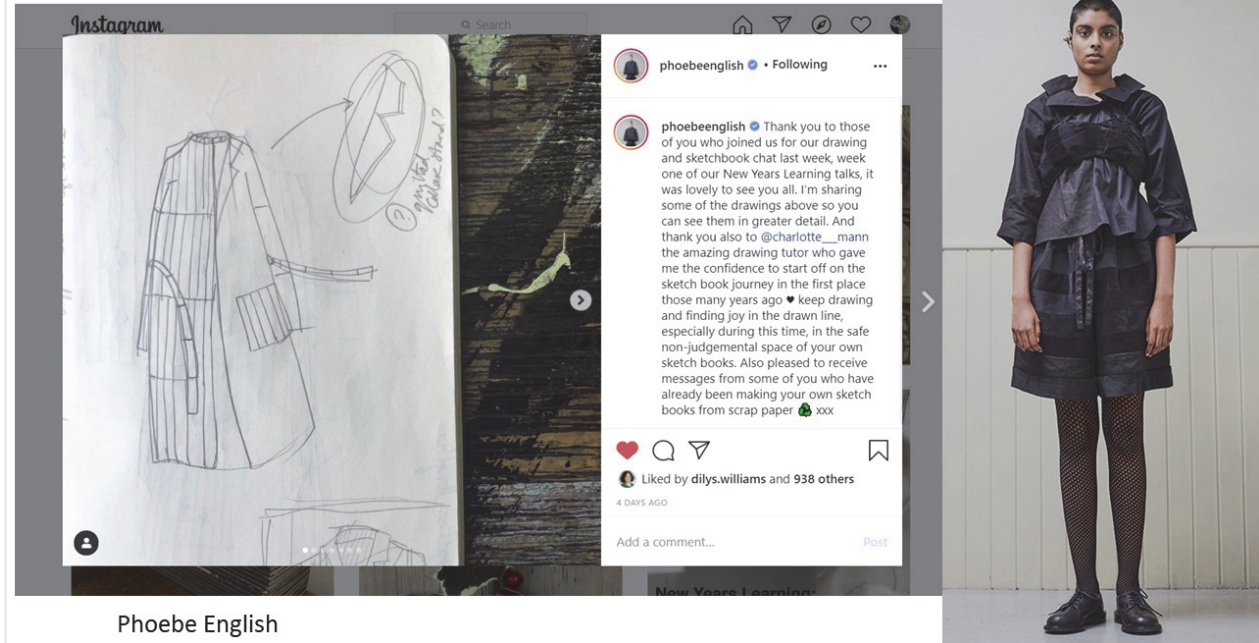
Community Engagement and Education
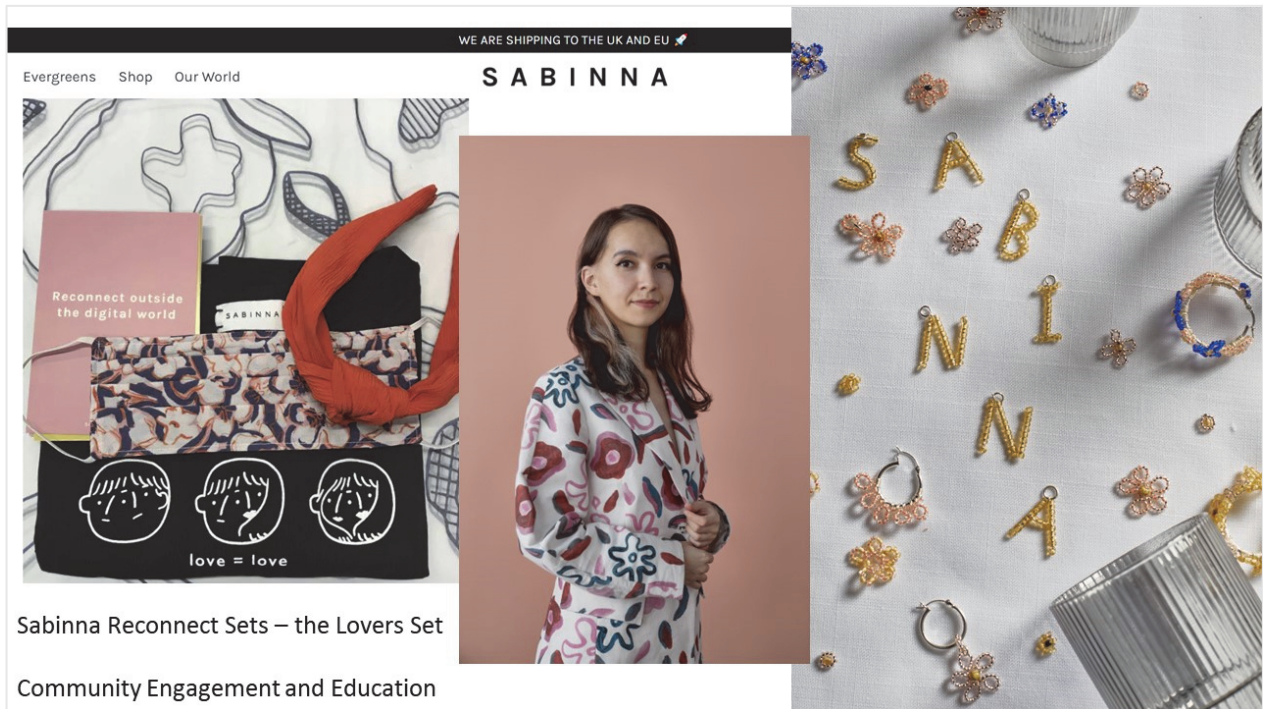
Phoebe English - ' Nothing New' Collection

Consumer Engagement, Communication and Education

Phoebe English

Business models for transformation

Finisterre
sustainability as standard

Riz Boardshorts – circular business model

THINK END OF LIFE AT BEGINNING OF LIFE

Paynter Jacket   limited edition production

Petit Pli
Innovative childrenswear

Digital Technology as an enabler of collaboration

How to Nuw

NuW   Clothes sharing and swapping platform

SAVE YOUR WARDROBE
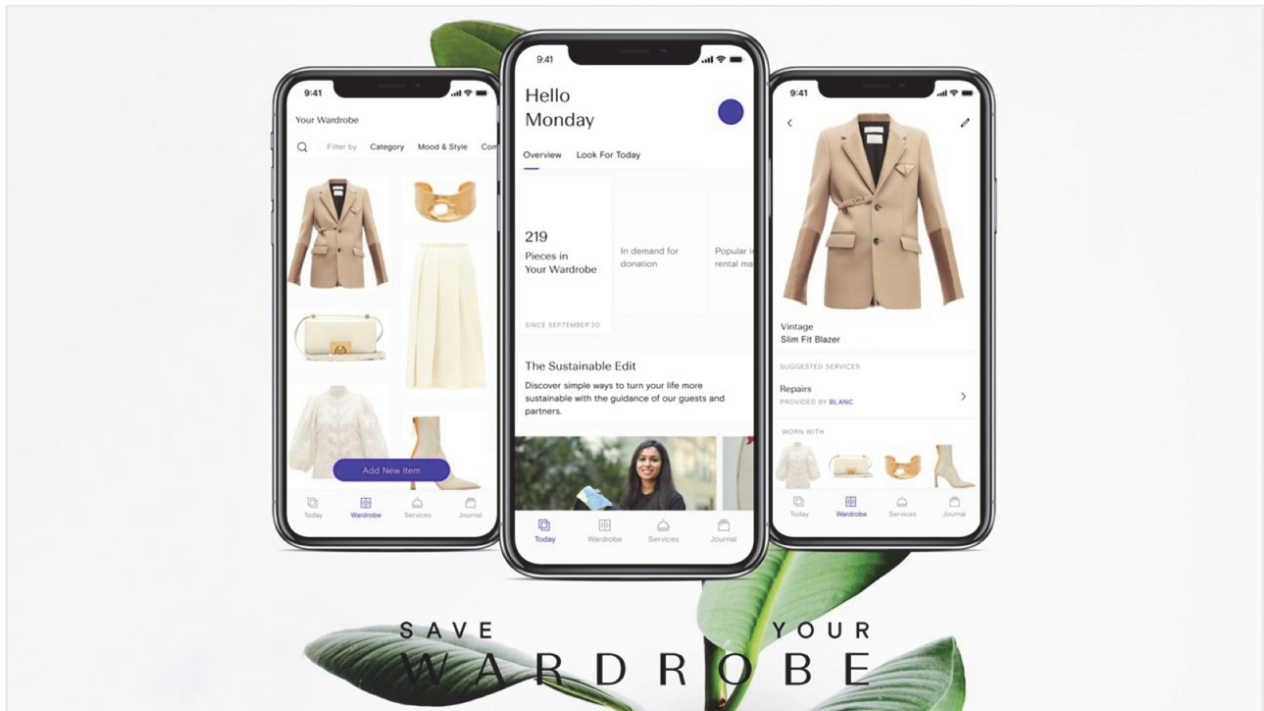
Digital Technology as an enabler of sustainability

Unmade software service - customisation and make on demand – digital end-to-end

MUD Jeans: Denim with Circularity

DEPLOY: customisation for 360° sustainability

DESSERTO : cactus fibre as leather substitute
APPLICATIONS

Small Business Finance –   UK SME External Finance Support Escalator

Owen et al., 2019
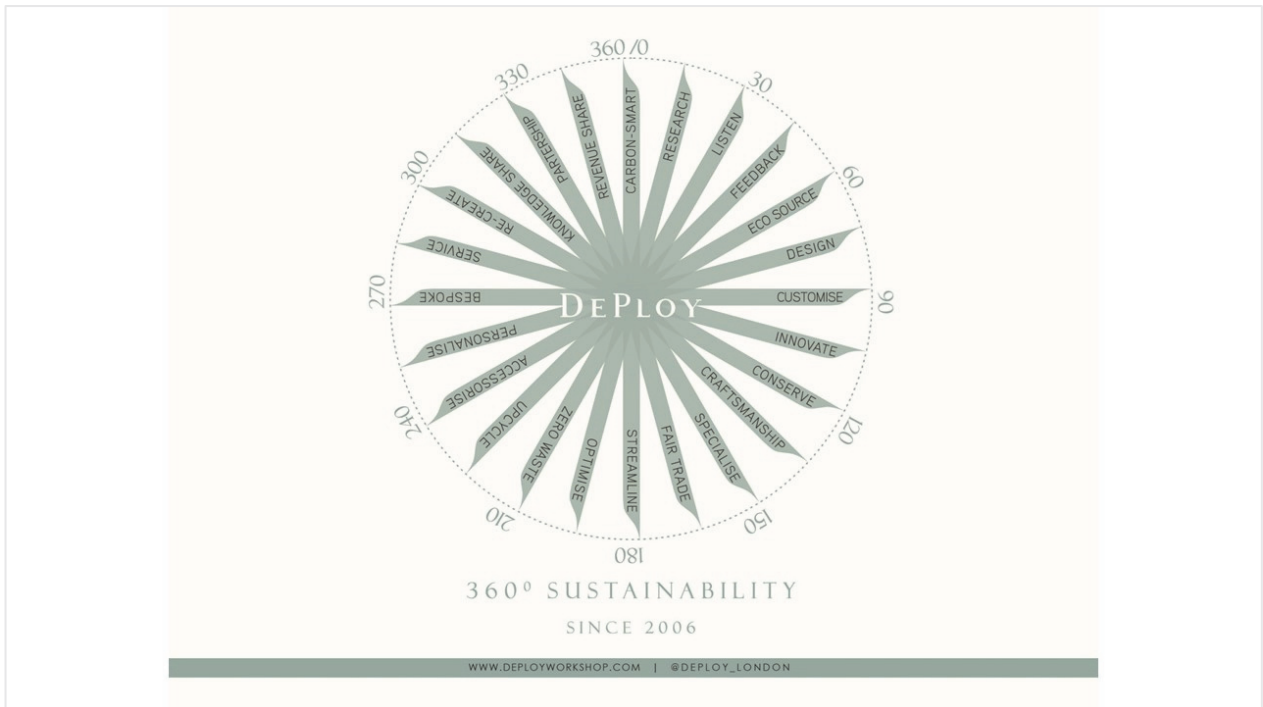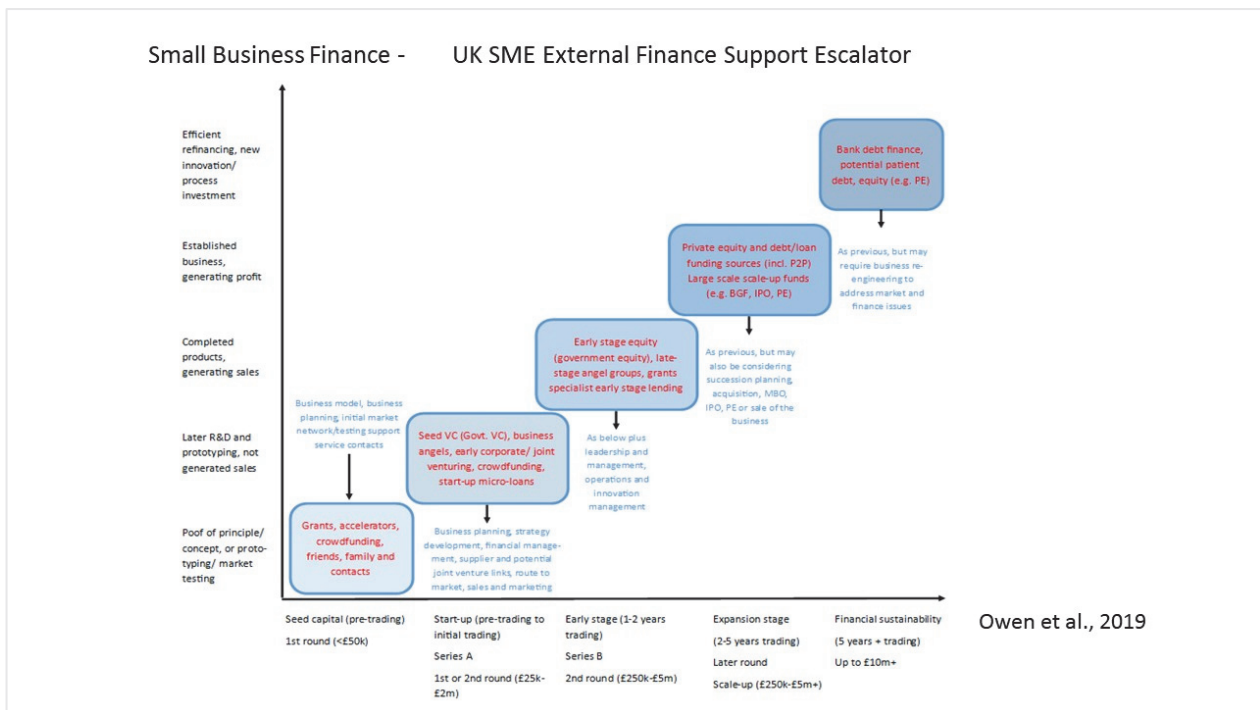
Accelerating Sustainability in Fashion, Clothing & Textiles

Published by Routledge
Sept 2023

Ch 9: Fostering Sustainable Practices:
the case of micro and small fashion enterprises.

Ch 10: Desserto: cactus fibre as leather substitute
Ch 11: DePloy: customisation for sustainability
Ch 13: MUD jeans: denim with circularity

Ch 7: Finance and funding for upscaling
sustainable fashion

ACCELERATING SUSTAINABILITY
IN FASHION, CLOTHING & TEXTILES

EDITED BY
MARTIN CHARTER | BERNICE PAN | SANDY BLACK
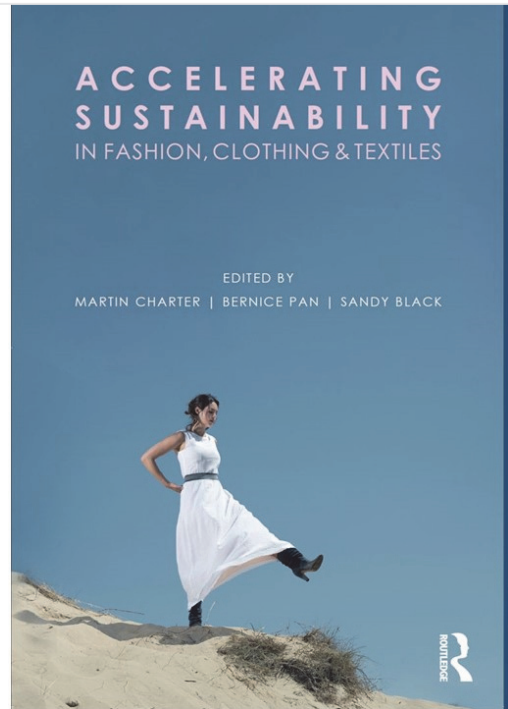
CENTRE FOR SUSTAINABLE FASHION

LONDON COLLEGE OF FASHION, UNIVERSITY OF THE ARTS LONDON

EAST BANK, CARPENTERS ROAD

STRATFORD, LONDON E20

@SUSTFASH

SUSTAINABLE-FASHION.COM

Thank you!

s.black@fashion.arts.ac.uk

ual: london college of fashion | centre for sustainable fashion

RETHINKING FASHION DESIGN ENTREPRENEURSHIP:
FOSTERING SUSTAINABLE PRACTICES

Special Lectures

2024 International Conference on Clothing and Textiles
CIRCULAR ECONOMY: FASHION FORWARD TO RESILIENT FUTURE

FASHION IN MOTION

The evolution of the Spanish Fashion Industry to achieve sustainability

Professor Paloma Díaz Soloaga
Intangible Assets & Fashion
Complutense University, Madrid - SPAIN

SPANISH FASHION INDUSTRY REPRESENTS
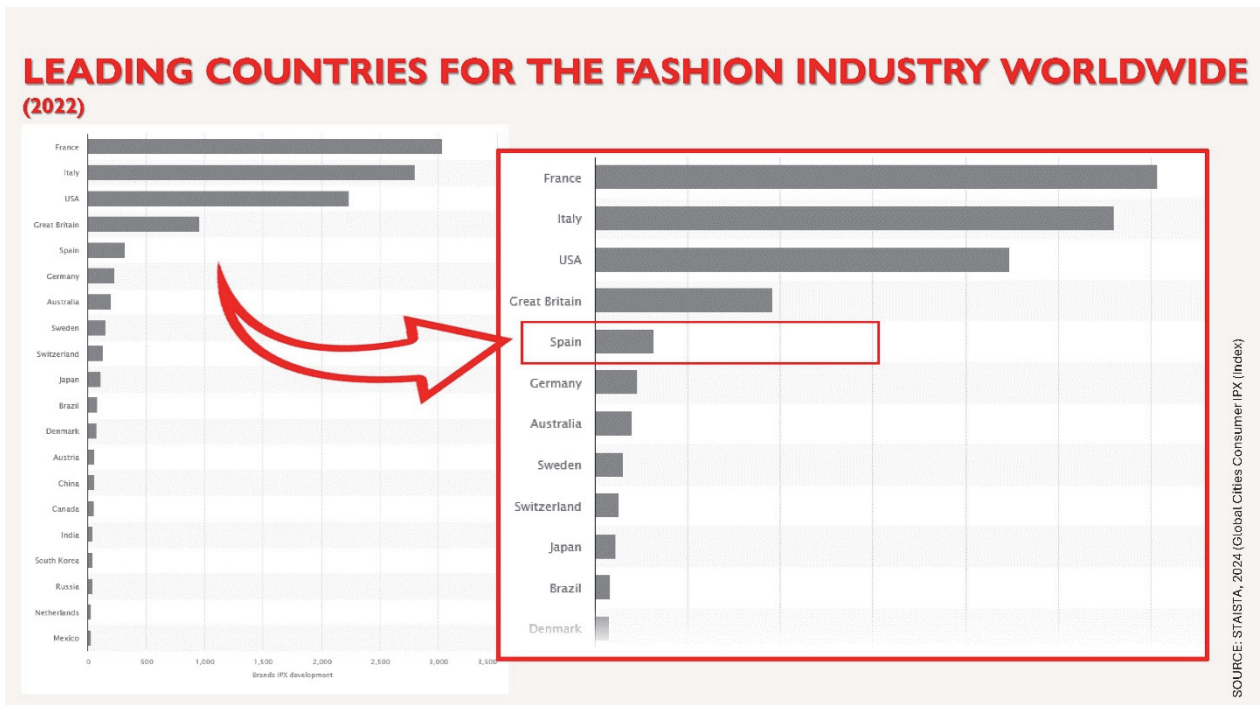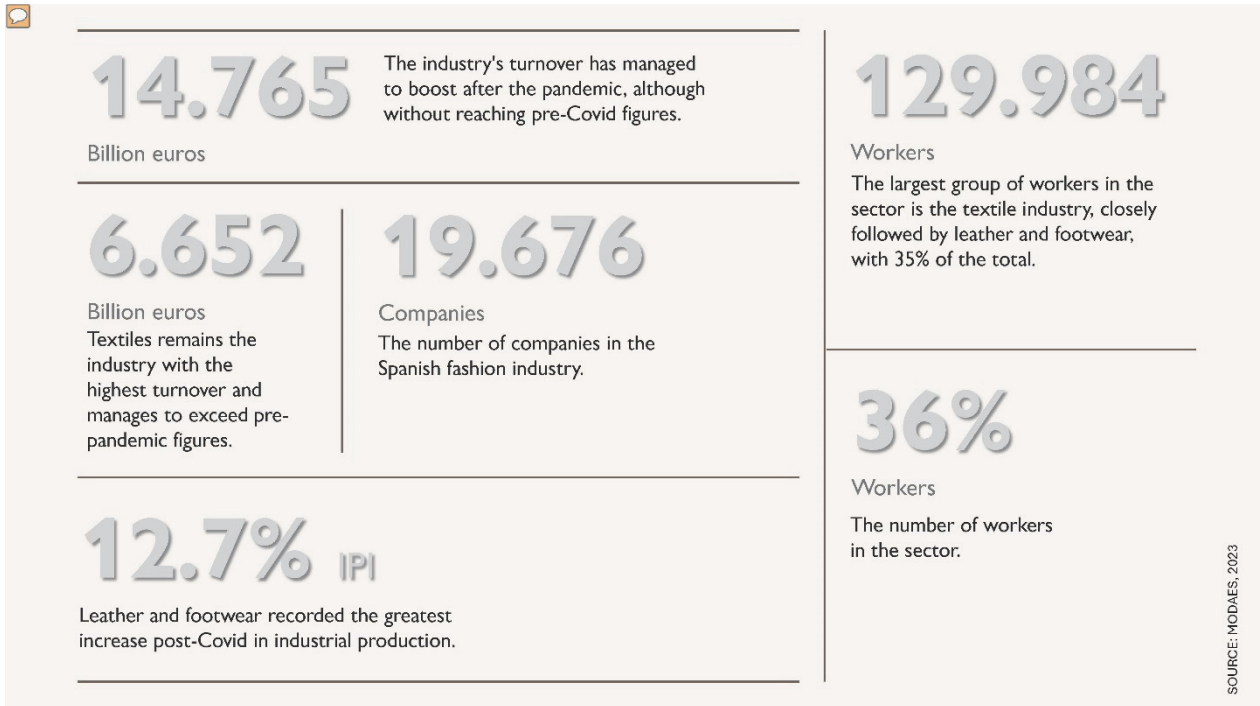
2.8% GDP
Economy

8.6%
Country's jobs

18.7%
Wholesale and distribution

8.9%
Country's imports

8.4%
Country's economy's total foreign sales

SOURCE: MODAES, 2023

14.765
Billion euros

The industry's turnover has managed to boost after the pandemic, although without reaching pre-Covid figures.

129.984
Workers

The largest group of workers in the sector is the textile industry, closely followed by leather and footwear, with 35% of the total.

6.652
Billion euros

Textiles remains the industry with the highest turnover and manages to exceed pre-pandemic figures.

19.676
Companies

The number of companies in the Spanish fashion industry.

36%
Workers

The number of workers in the sector.

12.7% IPI

Leather and footwear recorded the greatest increase post-Covid in industrial production.

SOURCE: MODAES, 2023

LEADING COUNTRIES FOR THE FASHION INDUSTRY WORLDWIDE
(2022)

SOURCE: STAISTA, 2024 (Global Cities Consumer IPX (Index)

FASHION BIGEST PLAYERS IN SPAIN

SOURCE: MODAES, 2023

INDITEX	**32.569 B€**
PUIG	**3.620 B€**
MANGO	**2.688 B€**
TENDAM GLOBAL FASHION RETAIL	**1.211 B€**
All We Wear Group AWWG	**594 B€**

TOUS	**450 B€**
mayoral	**400 B€**
Desigual	**379 B€**
STL SOCIEDAD TEXTIL LONIA	**347 B€**
BIMBA Y LOLA	**225 B€** *

* Billing corresponding to previous years

EUROPEAN SUSTAINABLE REGULATION

- Referring to materials, processes, communication and distribution of Fashion garments.
- Referring to circularity (reduce, reuse and recycle)
    - EPR (Extended Producer Responsibility)
- Referring to people:
    - Own workers
    - Those who depend on suppliers (1st, 2nd and 3rd tier)
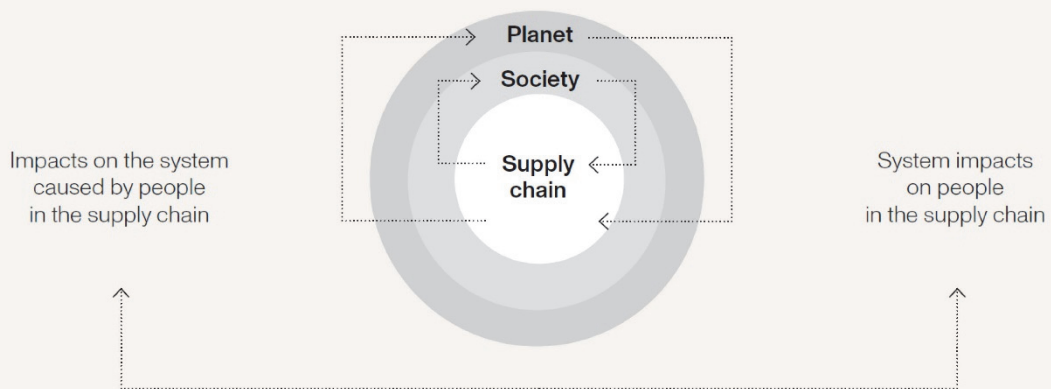- Certifications
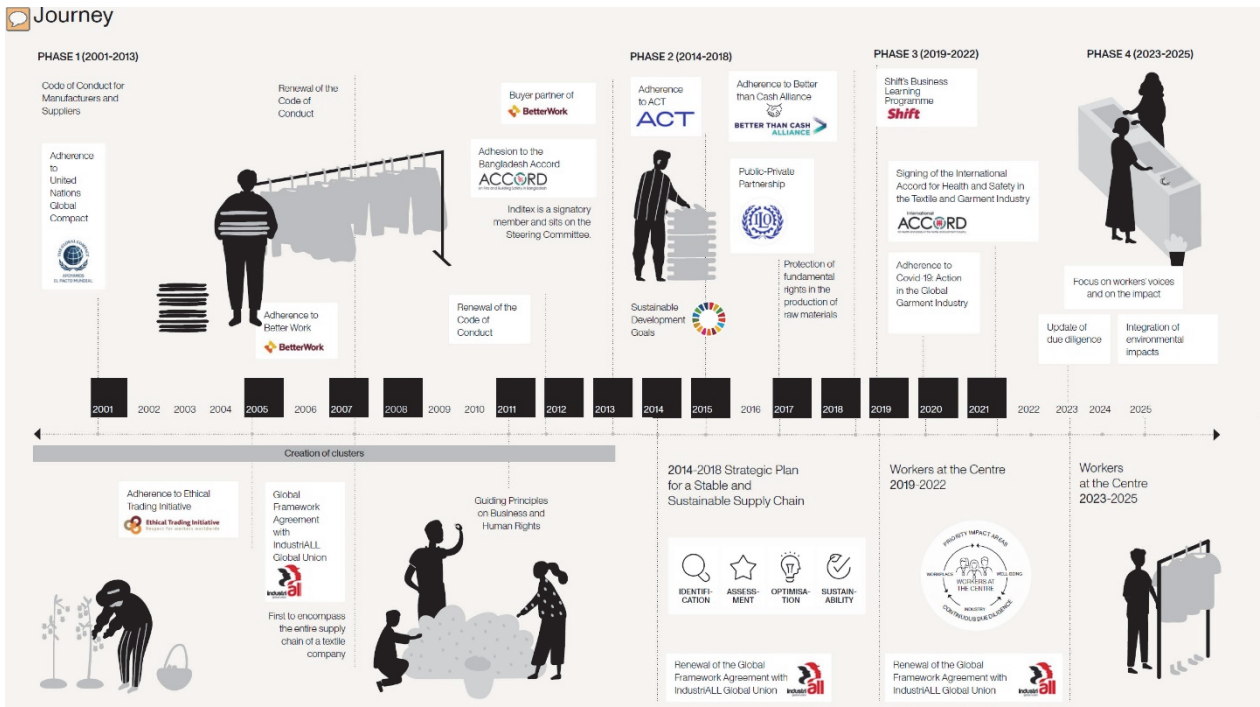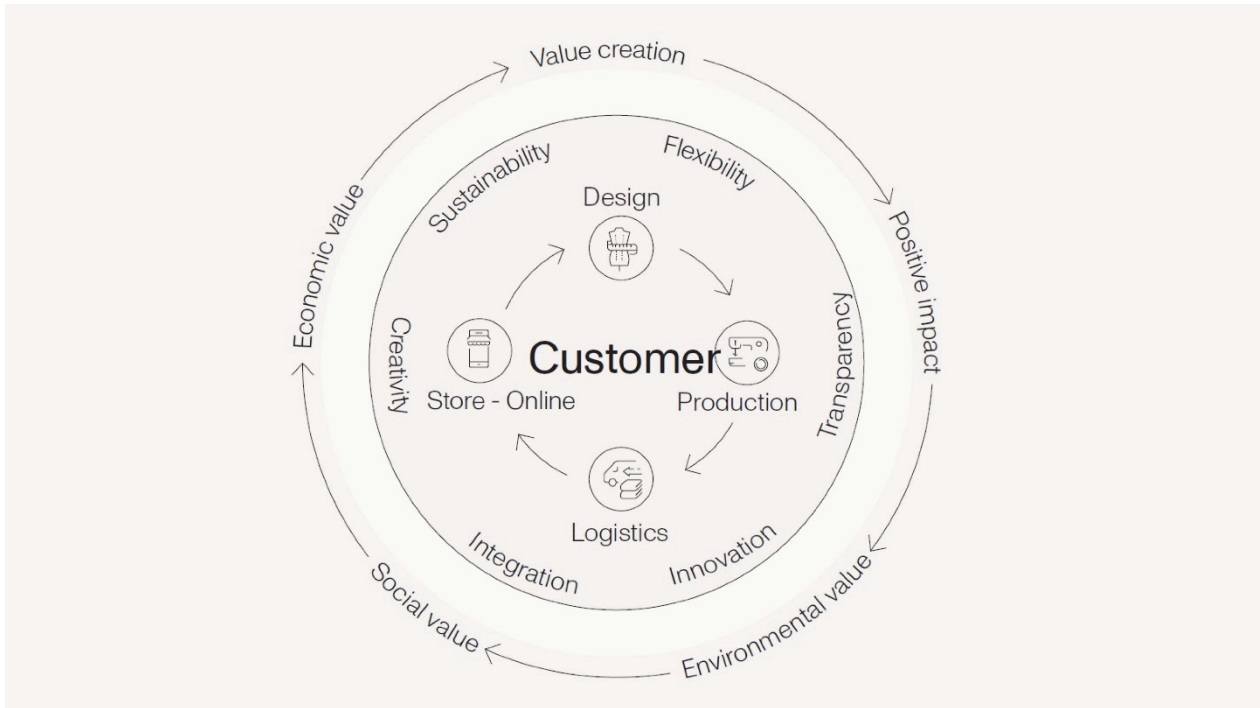
RESEARCH BASED ON:

- **Five in-depth personal interviews** with sustainable managers and directors:
    - INDITEX
    - TENDAM
    - MANGO
    - Moda RE_
    - El Corte Inglés

- **Three internal meetings with sustainable managers** from Inditex, TENDAM and El Corte Inglés;

- **Analysis of the sustainable annual reports**;

- Participation in the **periodic meetings of the Spanish Social Forum of the Fashion Industry**. Civil association that includes Companies, Labor unions, NGOs, consumer associations, circularity companies, industrial associations and universities.

The Spanish Fashion Industry is working hard to achieve all these demanding requirements even if society does not fully ask for them. There is a REAL concern in the fashion system to get things done → INDITEX, Mango, Tendam, Ecoalf, Sepiia, Jeanologia, Sociedad Textil Lonia, Desigual, Mayoral, Adolfo Domínguez, Roberto Verino, Bimba y Lola, Textil Santanderina, Piratex, SKFNK, El Corte Inglés, Moda RE_, to mention just some of the most active actors.

Systemic view

/ Health and human and planetary prosperity are interdependent and go hand in hand.

/ All human beings depend on the environment in which we live.

/ A safe, clean, healthy and sustainable environment is integral to the full enjoyment of a wide range of human rights, including the rights to life, health, food, water and sanitation.

Impacts on the system caused by people in the supply chain

Planet
Society
Supply chain

System impacts on people in the supply chain

100

- Sustainable departments created at the begining of the 2000's (Inditex, Mango, Tendam, STL, El Corte Inglés).

- Sistemic conception of sustainability

- Impact of climate change in human resources and communities

- Workers in the center is the mantra that big retailers managers have set as main goal for he strategies:

101
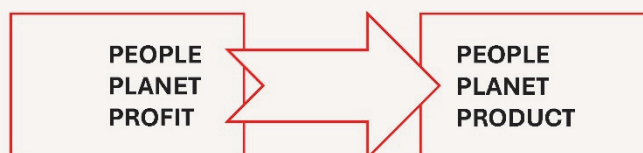
TENDAM

- Environmental care
- Our people
- Social contribution
- Value chain
- Referal partners

TENDAM with other leading companies in the textile sector, has participated in the creation of the Association for the Management of Textile Waste, with the aim of making progress in the management of textile waste generated in the Spanish market through a collective system of Extended Producer Responsibility (EPR).

MANGO COMMITMENT WITH SUSTAINABILITY

- Committed to the product
- Commited to the people
- Committed to the planet
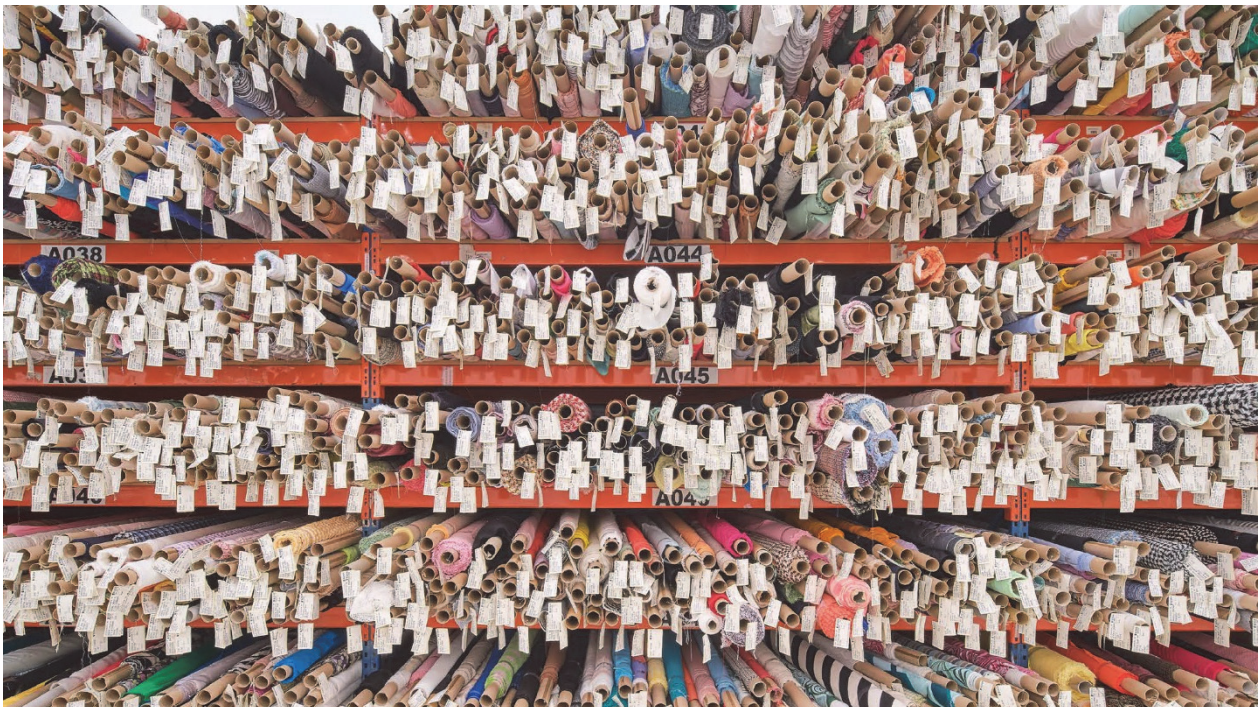
Give it back to the loop

Designing garments with a single type of fabric or fewer accessories, in order to allow increased recyclability.

Extended life

By focusing on designing more durable garments with the use of selected materiales with physical properties certified by independent entities.

No waste

By optimising the materials used and the reincorporation of textil waste.

A REAL CONCERN FOR THE WORKERS FAR FROM THE HEADQUARTERS:

- Most **Moroccan women** have never had a blood test in their lives. Inditex has promoted these and other health tests to the majority of its workers.

- Most of the **workers in the Turkish textile sector** come from Syria, since due to the war they have more than 3 million refugees from this country. Inditex works to offer the same rights to all workers (salary, health insurance, unionization...), starting with helping Syrians obtain residency documents.

- In **many South African countries**, children of workers are unable to receive education due to their parents' working hours. Inditex supervisors try to identify these and other problems and help workers solve them, in different ways: for example, by starting small schools closer to their home/workplace.

- In **Bangladesh, labor union is an unreal right** of workers. Inditex encourages the creation and participation of workers in this institution, which is so important for safeguarding their rights.

Artistic Garment Industries (Pakistan)

Artistic Garment Industries (AGI Denim) Pvt Ltd is a Karachi (Pakistan) based supplier with more than 17,500 employees in its garment division that has been producing outerwear and dyed garments for Mango since 2005. Founded in 1993, it is one of the world's leading Denim manufacturers, with market-leading technology and sustainability projects such as three LEED-certified factories and the production of sustainable Denim from 100% recycled water.

Roteks Tekstil (Turkey)

Roteks Tekstil Ihracat Sanayi ve Ticaret Anonim Sirketi is a supplier based in Izmir (Turkey) with more than 300 employees that has supplied Mango trousers, jeans, jumpsuits and lower body cotton garments such as skirts, shorts and jeans since 2017. Founded in 1986, Roteks produces high quality garments with professionals that work with fabrics and accessories supplied from all over the world.

Haian Lianfa Garments (China)

Haian Lianfa Garments Co., Ltd. is a supplier based in Jiangsu (China) with more than 1,000 employees that has been making a wide range of shirts for Mango since 2012. Founded in 2002, the company has always manufactured shirts, as well as trousers and sleepwear.

CIRCULARITY

EPR – COLLECTIVE SYSTEM

44% of Spaniards bought second-hand items in 2022. Regarding products, clothing represented 16% of total sales.

Collective Systems of Extended Responsibility of the Waste Producer

Social Impact ⟹ CIR CU LAR ⟸ Environment Impact

MODA RE_	→ 41% (44-278 t)
Humana	→ 16% (17.753 t)
Aeress	→ 16% (17.486 t)
Asirtex	→ 6% (6.900 t)
Madre Coraje	→ 6% (6.000 t)
Others	→ 15% (15.878 t)

MODA RE_

- CARITAS Project, from the Catholic Church,

- Great capillarity of the collection points,

- Based on a charity initiative with a social core, but profesionalized,

- Three reuse and textile recycling plants in Spain (Bilbao, Barcelona and Valencia) created between 2012 and 2014, that are the most advanced in Spain and southern Europe.

- The workers were in danger of exclusion and all profits were reinvested in the project.

ZARA PRE-OWNED

- Repair
- Resell / Buy
- Donate

SOLICITAR UNA REPARACIÓN

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"Este proceso tiene que ser comprendido por los directivos y compartido por todo el equipo, de lo contrario lo van a frenar", explica Ferrás. Por ello, la tecnología cada vez coge más peso en las escuelas de negocios. "Hace veinte años, en los MBA se explicaba que había departamentos tecnológicos, qué era un CRM y los sistemas de gestión de clientes", recuerda el experto. "Ahora, los directivos tienen que comprender cómo funciona la tecnología y con qué datos trabaja la IA que les va a recomendar si endeudarse o no, porque deben ser capaces de vislumbrar si esas recomendaciones son oportunas o no; aunque te lo aconseja una IA, la responsabilidad final sigue siendo tuya", añade.

"Los directivos del futuro han de tener una compren-sión clara del cambio tecnológico y geopolítico que se ha producido en los últimos años", sentencia Ferrás, que no se olvida de otras cualidades que debe tener el máximo responsable de una empresa. "Ha de ser una persona muy creativa y concienciada y saber navegar entre el cambio climático y la RSC", agrega Ferrás, que concreta que "el directivo actual está orientado hacia la transformación, no a la eficiencia operativa como hace veinte años". Ferrás confirma así que hay que añadirle más factores al modelo *just in time* que ha imperado en los últimos años la innovación jugará un papel fundamental, un campo en el que España no destaca. "España no ha hecho los deberes en innovación; es un ecosistema muy rico, pero no ha llegado a los objetivos que nos habíamos propuesto como europeos", dice.
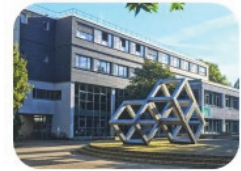
Q&A

PALOMA DIAZ SOLOAGA,
Full professor Complutense University, Madrid, Spain
pdiaz@ucm.es

Sustainability in Textile Education:

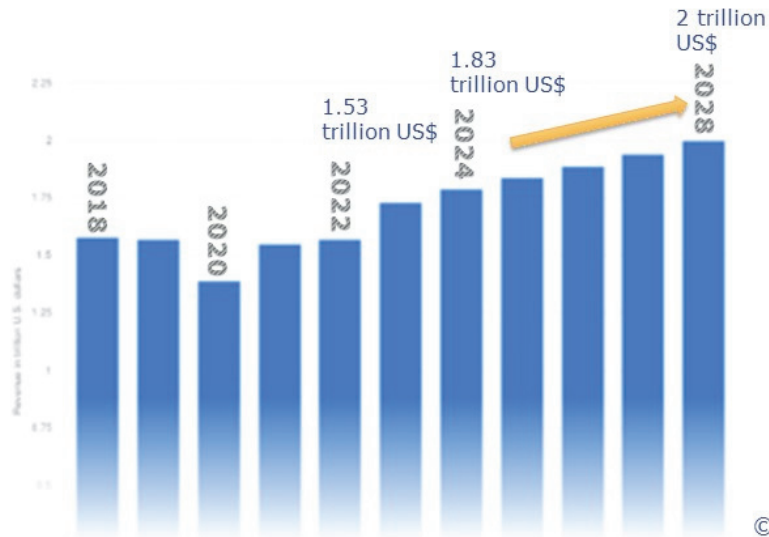**Meaning, Concepts and Evidence**

2024 International Conference on Clothing and Textiles (ICCT)
The Korean Society of Clothing and Textiles

South Korea, May 10-11, 2024

Prof. Dr. Anne-Marie Grundmeier
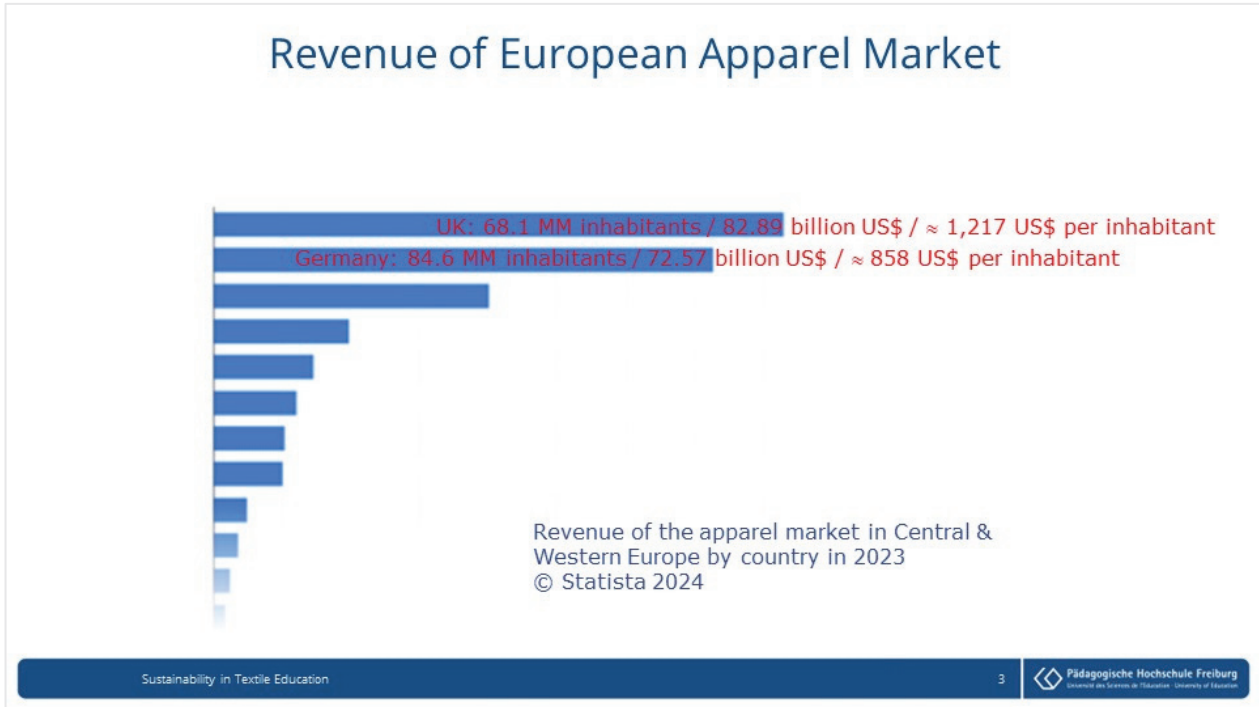University of Education Freiburg, Germany

Revenue of Apparel Market Worldwide

2 trillion US$

1.83 trillion US$

1.53 trillion US$

© Statista 2024

Sustainability in Textile Education

Revenue of European Apparel Market

UK: 68.1 MM inhabitants / 82.89 billion US$ / ≈ 1,217 US$ per inhabitant
Germany: 84.6 MM inhabitants / 72.57 billion US$ / ≈ 858 US$ per inhabitant

Revenue of the apparel market in Central &
Western Europe by country in 2023
© Statista 2024

Sustainability in Textile Education   3   Pädagogische Hochschule Freiburg

Used Textiles and Clothing in Europe

- 10%
- 16%
- 11%
- 8%
- 55%

Legend:
- Local and global reuse as second-hand
- Energy utilisation
- Shoes
- Mechanical Recycling (Nonwovens)
- Cleaning rags

Clothing Container in Freiburg City © Grundmeier

6.6 million tons per year equates to approximately 15 kg per European. Reinkenhof & Ahlmann, 2023

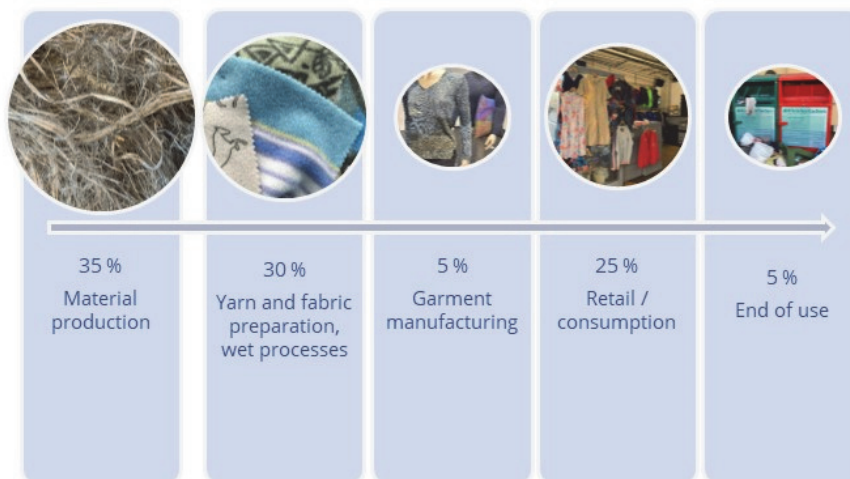Sustainability in Textile Education   4   Pädagogische Hochschule Freiburg

Policy Frameworks

- In late 2023, 16 pieces of EU legislation relating to fashion and textiles were under discussion, with the first coming into force in 2024.
- Regulations span the entire fashion value chain, from product design to marketing, and will impact consumers and companies globally.
- All textile products placed on the EU market have to be durable, repairable and recyclable, and largely made of recycled fibers, free of hazardous substances, produced in respect of social rights and the environment (European Commission, 2022).
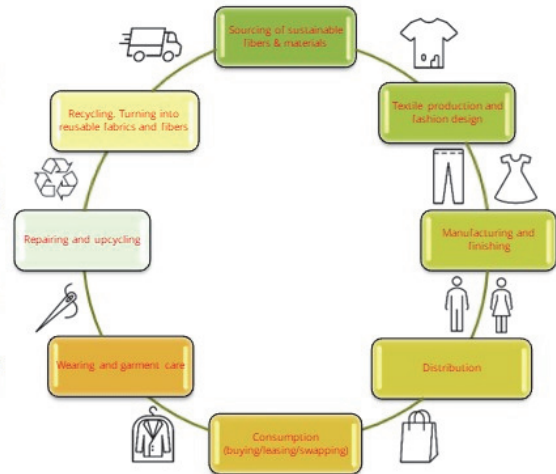
© European Parliament Research Service

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Relative Climate Impact Across Major Steps of Fashion Lifecycle

35 %	30 %	5 %	25 %	5 %
Material production	Yarn and fabric preparation, wet processes	Garment manufacturing	Retail / consumption	End of use

Modified from McKinsey, 2023b: 83

Sustainability in Textile Education   6   Pädagogische Hochschule Freiburg
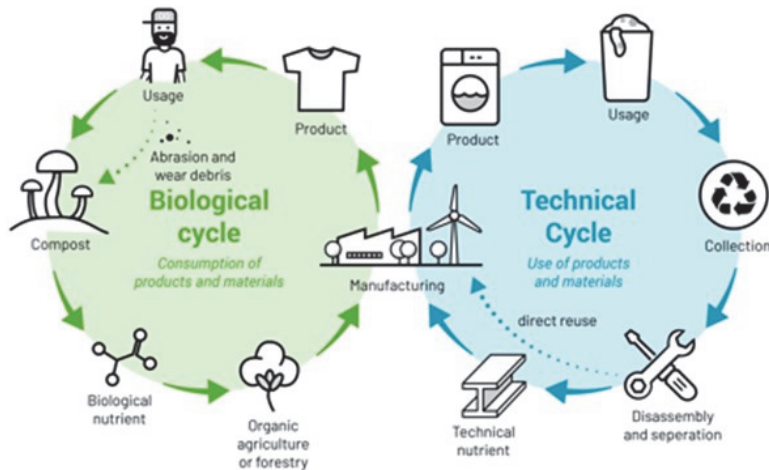
Product Design in a Circular Economy

o Up to 80 percent of a product's environmental impact is determined in the design phase.

o The Ecodesign for Sustainable Products Regulation (ESPR), which is set to come into full effect by 2025, sets minimum design standards for all individual products sold within the EU.

o This includes requirements around recyclability, durability, reusability, repairability and use of hazardous substances.

o Digital product passports that collect and share this information with consumers are expected to become required by law.
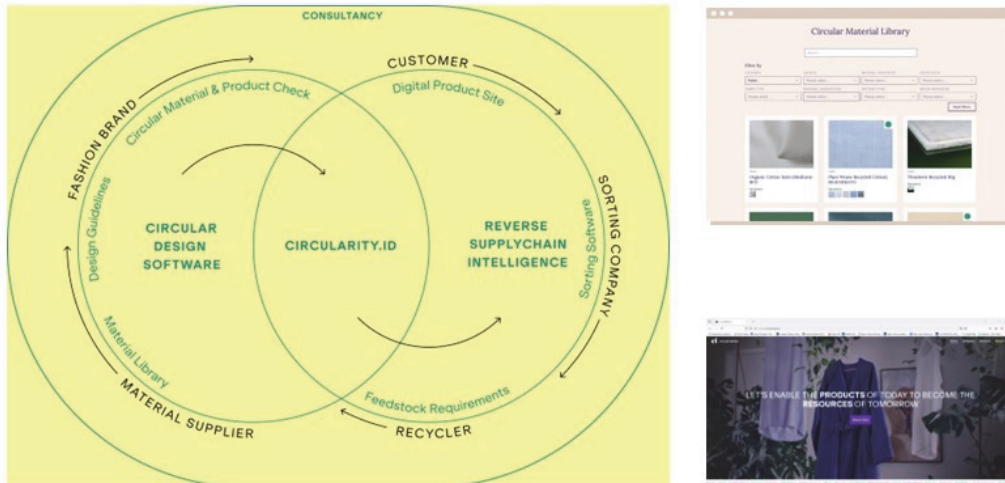
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Cradle To Cradle

Biological cycle
Consumption of products and materials

Technical Cycle
Use of products and materials

Concept by Michael Braungart and William McDonough
Illustration: CC0 Felix Joerg Mueller

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Circular Design Software for Fashion

© Circular.Fashion, https://circular.fashion/

Sustainability in Textile Education   9   Pädagogische Hochschule Freiburg

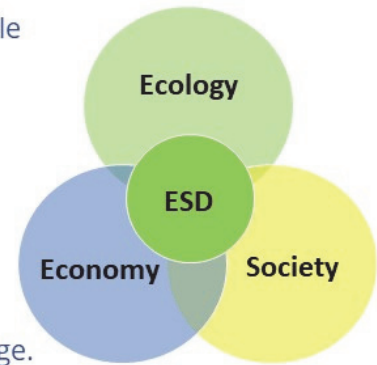## How to Reach Sustainability in Textiles and Fashion through Education?

o The term Education for Sustainable Development (ESD) emerged from the Johannesburg Summit in 2002.

o In the UNESCO Roadmap for the implementation of the Global Action Program 'Education for Sustainable Development' 2030, ESD is regarded an integral part of the SDGs.

o By 2030, all learners shall acquire the knowledge and skills needed to promote sustainable development (UNESCO, 2020: 14).
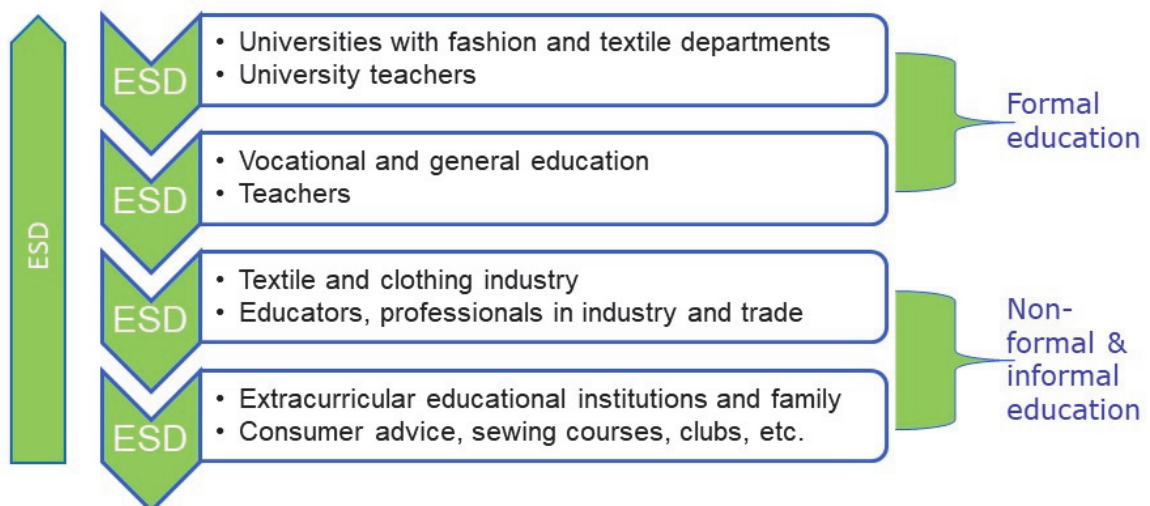
© European Commission

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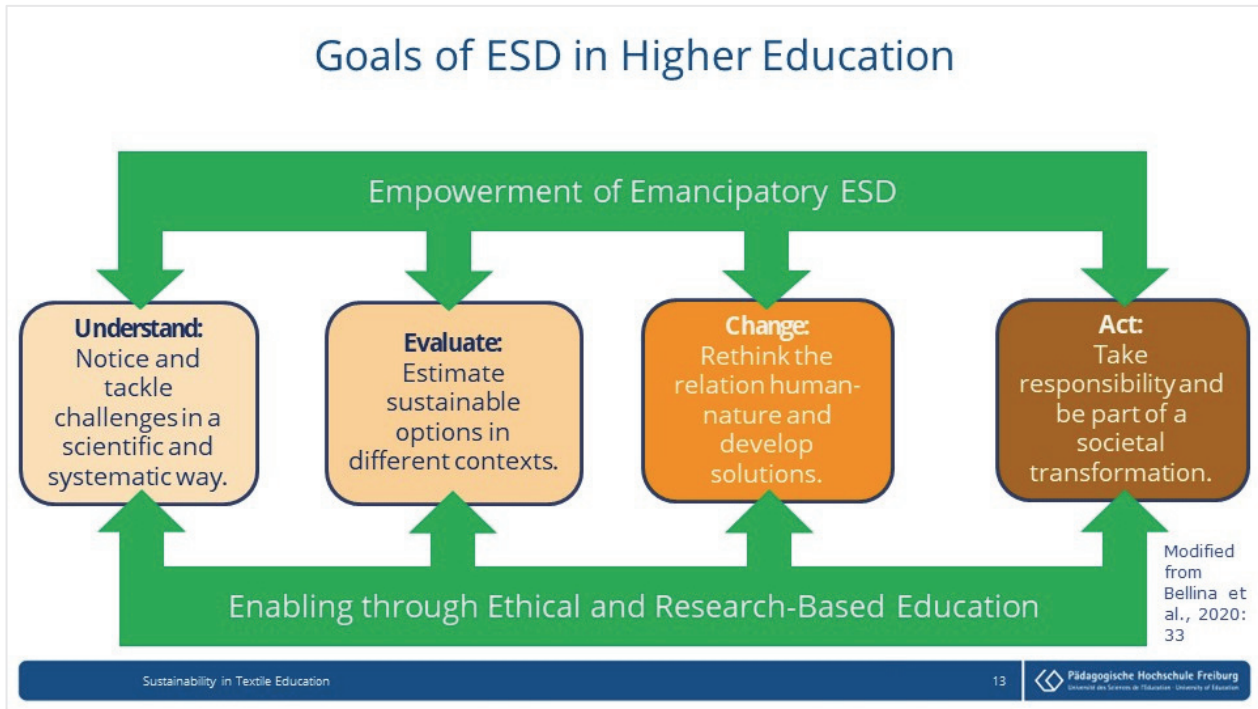
Education for Sustainable Development (ESD) in the Context of Fashion and Textiles

- ESD aims to enable people to think and act in a sustainable way.
- ESD topics are complex, multi-perspective and require a systemic approach.
- ESD should be treated as a cross-cutting issue/ guiding perspective from all subjects as it is not another subject.
- Considering a growing world, the worldwide demand for fibers and textiles is seen as a global challenge, not least against the backdrop of advancing climate change.
- Therefore, a profound change in design, production and consumption habits is essential, whereby education is an important lever.

ESD as a Guiding Principle in Textile and Fashion Education

- Universities with fashion and textile departments
- University teachers

- Vocational and general education
- Teachers

Formal education

- Textile and clothing industry
- Educators, professionals in industry and trade

- Extracurricular educational institutions and family
- Consumer advice, sewing courses, clubs, etc.

Non-formal & informal education

Goals of ESD in Higher Education

Empowerment of Emancipatory ESD

Understand: Notice and tackle challenges in a scientific and systematic way.

Evaluate: Estimate sustainable options in different contexts.

Change: Rethink the relation human-nature and develop solutions.

Act: Take responsibility and be part of a societal transformation.

Enabling through Ethical and Research-Based Education

Modified from Bellina et al., 2020: 33

Sustainability in Textile Education · 13 · Pädagogische Hochschule Freiburg

Concept of Design Competence

CC0 Alena Koval

Design competence refers to the ability to apply knowledge about sustainable development and to recognize problems of non-sustainable development.

This means being able to draw conclusions about ecological, economic and social developments in their interdependence from analyses of the present and studies of the future.

Furthermore, it also includes being able to make, understand and individually, collectively and politically implement decisions based on these conclusions, with which sustainable development processes can be realized.

(de Haan, 2006)

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Effects of ESD on Design Education

o Adopting disciplinary and interdisciplinary perspectives on global problems and their regional and local manifestations.

o Evaluating the significance of subject-specific focal points of sustainable development.

o Gaining new perspectives on professionalism of designers.

o Best Practice Example: The travelling exhibition "Use-less – Slow Fashion against waste and ugly clothes" was dedicated to conscious and sustainable fashion consumption.

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ESD: Knowledge Acquisition and Empathy

Besides the acquisition of knowledge, ESD is about ...

o the willingness to engage and to take responsibility,

o the willingness to manage risks and uncertainty,

o empathy for other people's circumstances and solid judgement on questions about the future.

ESD empowers students in textiles and fashion as consumers and professionals to contribute to sustainable development through civil society engagement and political action.

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Fashion DIET – Research Question

How to implement Education for Sustainable Development (ESD) as a guiding principle in textile and fashion education?

Sustainable Fashion Curriculum at Textile Universities in Europe – Development, Implementation and Evaluation of a Teaching Module for Educators (Erasmus+ project Fashion DIET)
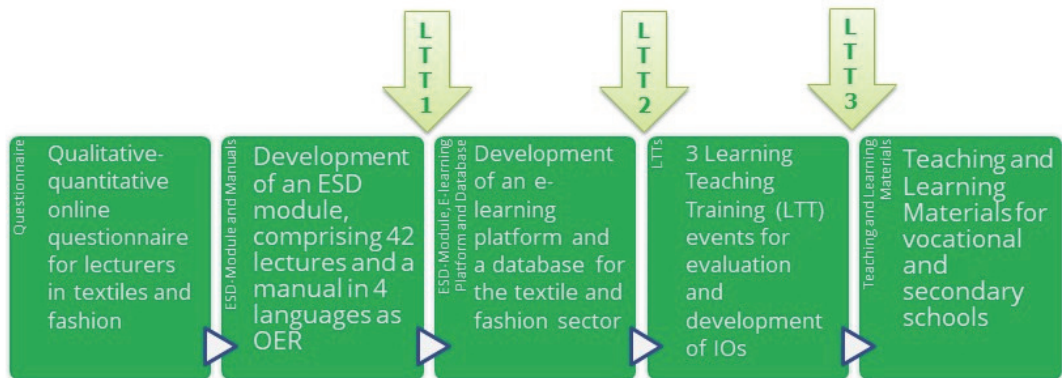
Project duration: 01.09.2020-31.08.2023

Hochschule Reutlingen
Reutlingen University

https://fashiondiet.eu/

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Research Design of Fashion DIET

LTT 1   LTT 2   LTT 3

Questionnaire	ESD-Module and Manuals	ESD-Module, E-learning Platform and Database	LTTs	Teaching and Learning Materials
Qualitative-quantitative online questionnaire for lecturers in textiles and fashion	Development of an ESD module, comprising 42 lectures and a manual in 4 languages as OER	Development of an e-learning platform and a database for the textile and fashion sector	3 Learning Teaching Training (LTT) events for evaluation and development of IOs	Teaching and Learning Materials for vocational and secondary schools

Major project website with access to the information & e-learning platform *Glocal Campus* and the data portal *Fashion+ Textile Database* (F+TD)

LTT = Learning Teaching Training Event

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Fashion DIET ESD-Module for Higher Education

Didactic and Methodological Implementation of ESD

Sustainable Textile Technologies and Fashion

Sustainability and Entrepreneurship

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OER on ESD in Textiles and Fashion

o Open Educational Resources (OER) are educational materials of any kind and in any medium that are published under an open license.

o They allow free access and free use, adaptation and redistribution of materials without or with minor restrictions.

o The OER Fashion DIET comprise 42 lectures at university level with PPPs, PDF-files and short introductions into different ESD topics.

o The ESD module is complemented by a manual and teaching and learning materials for general and vocational education. (Grundmeier & Höfer, 2023)

Open Educational Resources

Fashion DIET Manual

Sustainable Fashion Curriculum at Textile Universities in Europe

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E-Learning Platform Glocal Campus

Fashion DIET

0. Fashion DIET: Introduction & Overview

1. ESD Module Part 1: Didactic and …

2. ESD Module Part 2: Sustainable Textile …

3. ESD Module Part 3: Sustainability and …

4. Teaching and Learning Material

https://glocal-campus.org/

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Follow-up Project: ESD in Fashion Design Education

How to contribute to sustainable fashion design by implementing ESD as a guiding principle in fashion design higher education?

o Which sustainable design principles and teaching methods are already implemented in the curricula of fashion design studies at universities in Germany and Iran?

o What can be improved and what can we learn from each other by comparing fashion design education in Germany and Iran concerning the implementation of ESD?

© Choopani

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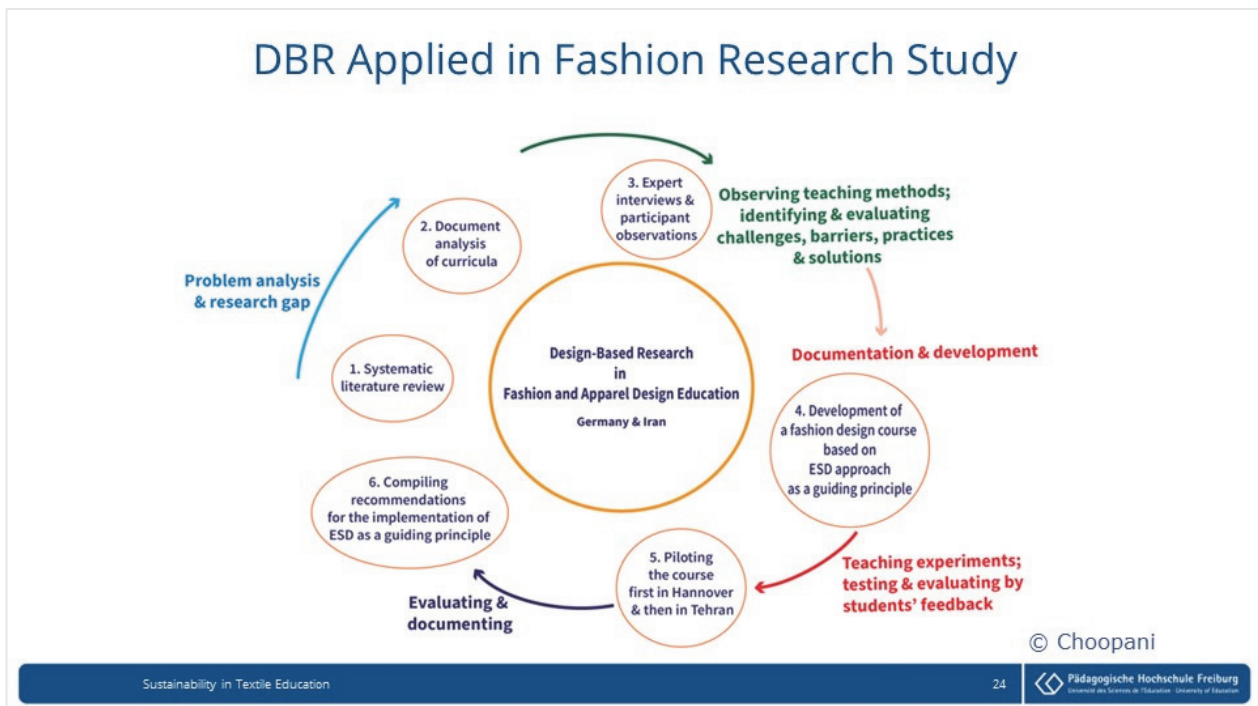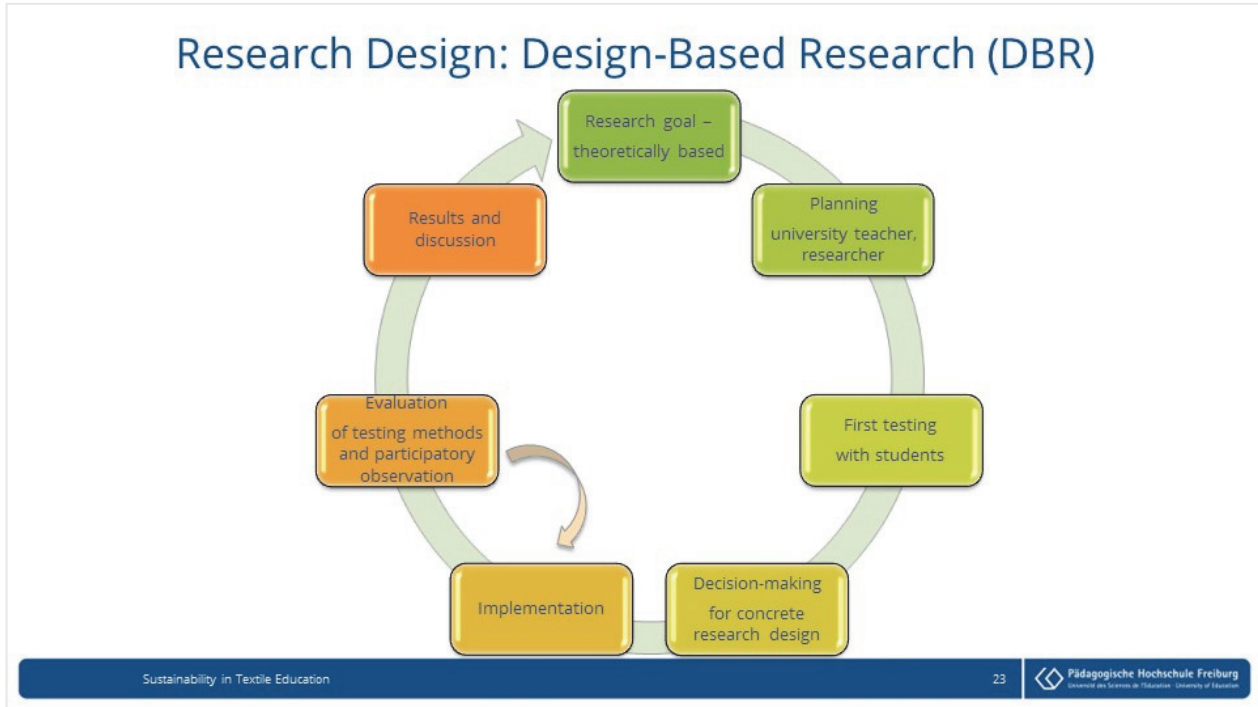
Iterative Processes in Fashion Education Study
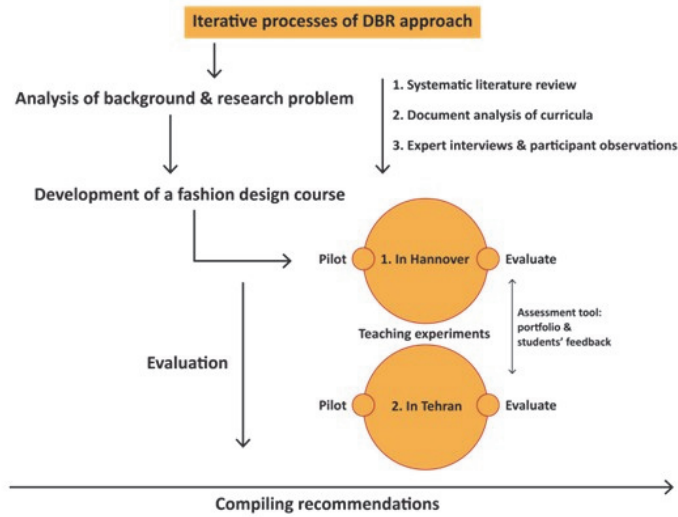
Interventions with the Loop
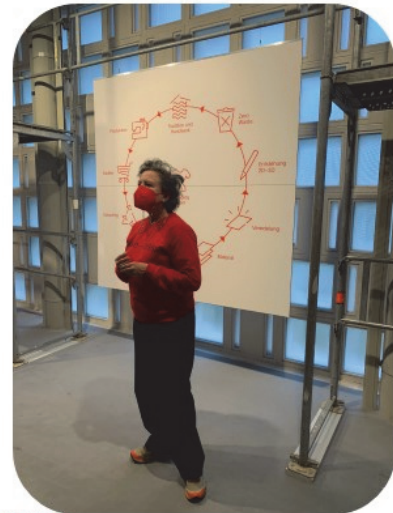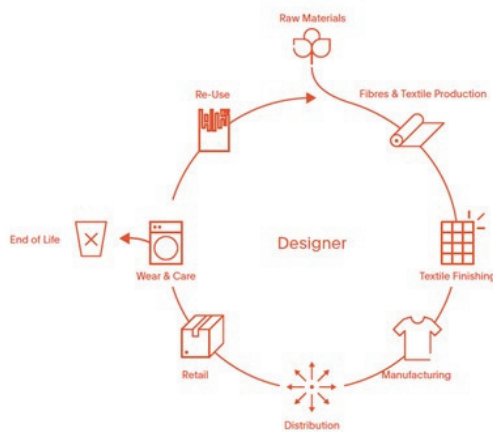
Research Center ReCCE

ReCCE is a central scientific institution of the University of Education Freiburg for research in empirical educational research in the fields of
- Climate Change Education (CCE) and
- Education for Sustainable Development (ESD).

ReCCE is listed by UNESCO as an ESD actor.

ReCCE distinguishes between research projects in empirical educational research on Climate Change Education (CCE) and Education for Sustainable Development (ESD).

The members are involved in ESD- and CCE-related practice projects with external partners.

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Concept of Climate Change Education (CCE)

- CCE helps people understand and address the impacts of the climate crisis, empowering them with the knowledge, skills, values and attitudes needed to act as agents of change.
- Climate action is one of the key thematic priorities of ESD for 2030, the Education for Sustainable Development's global framework.
- Through its program, UNESCO has been working to make education a more central and visible part of the international response to climate change.
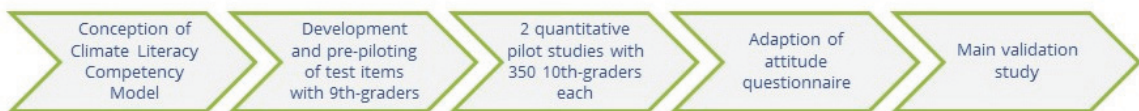
© United Nations

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Research Project on Climate Change Education

ProBiKlima

- How well do young people know about climate change?
- Do they have sufficient basic knowledge of the climate system to understand climate change and its consequences?
- Can they handle information on scientific findings, draw conclusions from it and distinguish facts from expressions of opinion?
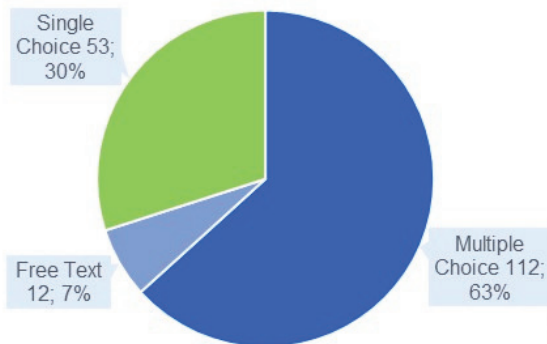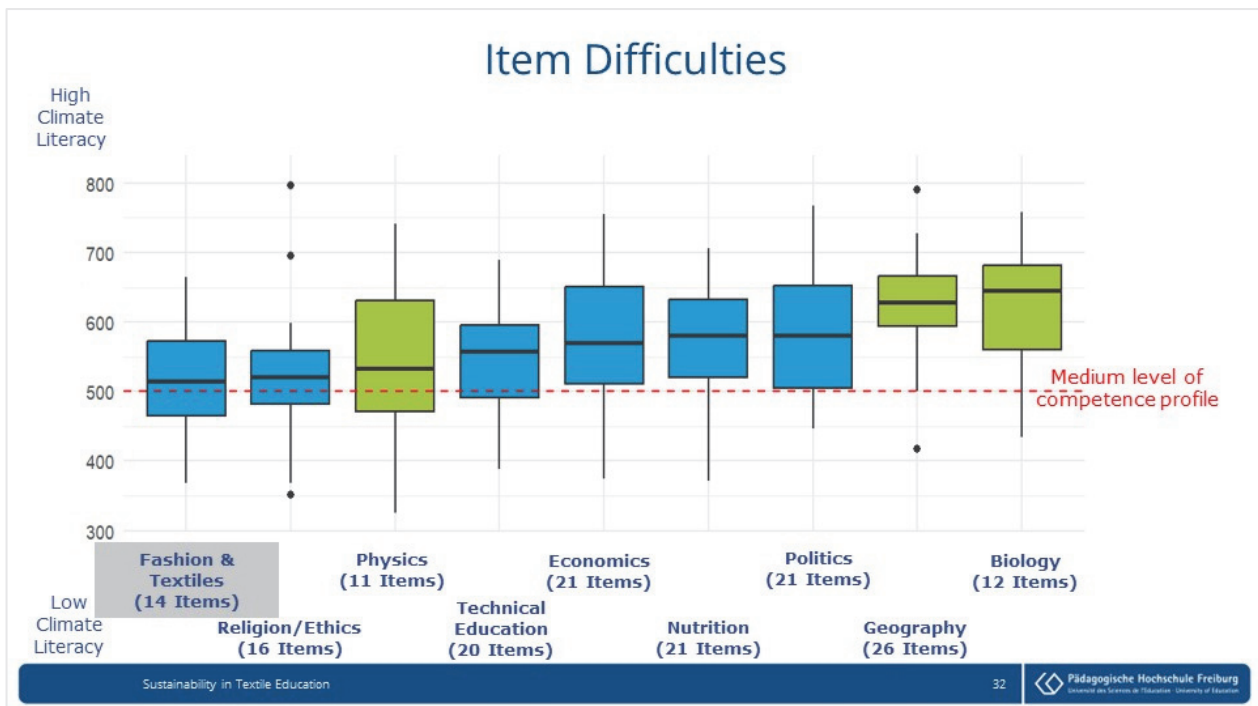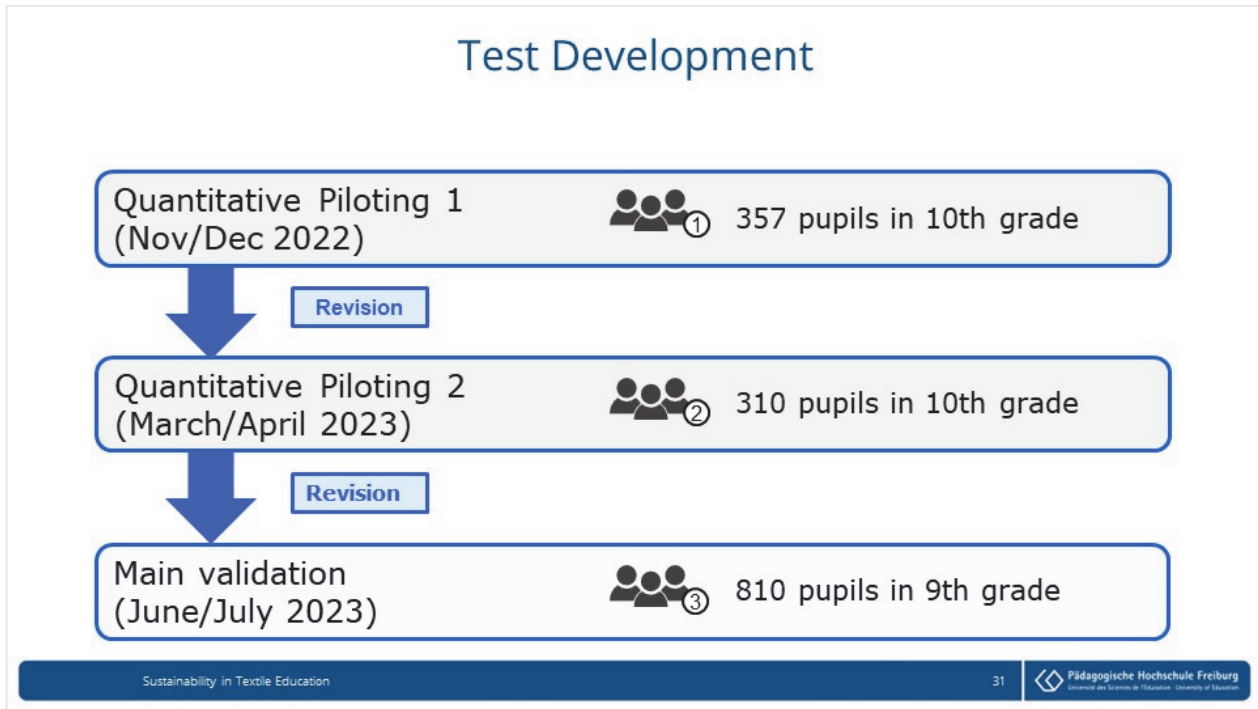- The focus of *ProBiKlima* is on testing whether pupils can apply their knowledge in solving climate-relevant problems.

Dealing with Subject Knowledge | Gaining and Assessing of Findings
Information and Communication | Normative Evaluation

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Milestones

Conception of Climate Literacy Competency Model → Development and pre-piloting of test items with 9th-graders → 2 quantitative pilot studies with 350 10th-graders each → Adaption of attitude questionnaire → Main validation study

© ReCCE

70 minutes

Single Choice 53; 30%
Free Text 12; 7%
Multiple Choice 112; 63%

177 Items in 43 thematic blocks (2-7 Items / block)

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Test Development

| Quantitative Piloting 1 (Nov/Dec 2022) | ① 357 pupils in 10th grade |

Revision

| Quantitative Piloting 2 (March/April 2023) | ② 310 pupils in 10th grade |

Revision

| Main validation (June/July 2023) | ③ 810 pupils in 9th grade |

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Item Difficulties

High Climate Literacy

Medium level of competence profile

Low Climate Literacy

Fashion & Textiles (14 Items)
Religion/Ethics (16 Items)
Physics (11 Items)
Technical Education (20 Items)
Economics (21 Items)
Nutrition (21 Items)
Politics (21 Items)
Geography (26 Items)
Biology (12 Items)

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127
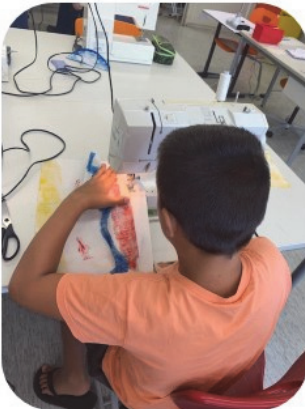
Thank you for your attention!

© Grundmeier

University of Education Freiburg
Institute for Everyday Culture, Sport and Health
Department Fashion and Textiles

Prof. Dr. Anne-Marie Grundmeier
grundmeier@ph-freiburg.de

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References

Amed, I., Berg, A., Balchandani, A., D'Auria, G., Balchandani, A., Rölkens, F., Barrelet, D., Grundberg, J., Kersnar, J., Branche, A. de, Crump, H., Starzyńska, E., & Bain, M. (2023a). *The State of Fashion 2024. McKinsey Report.* https://www.mckinsey.com/industries/retail/our-insights/state-of-fashion

Amed, I., Berg, A., Balchandani, A., André, S., Devillard, S., Straub, M., Rölkens, F., Grunberg, J., Kersnar, J., & Crump, H. (2023b). *The State of Fashion 2023. McKinsey Report.* https://www.mckinsey.com/~/media/mckinsey/industries/retail/our%20insights/state%20of%20fashion/2023/the-state-of-fashion-2023-holding-onto-growth-as-global-clouds-gathers-vf.pdf

Bellina, L., Tegeler, M. K., Müller-Christ, G., & Potthast, T. (2020). *Bildung für nachhaltige Entwicklung (BNE) in der Hochschullehre. BMBF-Projekt „Nachhaltigkeit an Hochschulen: entwickeln – vernetzen – berichten (HOCHN)"* [Education for sustainable development (ESD) in higher education teaching. BMBF project "Sustainability at universities: develop - network - report (HOCHN)"]. https://www.hochn.uni-hamburg.de/-downloads/handlungsfelder/lehre/hochn-leitfaden-lehre-2020-neu.pdf

European Commission (n.d.). *Ecodesign for Sustainable Products Regulation.* https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en [accessed 24 March 2024].

Fashion For Good & Circle Economy (2022). *Sorting for Circularity Europe: An Evaluation and Commercial Assessment of Textile Waste across Europe.* https://reports.fashionforgood.com/report/sorting-for-circularity-europe/ [accessed 24 March 2024].

Grundmeier, A.-M., & Höfer, D. (2023). *Sustainable fashion curriculum at textile universities in Europe – development, implementation and evaluation of a teaching module for educators.* OPUS-PHFR. https://phfr.bsz-bw.de/frontdoor/index/index/year/2023/docId/2213

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References

Haan, G. de (2006). The BLK '21' programme in Germany: a 'Gestaltungskompetenz'-based model for Education for Sustainable Development. *Environmental Education Research, 12*(1), 19-32. *https://doi.org/10.1080/13504620500526362*

McDonough, W., & Braungart. M. (2002). *Cradle to Cradle: Remaking the Way We Make Things*. North Point Press.

McKenney, S., & Reeves, T. (2013). Systematic review of design-based research progress: Is a little knowledge a dangerous thing? *Educational Researcher, 42*(2), 97-100. https://doi.org/10.3102/0013189X12463781

Lyle, J. T. (1996). *Regenerative Design for Sustainable Development*. Wiley.

Reinkenhoff, A.-K. & Ahlmann, T. (2023). *Second Hand – Second Thoughts? Von Strukturen, Prozessen und Akteuren im globalen Alttextilhandel* [Second Hand - Second Thoughts? On structures, processes and actors in the global used textiles trade]. Hrsg. v. FairWertung e.V. https://www.kleiderstiftung.de/fileadmin/user_upload/Downloads/_FW_Report_DKS_web.pdf

Smith, P. (2024a, February 20). Revenue of the apparel market worldwide from 2018 to 2028 *(in trillion U.S. dollars)*. https://www.statista.com/forecasts/821415/value-of-the-global-apparel-market [accessed 24 March 2024].

Smith, P. (2024b, February 9). Revenue of the apparel market in Central & Western Europe by country in 2023 *(in billion U.S. dollars)*. https://www.statista.com/forecasts/1101864/revenue-of-the-apparel-market-central-and-western-europe [accessed 24 March 2024].

UNESCO (2020). *Education for Sustainable Development: A Roadmap. ESD for 2030*. https://doi.org/10.54675/YFRE1448 [accessed 24 March 2024].

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Image Sources

Slide 5: European Parliament (2023, May 24). *Circular economy: definition, importance and benefits.* https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits [accessed 24 March 2024].

Slide 8: Cycles and design principles of the Cradle to Cradle concept by Michael Braungart and William McDonough, Felix Joerg Mueller, CC-BY-SA-4.0, https://commons.wikimedia.org/wiki/File:Cradle_to_Cradle_concept.png [accessed 24 March 2024].

Slide 9: Circular.Fashion (n.d.). *Let's enable the products of today to become the resources of tomorrow.* https://circular.fashion/ [accessed 24 March 2024].

Slide 10: European Commission (n.d.). *Sustainable Development Goals.* https://international-partnerships.ec.europa.eu/policies/sustainable-development-goals_en [accessed 24 March 2024].

Slide 14: Person's Left Hand Holding Green Leaf Plant, Alena Koval, https://www.pexels.com/license/, https://www.pexels.com/photo/person-s-left-hand-holding-green-leaf-plant-886521/ [accessed 24 March 2024].

Slide 22: Photo by Hanieh Choopani, University of Education Freiburg, 2023

Slide 24: Graph by Hanieh Choopani, University of Education Freiburg, 2024

Slide 25: Graph by Hanieh Choopani, University of Education Freiburg, 2024

Slide 26: Graph by use-less Zentrum für nachhaltige Designstrategien, Hochschule Hannover, 2021

Slide 28: United Nations (n.d.). *The 17 Goals.* https://sdgs.un.org/goals [accessed 24 March 2024].

Slide 30: Photo by ReCCE, University of Education Freiburg, 2023

Sustainability in Textile Education | 38 | Pädagogische Hochschule Freiburg

Computer Aided Fashion Intelligence – a bridge connecting the real & virtual worlds

Tracy Mok (PhD)

Future Fashion & Textiles

○ The original and primary function of textiles was to protect our body from environmental conditions like sunrays, cold wind, rain and so forth.

○ Aesthetic and comfort properties came to play a role in clothing.

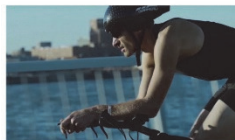○ *What next? Where will the future of textiles and fashion be heading?*

Healthcare

Daily life

Hexoskin's smart shirt, provides insights on a range of sporty metrics including workout intensity and recovery, calories burned, fatigue level and sleep quality.

OWO's haptic vest, using conductive gel, allows users to physically feel what happens in the metaverse or a video game, like a shooting or the wind on the skin.

Sustainable & Green

Sports & Fitness

Entertainment

Owlet's smart socks for baby, is able to track children's heart rate, oxygen level and sleep trends.

Google and Levi's commuter trucker jacket, uses conductive yarn to build touch and gesture sensitive areas on the sleeve to control connected devices like a phone.

2

People, particularly those in Gen Z, are spending more time online and exploring different possibilities of the virtual world.

There a lot of buzz surrounding, metaverse, digital fashion, and non-fungible tokens (NFTs)

©Internet image

The word Metaverse = Meta + Verse ,
Meta = beyond; Verse = universe,
Metaverse = "beyond the universe", i.e. an artificial space that runs parallel to the real world.

hyper-interactive, creative digital environments where people work, play, socialize, and shop.

©Internet image

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Research focuses :

Integration of computer vision in fashion (CV/AI)

Computer aided design (CAD)

Smart fitting & sizing (FITS)

Mixed reality & interaction/experience design (XR)

Sustainability & integration (SI)

CAFI lab   Digital Fashion

3D body processing – An application

Neck girth 39cm
Across shoulder 44cm
Bust girth 93cm
Waist girth 77cm
Arm length 62cm
waist 81cm
Hip girth 96cm
Max thigh girth 57cm
Knee girth 39cm
Calf girth 39cm
Knee girth 27cm

CAFI lab

理大3D技術助網購衣物
度身App影相 10秒算出尺碼

理大推新App
10秒度身
方便網購

拍攝兩張照片即可在10秒內得到準確的身體尺寸

An Integrated Platform for Online Fashion Sketch Design

Understanding Human Fashion Images: A Parse-pose Based Study
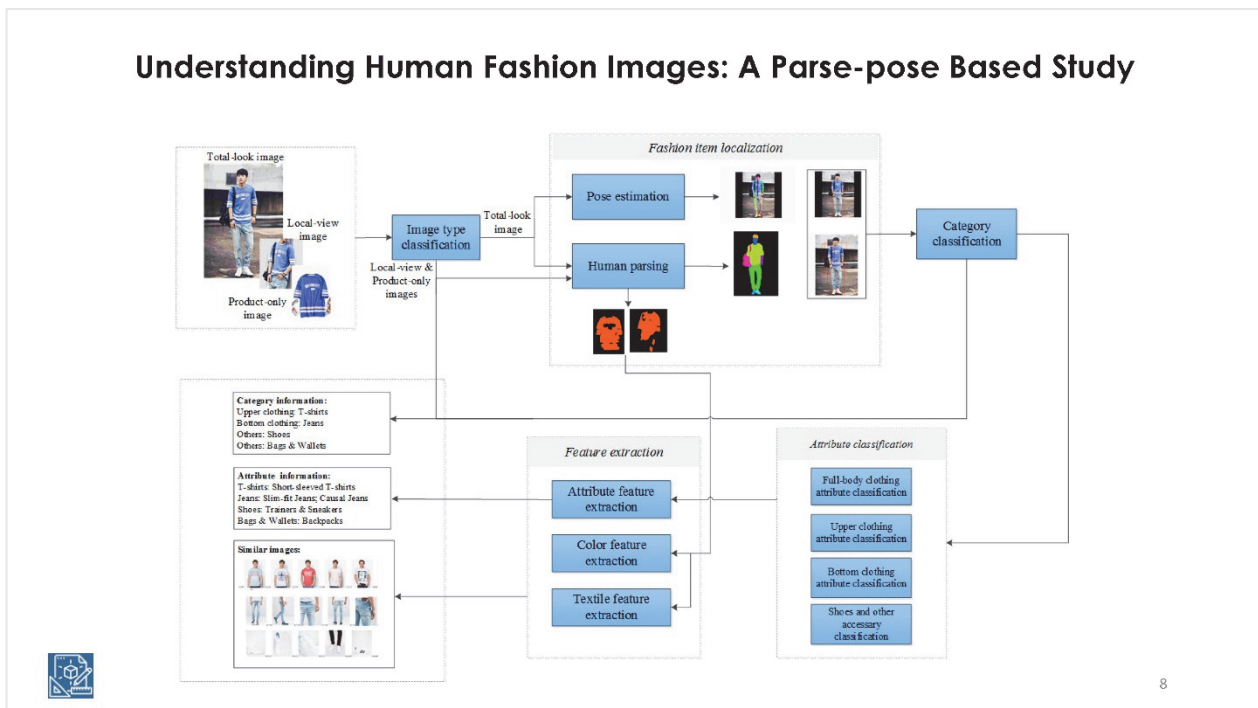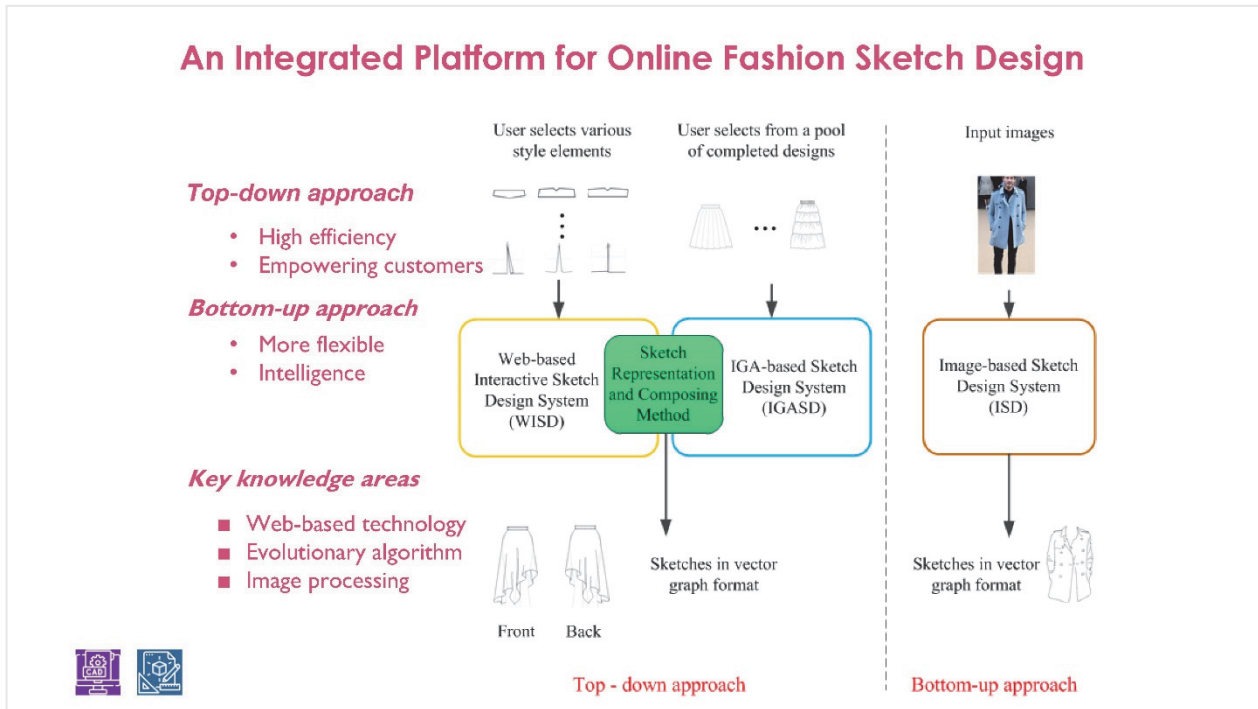
Personalised *Fashion Recommendation* based on heterogeneous information mining

Front end development

Deep learning

Data analytics

Needs a set of well-fitted bespoke suits?

IPDS is the answer...

Intelligent Pattern Design System

• Creat your bespoke suit here

Automatic: by inputting your measurements, your suit patterns can be generated within seconds, and ready for download and production;

Stylish and technology-based: The system is developed on the basis of over 30 years Hong Kong bespoke suit pattern masters' experience;

Web-based system: Create your suit anywhere and anytime – lower your hardware and software cost;

Versatile: Skinny, slim fit or classic fit for choices, works for special body shapes, including sloppy or square shoulders, hump back, belly, etc.

Intelligent Sizing and Somatotype Analysis for Uniform Production

- A web-based business intelligence online platform (SizeMaster-SMASS) developed for TOZI Technology Company Limited.

- Allow management of measurement data acquired across different platforms, online stores, mobile app or corporate clients' manual data, anywhere anytime over the internet.

- *Size grouping, body shape analysis, size recommendation, and size-cost analysis.*
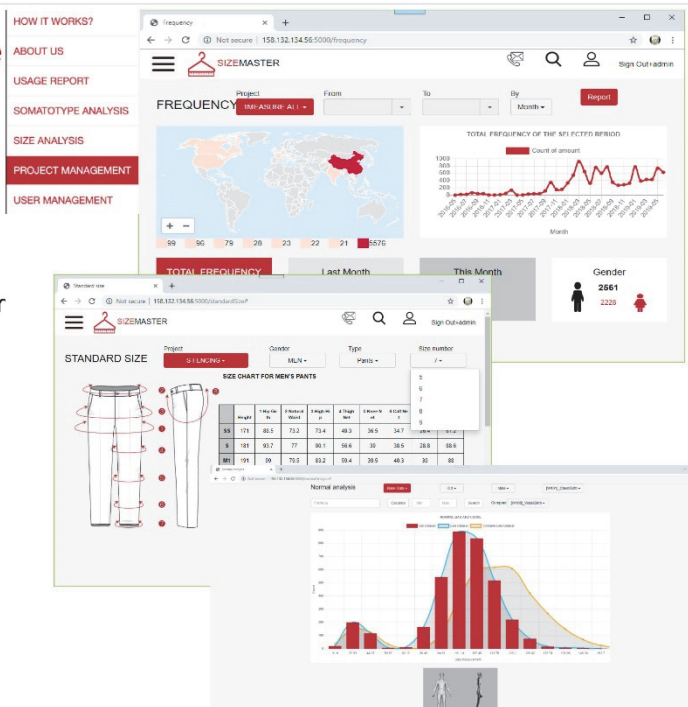
Decentralized Intelligent Platform for Made-to-Measure Mass Customization

CAFI lab

Industry 4.0 concept is applied to fashion supply chain

- Block Chain technology
- Size recommendation
- Mobile measuring
- Auto grading
- Fashion 4.0 -- cyber-physical system

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3d Virtual Try-on & Synchronised 2d & 3d Pattern Editing for Fit Optimisation

✓ Mathematical cross-parameterisation to map patterns pieces onto body surface;
✓ Geometric reconstruction and physical simulation – hybrid pop up to enable precise fit evaluation;
✓ Seamless textile & pattern design to flatter figure beauty;
✓ 3D pattern editing for fit optimisation.

GPU-based marbling textile pattern design

❖ Mathematical marbling models are combined with evolutionary computation to create marbling textile patterns.
❖ Instant design visualisation.
❖ Output patterns fulfils textile industry requirements on repeat, different colour ways and vector images

https://www.youtube.com/watch?v=xdtNvg1ZQMQ&t=3s

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SGDIFF: A STYLE GUIDED DIFFUSION MODEL FOR FASHION SYNTHESIS
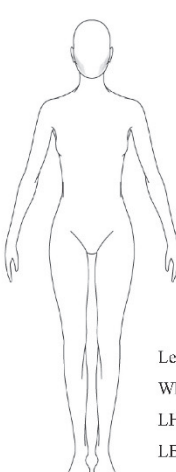
ACM Multimedia conference 2023

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Figure flattering print design
based on visual assessment on body shape attractiveness

- **What matters in judging the physical attractiveness of female body figures?**
  - Identification of ideal body shape
  - Application for digital prints to enhance perceived attractiveness.

Leg-length: 115cm

WHR ratio: 0.695

LHR ratio: 0.66

LBR ratio: 0.51

Using Augmented Reality (AR) to understand user's design and fit preferences

AR is a technology that may revolutionise future retail operations, because it introduces a new level of interaction between products and consumers.

Turing a floor into a virtual fitting room, it allows consumers to examine 3D product details and in virtual scenes, seeing how these products fit their figures.

EasyWear app iOS

EasyWear app Android, pls contact us by email
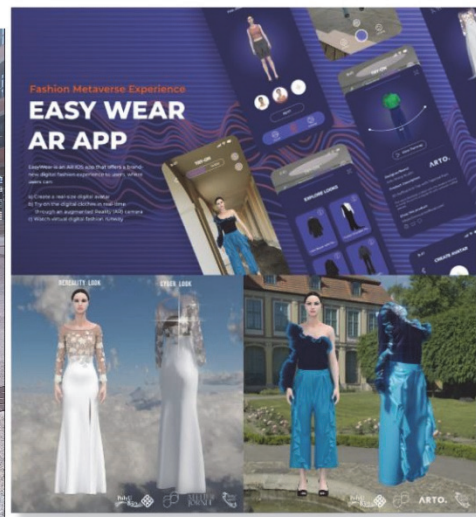
The Reality of Silk

We collaborate with the Hong Kong Museum of Art (HKMoA), taking part in and contribute to an exhibition named 'A Tale of Three Cities: Guangdong-Hong Kong-Macao Greater Bay Area and Export of Silk Products in the Ming and Qing Dynasties'. We design and develop an immersive exhibition experience, utilizing cutting-edge AR/VR technology, for visitors.

Digital Fashion

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THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學
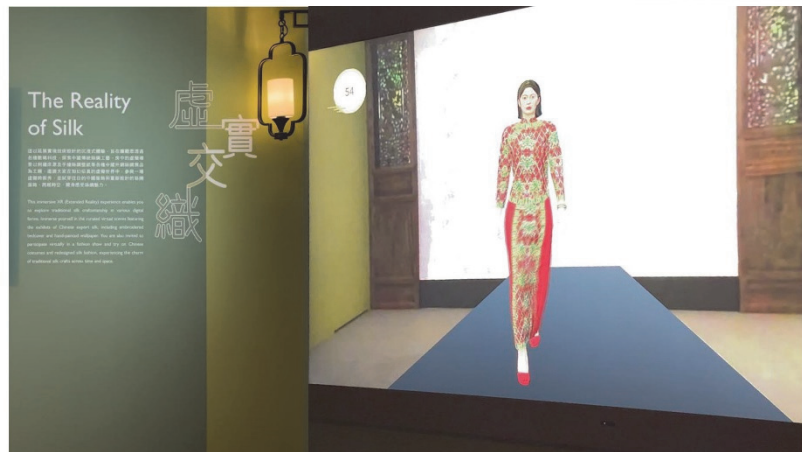
Thank You ！

Q&A

Email: tracy.mok@polyu.edu.hk

CAFI lab   Digital Fashion

Opening Minds • Shaping the Future • 啟迪思維 • 成就未来

2024 International Conference on Clothing and Textiles

Multifunctional Sensors For Smart Wearables

Hang Liu, Ph.D.

Department of Apparel, Merchandising, Design and Textiles

Washington State University

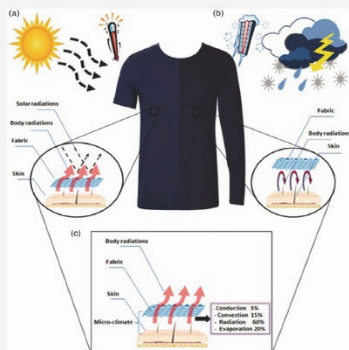# Introduction –
Textiles & Smart Wearables

| Apparel | Home Products | Medical Textiles | Agro Textiles | Geo textiles | PPE |

Advancement in Apparel

Apparel

- Provides the first layer of protection to the human body.
- Exposed to external environmental elements.
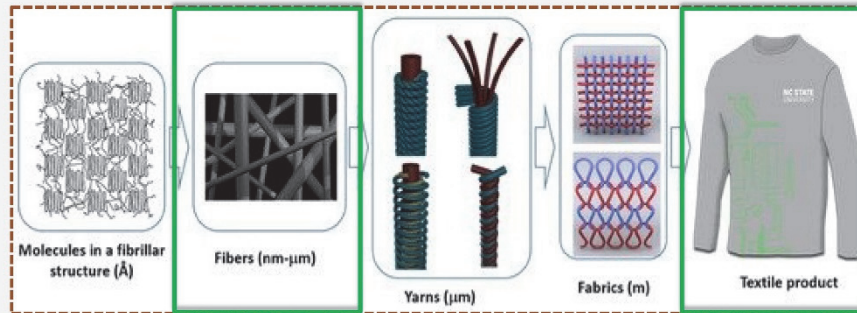- Interacts with the human body directly or via the micro-environment created.

ACS Nano 2021, 15, 8, 12497−12508

Smart Textiles

Textile materials that sense, adapt, actively respond to environmental stimuli, or actuate user's commands.

Pictures are from the internet.

Apparel - Structure

Hierarchical Structure of Textiles
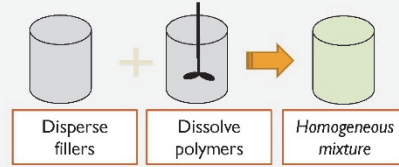
Fibers, 2019, 7(6):51

Electrically Conductive Fibers

Problem Statement

Current Method – Homogenous Blend
- Traditional textile materials are electrical insulators.
- Conductive fillers are incorporated into polymer solutions for fiber spinning.

Limitations
1. Load of the filler needs to be high enough to satisfy the percolation threshold to be conductive.
2. Adding fillers affects the viscoelasticity of the matrix polymer solution, *i.e.*, increased filler load decreases the solution processability.
3. Fillers can deteriorate the mechanical properties of the blend fibers, especially at a high load.

Proposed Solution



Homo to Hetero Blend
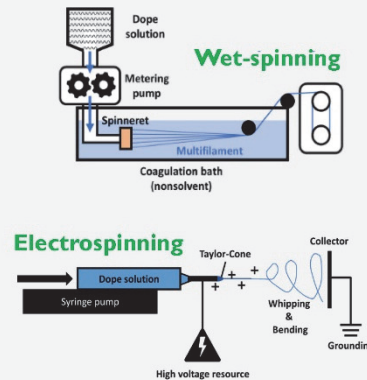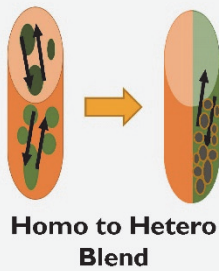
Proposed Method – Side-by-side (SBS) Fibers
1. The neat matrix polymer side provides processability and mechanical support.
2. The high filler load side provides functions.
3. The interface between the two phases plays a critical role.
   - Sufficient mixing to ensure strong interfacial bonding
   - Limited mixing to maintain the heterostructure.

Challenges
The SBS fiber formation process is very complex. Many factors affect the interfacial bonding and interface morphologies:
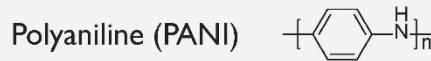- Intrinsic properties of the two solutions: viscosity, elasticity, and interfacial tension
- External factors: flow velocity, contact time, contact area, shear stress at the interface, solution miscibility.
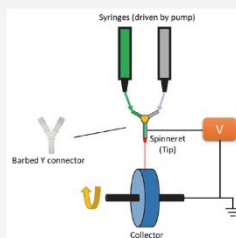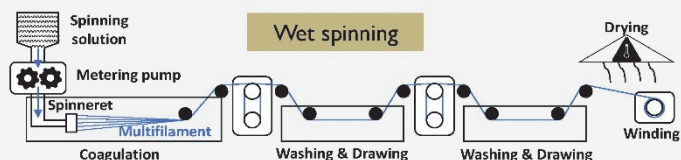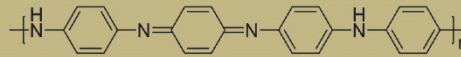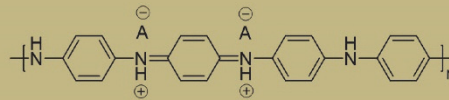
Conductive Polymer

Polyaniline (PANI)

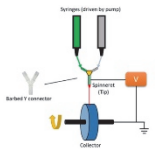|		
Polyaniline Emeraldine base (Blue)		
Polyaniline Emeraldine Salt (Green)		

- ➤ Inexpensive
- ➤ Easy to synthesize
- ➤ Great biocompatibility
- ➤ Tunable conductivity

- ➤ Infusible & insoluble: poor processability
- ➤ Brittle
- ➤ Rich redox chemistry
- ➤ Color change

Results 1 – Conductive SBS Nanofiber Mats

Side 1: Poly(ethylene glycol) (PEO); Side 2: PEO/PANI blend

Morphology

Tensile
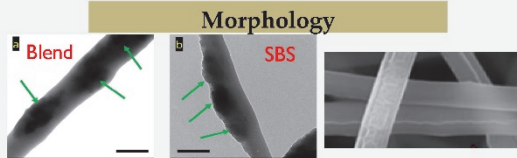
Conductivity		
PEO-PANI	Blend	Side-by-Side
3%-1.5%	$6.8\text{-}9.2 \times 10^{-6}$	$5.8\text{-}7.9 \times 10^{-5}$
3%-2.5%	$2.5\text{-}4.3 \times 10^{-5}$	$1.6\text{-}3.8 \times 10^{-4}$
3%-3.5%	$2.8\text{-}4.3 \times 10^{-5}$	$3.5\text{-}5.8 \times 10^{-4}$
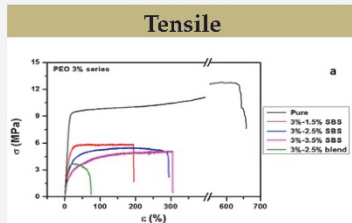
Relative electrical resistance as strain sensors
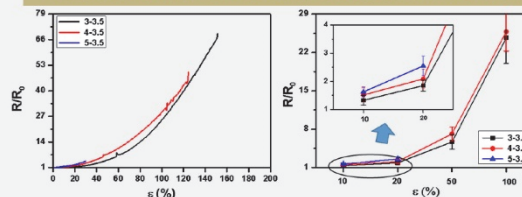
Potential Application: Motion Detection

Liu, W., Zhong, T., Liu, T., Zhang, J., & Liu, H. (2020). Preparation and characterization of electrospun conductive janus nanofibers with polyaniline. *ACS applied polymer materials*, 2(7), 2819-2829.
Liu, W., Zhang, J., & Liu, H. (2019). Conductive bicomponent fibers containing polyaniline produced via side-by-side electrospinning. *Polymers*, 11(6), 954.

Results 2 – Conventional-Size SBS Fibers

Side 1: Polyacrylonitrile (PAN); Side 2: PAN/PANI blend

Morphology

Tensile

Conductivity

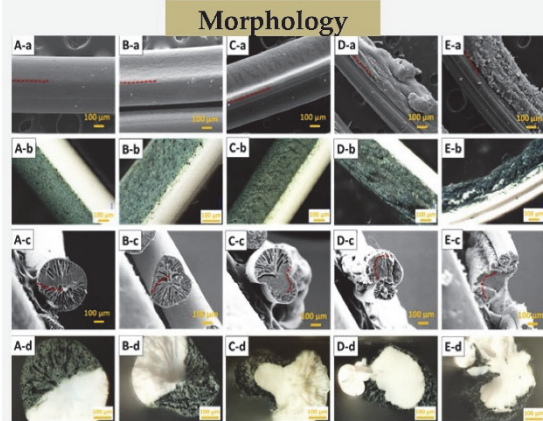| Code		Conductivity (S/cm)	PANI Load (wt.%)
Homo Blend Fibers	12/3	$1.3\text{-}4.1 \times 10^{-10}$	20
	9/3	$3.2\text{-}8.7 \times 10^{-10}$	25
	6/3	$0.86\text{-}2.2 \times 10^{-5}$	33.3
	4.5/3	$5.1\text{-}8.9 \times 10^{-5}$	40
	3/3	not spinnable	50
SBS Fibers	12/3	$1.3\text{-}4.1 \times 10^{-10}$	8.8
	9/3	$3.2\text{-}8.7 \times 10^{-10}$	9.7
	6/3	$3.1\text{-}7.8 \times 10^{-6}$	11.0
	4.5/3	$1.2\text{-}2.9 \times 10^{-5}$	11.7
	3/3	$0.89\text{-}1.9 \times 10^{-7}$	12.5

PAN/PANI: (A) 12/3; (B) 9/3; (C) 6/3; (D) 4.5/3; (E) 3/3

Liu, W., Chang, Y. C., Zhang, J., & Liu, H. (2022). Wet-Spun Side-by-Side Electrically Conductive Composite Fibers. *ACS Applied Electronic Materials*, 4(4), 1979-1988.

Results 2 – Conventional-Size SBS Fibers

Influence of viscosity on fiber interface morphology
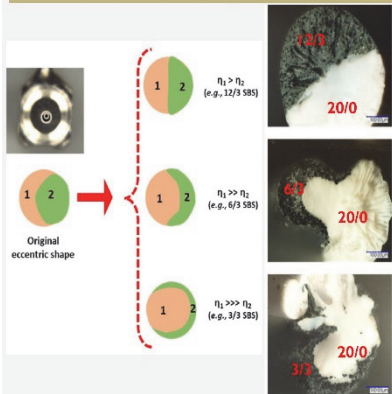
Interface shift
(due to the unbalanced pressure gradient)
Interface encapsulation
(governed by the Principle of Minimization of Viscous Dissipation)

Solution Flow at the tip of spinneret
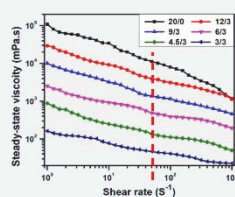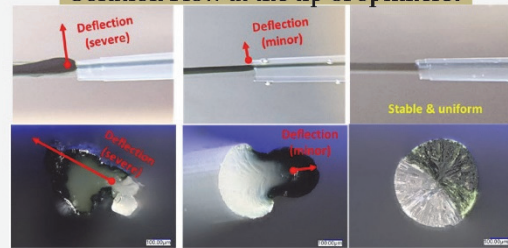
Flow Velocity Calculation
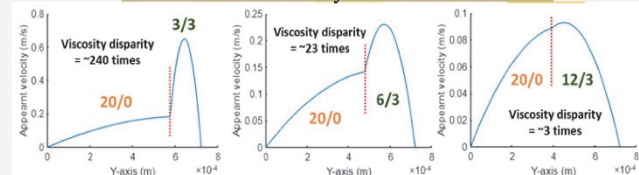
Results 2 – Conventional-Size SBS Fibers

Side 1: Cellulose (cotton); Side 2: Cellulose/PANI blend
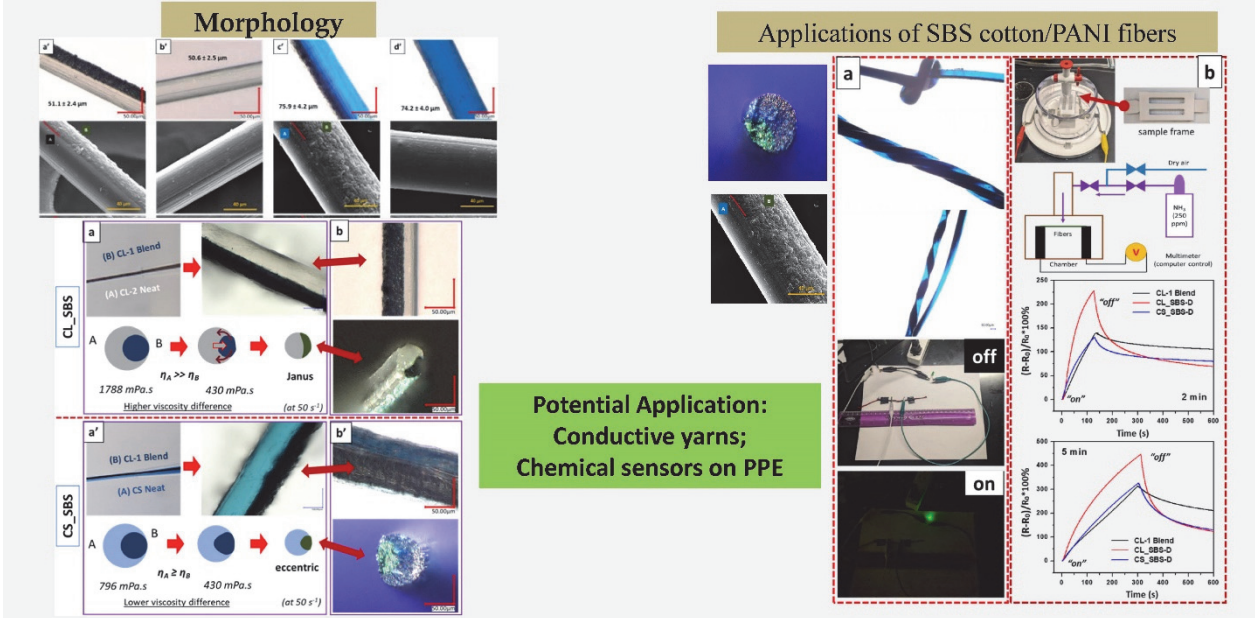
3D Printed Conductive Fabric

Current Method & Limitations

- 3D printed conductive fabric uses Fused Deposition Modeling (FDM)
- Low affinity of the printed layer to the fabric substrate: peel off
- FDM materials are brittle: breaking easily and losing conductivity.

Proposed Solution - Direct Ink Writing 3D Printing

1. Print polymer and conductive filler solutions, which can penetrate in the fabric for enhanced affinity.
2. Various factors affect the printing performance: compatibility of the solution with the fabric, printing parameters, fabric structures (fiber, yarn, and fabrication)
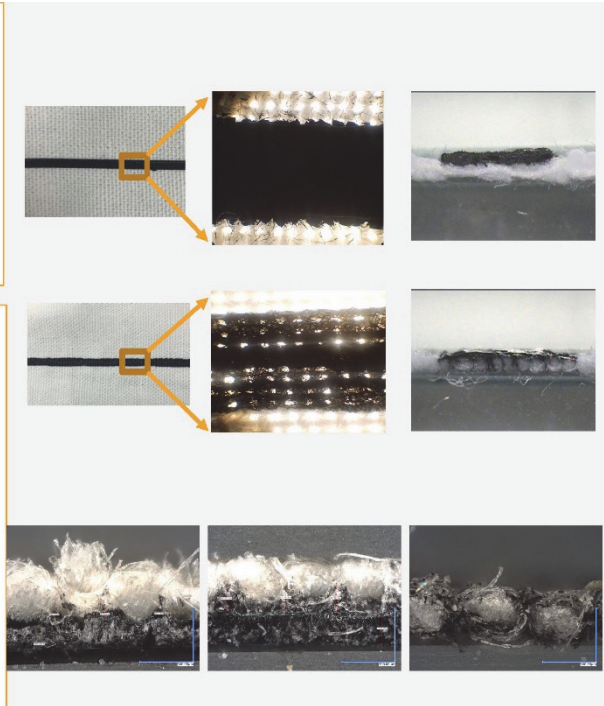
Applications of 3D Printed fabric in motion detection
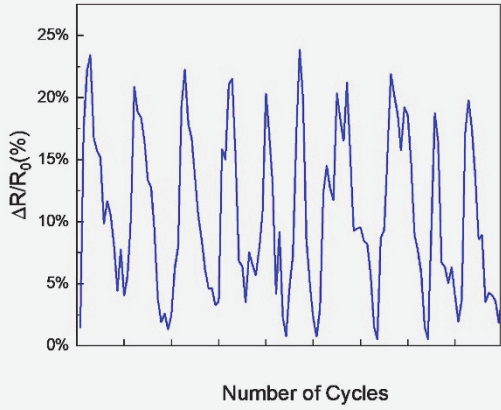
Conclusions

1. Heterogeneous side-by-side fibers can be successfully produced via electrospinning and wet spinning. SBS fibers have superior mechanical properties than blend fibers and similar electrical conductivity with much lower PANI load within the whole fibers.

2. The polymers and solution viscoelasticity play a major role in determining the SBS fiber morphology.

3. Other spinning parameters, including spinneret configuration, solution feeding rate, and voltage in electrospinning, also affect SBS fiber morphology and properties.

4. The SBS fibers demonstrate great potential in strain and chemical sensing.

5. 3D printing holds a great promise for smart wearable development.

THANK YOU!

FTEX Best Paper Awardees

3D Dynamic Fashion Design Development, Using Digital Technology and its Potential Prospects

Kyung Hee Choi

School of Global Fashion Business
Hansung University, South Korea

Background

- Digital technologies to develop new ways of thinking and augment the innovative potential of fashion design
  - Fashion materials in the future will be more fluid than fixed, responding, changing, and adapting to sets of pre-programmed parameters (Quinn, 2012).

- COVID-19 moving up the digitalization of the fashion market and the rise of the virtual world
  - Not only forced fashion industries to turn to digital and virtual fashion but also provided an opportunity to redefine business models toward more digital innovation.

- Current studies on textiles and garments integrated with technology
  - Emphasizing the potential for aesthetic expression and playful experimentation, as well as technical dimensions
  - Sociocultural directions toward digital garments and technology adoption.

→ If our fashion garments have limitless and dynamic possibilities interwoven with digital technology, how do they look fascinating and show great promise?

Purpose & Objectives

- This study aims to develop 3D dynamic fashion garments of changeable styles, colors, and textile patterns for online platforms, especially using 3D virtual simulating systems, and to examine its potential possibilities by exploring the reactions of fashion designers and digital experts to them.

01 To identify the concept of dynamic fashion design and its effects in virtual spaces through prior cases.

02 To explore 3D virtual simulating systems and their prospects in the online fashion industry.

03 To develop 3D dynamic fashion design and investigate its technical design procedure.

04 To perform a focus group interview with digital fashion designers and discuss the potential of 3D dynamic fashion design in future online platforms.

Dynamic fashion design?

Digital fashion garments with transformable styles and animated colors or graphical patterns that visibly change from the garments' underlying colors or patterns and even details to others and then return to the initial condition after a period of time.

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Prior cases of dynamic fashion

- Nineteen prior cases and their effects on dynamic fashion garments, based on digital technology used, dynamic range, dynamic elements, wearability, expressivity, interactivity, sustainability, and context.

Video-mapping projection
: Virtual & virtual-physical

On-screen only to fully
portable in various contexts
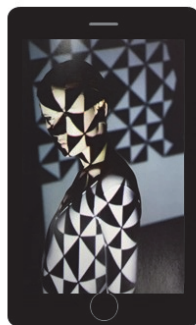
Dynamic moving displays,
focusing on canvas-based design

Interactivity
and sustainability

Kleinberger & Panjwani's
'Enchanted Wearable system'

Studio XO & Nancy Tilbury's
'Digital Skins'

Studio Performa's 'DROMe'
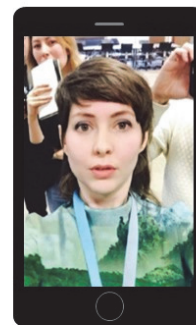
Mackey et al.'s
'Greenscreen Dress'

3D virtual simulating systems and their online usages

3D virtual fashion cad systems

V-Stiticher, CLO3D, Marvelous Designer, Modaris3D, DC Suite, 3D Suite, Vidya, i-Designer.
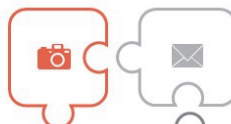
Concept of 3D virtual garment systems

Computer software to visualize a real-time interaction between 3D simulation and 2D pattern of virtual garments.

Usages in the online fashion industry

Digital fashion shows, mobile fashion contents, augmented reality fashion, digital signages, digital installations, online fashion magazines, and lookbooks.

Technical possibilities

Useful technical devices to develop 3D dynamic fashion garments.

HCI with aesthetics and sociocultural adoption

Solutions to balance HCI with aesthetic resonance, social adoption, and cultural relevance for the user.

An example of 3D dynamic fashion garments

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- Ten samples of 3D dynamic fashion garments, including three runway animations, three turntables, and four v-ray rendered imageries.
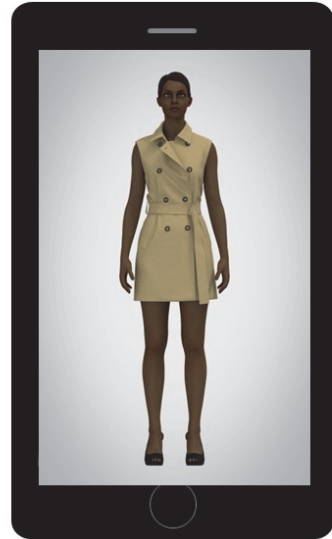
Two foci in methods

Aesthetic & technological aspects: Design development

To develop 3D dynamic fashion garments, using 'CLO 3D' and 'Aftereffects,' in collaboration with a motion graphic artist group, 'Protobacillus,' through Tumblr.

Social & commercial aspects: Focus group interview
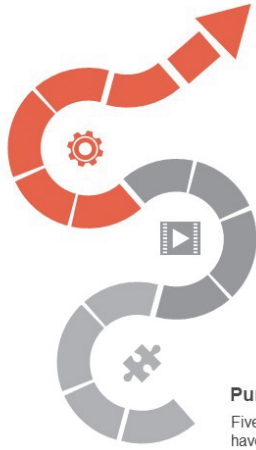
To examine social reactions and commercial possibilities toward 3D dynamic fashion garments, alongside the current state of 3D virtual simulation systems.

Focus group interview

FGI questions

Evaluating criteria: Wearability, expressivity, interactivity, and sustainability

Opening questions	What experiences have you had of 3D virtual simulation systems or the virtual fashion world? Are you an active user of online platforms about digital fashion?
Introductory questions	How useful are 3D virtual simulation systems, including CLO 3D, in designing or retailing garments under the current states? Especially during COVID-19, is there more significance for 3D virtual garment simulations?
Transition questions	What differences are there between the hands-on design and digital design processes using 3D virtual simulation systems?
Key questions	How do you feel about the ten video animations representing 3D dynamic fashion garments that have been shown? Do you determine any potential from the video of 3D dynamic fashion garments?
Ending questions	Finally, is there anything connected with 3D dynamic fashion garments, virtual simulation systems, or digital fashion, that has not been discussed but you feel strongly about and would like to bring up now?

Thematic analysis / Inter-rater reliability

The researcher and another independent researcher crosschecked the codes and themes of the interview transcripts.

Purposeful sampling

Five professional fashion designers who have work experience of at least three years and have used CLO3D for their jobs, regardless of other demographics

Findings & Discussions

- Wearability
  - ○ Only on-screen and fully portable, reacting to avatar movements in a virtual space.
  - ○ Changing trends in fashion companies, creating digital-only clothing for their virtual models.
  - → The wearability of 3D dynamic fashion garments available in online industries.
  - ○ Requiring more technological development, particularly including size accuracy, which poses future agenda to be solved.

"… As they are considered entities in a virtual space in themselves, avatar models could be developed in much greater variety in the future in online fashion industries, like virtual models for look-books or music videos."

Findings & Discussions

- Expressivity
  - ○ Innumerable expressive ideas, presenting multiple transformations in forms and styles, as well as surface changes.
  - ○ Plausible textual expressions of physical fabrics, rather than flat screen-based ones.
  - ○ Demand of younger consumers, highly interested in expressing their self-identities through online social networks.
  - ○ An "uncanny valley" (Mori, 2012[1970]) users could feel from avatars to be solved.

"Although 3D software is useful, its basic avatars tend to make us feel slightly uncomfortable. Such an unavoidable "uncanny valley" seems to prevent garment images generated using 3D software from being posted on online platforms for sales in reality."

Findings & Discussions

- Interactivity
  - Co-design and customization in presenting users with predesigned modules of styles and design elements.
  - Through an online platform, users might store their preferable styles as well as still or moving images as digital content for a personalized virtual closet.
  - Possibly within virtual spaces, users might enjoy 3D dynamic textiles or garments as much as traditional still ones.

"Well… a customer could be scanned to produce his/her own avatar, and then with the data, including accurate sizes and design preferences, the customer could try on his/her personalized garment in an online platform"

Findings & Discussions

- Sustainability
  - 3D dynamic fashion garments integrated into a base garment as a generic object will be connected to sustainable practices of consumers, rechargeable without any waste in a virtual world.
  - Changes in the fashion design process and designers' practices in the virtual and physical continuum: Iterative interplays between 2D patterns and 3D simulations (McQuillan, 2020).

"… From the first stage, I start 3D toiling based on prior designs from the company, and then I make 2D patterns, as opposed to the past design process. In this way, 3D toiling antecedes a 2D pattern."

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Findings & Discussions

- Online interdisciplinary collaborations
  - New and innovative design outcomes in 3D dynamic fashion design development for relevant themes.
  - Social media platforms as valuable outlets to introduce and facilitate new communication modalities.
  - Digital technology integrated into the fashion design field to create highly versatile combinations in virtual worlds.

Introducing the term 3D dynamic fashion garments to digital fashion design.
3D moving visualizations with transformable styles and animated colors or textile patterns in a virtual space.

The possibility of innovative fashion design, integrated into emerging technologies
Dynamic expressions and technologies programmed in 3D virtual simulation systems, and also new perspectives to the fashion design field.

Extending potential realms of fashion design fields.
Fashion products in online platforms and entertainment devices, beyond the usage of HCI research or digital users' DIY.'

Limitations and Future Studies
- Limited FGI sample size; More sample size for transferability
- Focusing on fashion designers' viewpoints, requiring consumers' reactions
- Requiring shedding enough light on the online collaborative process
- Extended toward a social media study of dynamic fashion design.

Implications & limitations

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KSCT-JRATEU Joint Symposium
Oral Session

Co-Chairs: Dr. Su-Young Son, Kyungpook National University
Dr. Takako Fukazawa, Kyoto University of Education

JK-O6

FOLKLORE TRADITIONS TO TREND: INCORPORATING LOCAL TEXTILE PROCESSING KNOWLEDGE WITH CONTEMPORARY FASHION

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MEASUREMENT OF STRAIN DISTRIBUTION ON JACKETS WITH DIFFERENT ADHESIVE INTERLININGS DURING ARM MOVEMENT

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Introduction

When people put on clothes, the inherent movements of the human body cause the garments to undergo deformation. It is essential to measure these deformations quantitatively to make clothing that prioritizes comfort. On the other hand, adhesive interlining plays a crucial role in shaping silhouettes. Adhesive interlinings affect the wearing and moving comfort of jackets and the pressure exerted by a jacket on the body, especially in the shoulder, back, forearm, under the arm, and bust areas [1]. However, the relationship between comfort and deformation is not clear. This study focuses on measuring deformations arising from arm movements in jackets constructed using various adhesive interlining materials, each varying in stiffness. Our objective is to elucidate the distribution of these deformations, ultimately contributing to the design of clothing that facilitates greater ease of movement. Furthermore, we explore the impact of the physical properties of the fabric, particularly when combined with adhesive interlining, on the overall deformation process.

Literature Review

The examination of fabric strain due to garment deformation has been the subject of extensive research. Makabe and Momota [2] focused on measuring strain in a moving skirt, highlighting its directional characteristics. They found a correlation between strain and the air gap size between the skirt and the body, as well as the physical properties of the material. Ito et al. [3] delved into knee deformation in seated slacks, manipulating ease levels in different slacks. Kim et al. [4] measured clothing deformation using a variable-sized body to understand how it is distributed with variations in body shape. Yamakoshi et al. [5] investigated the impact of ease variations on garment deformation during arm movements using differently sized bodies, particularly emphasizing the deformation of the jacket's back. They [6] also investigated the strain distribution of the back of the jacket due to arm movements while wearing different-sized shirts with and without sleeves. Despite these studies, there has been limited exploration into clothing deformation arising from different materials such as adhesive interlining with the same pattern. Consequently, there exists a need for research focusing on measuring strain in jackets with diverse interlinings.

Research Method

A jacket of size 9AR was worn on a torso with arms. Arms movement, raising both arms forward, was performed. The strain on the back of the jacket during the movement was quantified using a non-contact optical three-dimensional deformation measurement system (ARAMIS, GOM GmbH, Germany). The maximum principal strain in the shoulder and armpit region was measured during the forward arm movement. An electric tripod facilitated movement, maintaining uniform arm angles and a movement speed of 0.55 cm/s. Each sample was measured seven times for each part, and the average value of five measurements (excluding the maximum and minimum values) was calculated. Statistical analysis, including one-way analysis of variance and multiple comparisons using the Tukey method, was conducted to assess strain differences between samples. The study involved four jackets: one (None) crafted solely from outer material (100% wool, plain weave) without bonded interlining, and three types of jackets (Soft, Normal, Hard) with adhesive interlinings of varying rigidity (Soft-I, Normal-I, Hard-I) adhered to the same outer fabric. No lining was incorporated.

Results & Discussion

When examining the direction of maximum principal strain, it primarily indicates shear deformation. While the force applied by arm movements should result in identical strains among the samples, the results of this

experiment show variations in strain among the samples. During the measurements, areas where wrinkles occurred and couldn't be measured were excluded from the analysis. Comparing the maximum principal strain in the lower armpit, significant differences were observed among samples, indicating variations in strain due to arm movement. The maximum principal strain tended to be smaller in the order of Hard, Normal, Soft, and None. These are the same results as the comfort test of the same jackets [1]. Examining the distribution, None and Soft exhibited more enormous maximum principal strains near the back and armpits, while Normal and Hard showed more significant strains near the back. This suggests that arm movements pulled the jacket forward, leading to increased strain in the back. When both arms were raised forward, the maximum principal strain from the shoulder tip to the vicinity of the scapula was larger for None and Soft compared to other points. In the case of Normal and Hard, the maximum principal strain near the shoulder tip exceeded other measurement points. This implies that arm movements caused the jacket to be pulled from the shoulder tip to the shoulder blade area, resulting in strain.

Conclusion

Jackets featuring adhesive interlining of varying stiffness were donned on a torso with arms, and arm movements were executed to measure the maximum principal strain. Consequently, the distribution of deformation in the shoulders, back, and underarms of the jacket due to arm movements was elucidated. It is believed that utilizing fabrics with more stretchable physical properties would facilitate easier movement in regions where strain is prominent, specifically from the shoulder tip to the shoulder blade area and under the armpits.

References

[1] Kim, K., Sugiyama, C., & Takatera, M. (2015). Relationship between jacket comfort and stiffness of adhesive interlining. *International Journal of Affective Engineering, 14*(3), 137-142.

[2] Makabe, H., & Momota, H. (1986). Studies on the deformation and its direction of skirts caused by wearing. *Journal of the Japan Research Association for Textile End-Uses*, *27*(9), 402-411.

[3] Ito, N., Nakaya, H., Niwa, M., & Furusato, K. (1977). Interrelation between slacks ease and deformation of fabric under wearing condition. *Journal of Home Economics of Japan*, *28*(5), 360-365.

[4] Kim, KO., Monobe, A., & Takatera, M. (2018, May 26). Measurement of strain distribution on tailored jacket for different body dimensions. *11th Textile Bioengineering and Informatics Symposium, Manchester*, UK (pp. 445-450).

[5] Yamakoshi, M., Kim, KO., & Takatera, M. (2021, September 9). Jacket strain measurement for different amounts of ease. *14th Textile Bioengineering and Informatics Symposium*, Webinar.

[6] Yamakoshi, M., Kim, KO., & Takatera, M. (2022, May 26). Measurement of jacket strain distribution on different shirts during arm movements. *ICCT 2022*, Webinar.

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RELATIONSHIPS BETWEEN FOOT TEMPERATURE AND PSYCHOLOGICAL RESPONSES IN COLD ENVIRONMENTS FROM 0ºC TO -12ºC FOR DEVELOPING ACTIVE-HEATING SMART FOOTWEAR

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Introduction

As the average life expectancy increases and interest in health increases, outdoor activities in winter for various leisure sports increase, smart shoes that diagnose specific diseases or continuously monitor the body have been discussed in academia and industry (Kim et al., 2022). The health care functions of smart shoes were developed to control gait stages and steps for the purpose of diagnosing and treating specific diseases (Carbonaro et al., 2016). Also, there has also been attempts to verify the position of the sensor to constitute a user interface (UI) for Parkinson's patients by continuously monitoring the pressure of the soles of the feet (Das et al., 2016). The most vulnerable parts of the human body during cold exposure are the peripheral regions, such as the hands, feet, and ears. In particular, the feet where frostbite or non-freezing cold injury (NFCI) are most frequently reported during outdoor work. Unlike the human trunk the foot has relatively limited metabolic heat production, along with many tissues and organs of heat production, so the foot temperature is mainly controlled by vasoconstriction, vasodilatation, and evaporation of perspiration (Taylor et al., 2014). Although partial heat generation of the human body using heating elements affects the wearer's sense of heat and comfort (Moon et al., 2006), it is important to find an effective heating method according to the purpose because there are various variables. Several studies have been discussed on smart shoes with a heating function that maintains foot temperature, but there is little discussion on sensor positioning according to foot temperature in cold environments. Therefore, the purpose of this study was to investigate the regional temperature and psychological response of the foot according to the level of cold stress.

Research Method

[Subjects] A total of 10 male subjects participated in this study (mean ± SD: 24.5 ± 3.4 y in age, 176.8 ± 4.2 cm in height, 72.9 ± 9.8 kg in body weight, 23.3 ± 2.8 kg/m^2 in body mass index, and 13.9 ± 3.2 in total body fat (%)). There were no subjects with foot frostbite experience, susceptibility to cold and cold-related cardiovascular disease.

[Experimental conditions] All subjects participated in the following five air temperature conditions: 0ºC, –3ºC, –6ºC, –9ºC, and –12ºC. The airflow in climate chambers remained below 0.25 m·s^{-1}. A trial consisted of a 10-min rest on a stool, followed by 60-min walking at 4 km·h^{-1} on a treadmill and a 10- min recovery in a sitting position on the stool. All subjects wore the identical winter clothing during the experiment, and running shoes (435 g) (2,830 g in total clothing mass). The total insulation (I_T) was 1.90 clo under standard conditions (21ºC, 50%RH) and 1.72, 1.71, 1.70, 1.69 and 1.65 clo under five low temperature conditions (0, -3, -6, -9, -12ºC).

[Experimental procedure and measurements] Left foot temperature on the instep 2nd toe, sole, heel, and anklebone were recorded every 5 s using temperature sensors and a data logger (LT8A, Gram Corp., japan). Thermal sensation and thermal comfort were recorded every 10-min using the following categorical scales: 9-point thermal sensation; 7-point thermal comfort. The subjective assessments were obtained from the overall body and feet.

Results & Discussion

[Foot skin temperature] At initial 10-min rest, there was no significant temperature difference according to environmental temperature (temperature: 0°C, -3°C, -6°C, -9°C, -12°C) in the five sites of the foot, but the temperature of the instep was the highest among the five areas of the foot after a total of 80-min of cold exposure (maintained above 25°C on average at -12°C). There was a tendency to increase at temperatures of 0°C and -3°C after 10-min of rest after exercise, but the temperature of the instep was maintained at environment temperatures of -6°C, -9°C, and -12°C. In particular, toe has the greatest temperature change as the temperature decreased. At the end of the exercise, the temperature of the toe was 23.2 ± 7.4°C (air temperature [T_a] 0°C), 20.5 ± 7.7°C (-3°C in T_a), 18.0 ± 6.4°C (-6°C in T_a), 17.1 ± 8.2°C (-9°C in T_a), 15.0 ± 4.9°C (-12°C in T_a), and the temperature conditions were classified as group 1 (0°C and -3°C in T_a), group 2 (-6°C and -9°C in T_a), and group 3 (-12°C in T_a) on the basis of toe temperature. **[Psychological responses]** Under the five temperature conditions, the lower the temperature, the colder the whole-body thermal sensation was, but the difference between -9°C and -12°C was not significant. Also, after walking for 60-min, the thermal comfort increased by 1 point more than when walking began. However, after a 10-minute recovery immediately after exercise, thermal sensation decreased by about 1 point again. Therefore, foot thermal sensation was responded lower when there was no movement of the foot sites than it decreased as the outside temperature decreased. The thermal sensation of the foot was lower than that of the whole body, so it felt colder at the end of the human body. **[Relationships between foot temperature and psychological responses]** At rest for the initial 10 minutes, the thermal sensation of the foot responded colder as the temperature of the instep, toe, and sole decreased, but no significant correlation was found in the case of heel or anklebone temperature. There was no significant correlation in thermal comfort on the instep, toes, heels, and ankles, except for the soles of the feet ($P < 0.05$). On the other hand, thermal sensation of the foot during walking at 4 km/h was strongly correlated with the Tsk of the instep (r = 0.732, $P < 0.001$), toe (r = 0.712, $P < 0.001$), sole (r = 0.751, $P < 0.001$), and heels (r = 0.720, $P < 0.001$). Meanwhile, a weak correlation was noted between the thermal comfort and foot temperature in walking and recovery ($P < 0.001$). When exposed to cold temperature for a total of 80 minutes, the T_{sk} of the feet in five sites was more strongly correlated with thermal sensation than with thermal comfort.

Conclusion

Through the present results, we provided basic data for the review of sensor-related technical information and sensor design of smart heating shoes by verifying the location and user psychological responses of each T_{sk} during rest and activity in cold environments (0, -3, -6, -9, and -1°C in T_a). Among the skin temperatures on the five local spots on the foot, the toe temperature decreased significantly as the environmental temperature decreased, and especially at lower temperatures, the drop was the largest. Based on the results, toe temperature monitoring was considered essential when developing active heating smart shoes in winter. In addition, the need for toe temperature monitoring is also supported by the fact that there was a significant relationship between the toe temperature and foot thermal sensation, while other skin temperatures on the other four spots of the foot showed less marked relationship with the thermal sensation. The results of this study are meaningful in that they can be used for sensor mapping of smart shoes for foot temperature monitoring and heating by confirming the relationships between foot temperature and psychological responses of users in winter.

References.

Carbonaro T. M., Gatch, M. B. (2016). Neuropharmacology of _N_, _N_-dimethyltryptamine. _Brain research Bulletin, 126_(1), 74-88.

Das, D., Biswas, Atanu., Roy, A., Sauerbier, A., Bhathacharyya, K. B. (2016). Cognitive impairment in idiopathic Parkinson's disease. _Neurol India_, _64_(3), 419-427.

Kim, A., Park, J, Kim, S, Kim, K. B., & Park, K. (2022). The validity of wireless earbud-type wearable sensors for head angle estimation and the relationships of head with trunk, pelvis, hip, and knee during workouts. _Sensors, 22_(2), 597.

Moon, JH., Rho, SH., & Lee, JY. (2022). Determining proper surface temperature for radiant heaters to warm passengers in electric vehicles: Effects of heating size, body region and body mass index. *The Korean Society of Living Environmental System, 29*(3), 261-270.

Taylor, N. A., Tipton, M. J., Kenny, G. P. (2014). Considerations for the measurement of core, skin and mean body temperatures. *Journal of Thermal biology, 46*, 72-101.

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PANTYHOSE TO RELIEVE MUSCLE ACTIVITY WHEN WEARING HIGH-HEELS

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Introduction

Wearing high heels can make the wearer appear taller, which results in a slimming effect on the appearance of the legs. However, compared with being barefoot, wearing high heels is thought to put more strain on the lower legs (Kim 2013, Wiedemeijer 2018, Barkema 2012, Simonsen 2011, Blanchette 2011, Satsumoto 2020). Pantyhose makes the appearance of bare skin beautiful (Wakako 2016), and pantyhose is often worn with pumps and exerts cosmetic effects (Orhon 2002), such as raising the hip line and causing the legs to appear longer. Wearers typically expect pantyhose to fit well but not too tightly without hard clothing pressure, and for the pantyhose to reduce fatigue on the legs and hips when wearing heeled shoes. Thus, the goal of this research study was to develop pantyhose that can reduce leg muscle fatigue when wearing heels. In more specific terms, to develop a product that reduces muscle activity in the lower limbs and provides a comfortable wearing sensation when worn for many hours daily.

Research Method

Two types of pantyhose were examined in this study, namely size M and L. Japanese women of 88% can be covered by the JIS standards with S, M and L (Their heights were about 150 cm, 158 cm, and 166 cm) sizes. The pantyhose used in this study were sized to fit M and L size people; their height was 159.5 ± 6.1 cm, and their weight was 50.3 ± 3.3 kg. The pantyhose was composed of a single covered yarn (SCY) composed of 20D (2.2 tex) polyurethane/12D (1.3 tex) nylon in the legs. In the panty part, the thickness of the nylon yarn was changed from 12D (1.3 tex) to 30D (3.3 tex), and woolly nylon yarn was added to increase the strength (pantyhose A). Using the design of pantyhose A as a baseline, the SCY was partially doubled in pantyhose B to change the supporting pressure of the panty part. The pantyhose was measured using a KES-FB1-A-AUTO (KatoTech, Kyoto, Japan) with a speed of 0.2 mm/s, chuck size of 5.0 cm, and maximum load of 25 gf/cm at 20°C and 65% relative humidity (Mitsuno 2022).

Measurement of Clothing Pressure While Wearing the Experimental Pantyhose and Its Pressure Sensation: The participants were 17 healthy Japanese women in their twenties. The clothing pressure of the pantyhose at 46 measuring points used on the right half of the body were determined using a clothing pressure measurement system based on a hydrostatic pressure-balanced method. The pressure sensation was then reported based on a visual scale. The two types of pantyhose were worn in the order of A then B.

Measurement of Muscle Activity While Wearing Experimental Pantyhose: The EMG of the lower limbs was then measured as the participants either walked with bare feet, or while wearing one of the two types of pantyhose. Participants walked on a treadmill at 3 km/h for a certain period. The EMG was measured using a multi-channel telemeter (WEB-1000, Nihon Kohden, Japan). Eight measurement points on the right half of the body were separated into two groups of muscles: muscles around the knee and the hip. The root mean square (RMS) of muscle activity was calculated from the EMG obtained for twelve conditions: barefoot, wearing two types of pantyhose, and three types of shoes and their combinations.

Measurement of Posture from a Two-Dimensional Image: The layout of the participants, the experimental equipment, and a typical experimental image are shown in Fig 1. The participants were asked to wear the 10 reflective markers as hand-made reflector on a hemisphere with a diameter of 10 mm (See the right image). Distances were determined using a 35-mm-square piece of paper attached to the thigh and a vertical pole with a length of 1800 mm and marked 300-mm intervals in the image. Two mirrors, a 500-mm square sheet at the foot, and the guide rod set on top of the head were used to confirm that the right side of the participant's body was perpendicular to the camera, i.e., the participant's body was not twisted. Postures were then photographed under four experimental conditions, namely being barefoot,

wearing three types of shoes with different heel heights (less 15mm, 35mm, 75mm over) without pantyhose, wearing only the two types of pantyhose, and wearing a combination of the three types of shoes and two types of pantyhose.
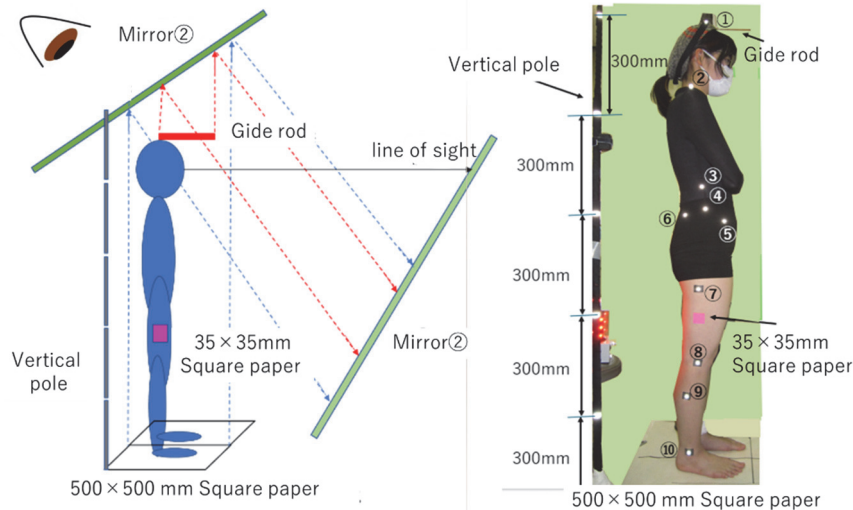
Fig. 1 Layout of the participants, the equipment, and a typical experimental image

Results & Discussion

Tensile Test for the Two Types of Experimental Pantyhose: Pantyhose A and B were both well-stretched materials with knitted structures. In addition, the width of the panty part was set at 185-195 mm for both pantyhose A and B. Thus, when compared without conversion, pantyhose B was less stretchy than pantyhose A, as pantyhose B was made by partially doubling the threads and changing the knitting method.

Clothing Pressure and Its Pressure Sensation: For the experimental pantyhose, the clothing pressure at the hips was significantly higher for pantyhose B than for pantyhose A, but there was no significant difference in the other body parts. In addition, when the clothing pressure generated for pantyhose A and B were compared for each body part, the clothing pressure at the foot was always significantly higher than that of the other body parts ($p < 0.001$). The range of pressure sensation did not reach tight value, indicating that the pantyhose was within the loose to tight range, as described below. The pressure sensation was significantly higher for pantyhose B than for pantyhose A in the hips and foot, but the pressure sensation showed no difference between pantyhose A and B for the other body parts. The participants reported that pantyhose A felt slightly loose, whereas pantyhose B provided a nearly perfect fitting sensation (Mitsuno 2022).

Muscle Activity While Wearing Experimental Pantyhose: The RMS of the EMG for eight muscles in the right leg was calculated. There was a significant positive correlation between the muscles around the knee and the dorsal muscles and a significant positive correlation between the hip muscles and the ventral and dorsal muscles. Participants who used muscles around the knee also used their dorsal-side muscles, and those who used muscles around the hip used their ventral- and dorsal-side muscles when walking. When wearing shoes, participants stopped using muscles around the knees and back. Even with an increased heel height, the RMS of the EMG for participants wearing pantyhose B was the same for bare feet (Mitsuno 2023).

Pelvis rotation when wearing pantyhose and shoes: When wearing only pantyhose or shoes, the body axis did not change. When wearing pantyhose A and shoes, the higher the heel, the more the pelvis was rotated backward. So that the upper body became bent backward, the head moved backward, and the shoulders moved forward to balance the body. On the other hand, when wearing high heels with pantyhose B, the pelvis rotated forward, offsetting the backward bending of the upper body. Therefore, the head and shoulders were positioned at the center of the body axis. This could explain why the barefoot muscle activity was the same as when wearing pantyhose B and high heels.

Conclusion

Wearing high heels can make the wearer appear taller, which results in a slimming effect on the appearance of the legs. However, compared with being barefoot, wearing high heels is thought to put more strain on the lower legs. Thus, the goal of this research study was to develop pantyhose that can reduce leg muscle fatigue when wearing heels. Two types of experimental pantyhose A and B were both well stretched materials with knitted structures. In addition, pantyhose B was less stretchy than pantyhose A, as pantyhose B was made by partially doubling the threads and changing the knitting method. The clothing pressure at the hips was significantly higher for pantyhose B than for pantyhose A, but there was no significant difference in the other body parts. The participants reported that pantyhose A felt slightly loose, whereas pantyhose B provided a nearly perfect fitting sensation. The RMS of the EMG for participants wearing pantyhose B was the same for bare feet. When wearing pantyhose A and shoes, the higher the heel, the more the pelvis was rotated backward. So that the upper body became bent backward, the head moved backward, and the shoulders moved forward to balance the body. On the other hand, when wearing high heels with pantyhose B, the pelvis rotated forward, offsetting the backward bending of the upper body. Therefore, the head and shoulders were positioned at the center of the body axis. This could explain why the barefoot muscle activity was the same as when wearing high heels with pantyhose B.

References

Barkema, D. D., Derrick, T. R., & Martin, P. E. (2012). Heel height affects lower extremity frontal plane joint moments during walking. *Gait Posture*, 35, 483-488.

Blanchette, M. G., & Brault, J. R. (2011). Powers CM. The influence of heel height on utilized coefficient of friction during walking. *Gait Posture,* 34, 107-110.

Kim, Y., Koo, J., & Oh, D. (2013). Influence of Shoe Heel Height and Muscle Fatigue on Static and Dynamic Balance in Healthy Young Women. *Phys. Ther. Kor.*, 20, 36-44.

Mitsuno, T., & Kondo, S. (2022). Clothing Pressure Gradient for Comfortable Pantyhose. *Journal of Fiber Bioengineering & Informatics, 15*(4), 243-257.

Mitsuno, T., & Kondo, S. (2023). Possibility of Pantyhose Design Using Clothing Pressure and Myoelectric Potential as Indices. *Journal of Fiber Bioengineering & Informatics, 16*(1), 1-14.

Orhon, S., Morooka, H., Morooka, H., Manabe, I., Nakahashi, M., & Wakashima, K. (2002). Relationship between aesthetic and shape of legs. *Kansei Engineering International*, *2,* 1-8. (English abstract and Japanese text)

Satsumoto, Y., Shimazaki, Y., Saito, H., & Maruta, N. (2020). The effect of the height of the heel of pumps and the age to the gait analysis in wearing business pumps. *Desant sports science*, *40,* 236-246.

Simonsen, E. B. (2014). Contributions to the understanding of gait control. *Dan Med J,* 61, B4823.

Wakako, L., Shimokawa, T., & Kinari, T. (2016). Analyss of the evaluation factors and indexes for the aesthetic properties of pantyhose. *J Fiber Sci Technol*, 72, 112-119. Doi: 10.2115/fiberst.2016-0017

Wiedemeijer, M. M., & Otten, E. (2018). Effects of high heeled shoes on gait. A review. *Gait Posture*, 61, 423-430.

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BRASSIERE USAGE DURING SLEEP AMONG YOUNG AND MIDDLE-AGED JAPANESE FEMALES

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Introduction

In our previous study of university students in northeast Japan, more than 46% of women wore brassieres during sleep (Nishiyama et al., 2021). Brassieres specifically made for sleep (night brassieres) have been sold in Japan since the 2000s. However, to the best of our knowledge, no study has reported details of brassiere usage during sleep or differences based on age. Investigating brassiere usage during sleep is vital because increased clothing pressure by brassieres and girdles/shorts decreases melatonin levels and body temperature during sleep (Lee et al., 2000; Tamura, 1999). Furthermore, the clothing pressure of brassieres negatively affects the autonomic nervous system by decreasing parasympathetic activity (Miyatsuji et al., 2002) and increasing the risk of constipation (Lee et al., 2000).

This study investigated differences in brassiere use during sleep among young and middle-aged females.

Research Method

This study was approved by the Ethics Committee of Wayo Women's University. An internet survey was conducted in October 2022 in the Kanto area (Tokyo, Saitama, Chiba, and Kanagawa) of Japan. The number of respondents was 1,000 young and middle-aged Japanese women. There were 943 eligible responses (response rate: 94.3%).

The percentages of young and middle-aged participants were similar (48.6% and 51.4%, respectively). Two age groups, the young group (YG), aged 20–29 years, and the middle-aged group (MG), aged 40–49 years, were compared using the chi-square test for usage, type, size, requirement, dissatisfaction, frequency of washing the brassiere during sleep and wakefulness, reason for use/not using the brassiere during sleep, and subjective sleep evaluation. Data were analyzed using SPSS Statistics ver. 28 (IBM). The significance level was set at $p < 0.05$.

Results & Discussion

Brassiere usage during the day was 95% in both groups. The usage of brassieres with wires was significantly higher in the YG (65%) than in the MG (42%), whereas the use of underwear with cups was significantly higher in the MG (29%) than in the YG (21%). Brassiere use during sleep was significantly higher in the YG (79%) than in MG (37%) (Fig 1). Regarding the type of brassiere used during sleep, the use of night brassieres was significantly higher in the YG (41%) than in the MG (25%), while approximately 30% used a brassiere with a wire in both the YG and MG (Fig.2). The brassiere size worn during the daytime was significantly higher in D and E cups in the YG than in the MG, while A and DE cup
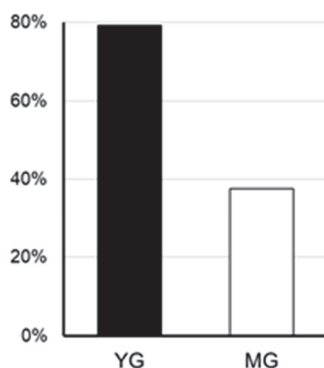
Fig .1 Usage of Brassiere during sleep* (N=943) *P<0.05
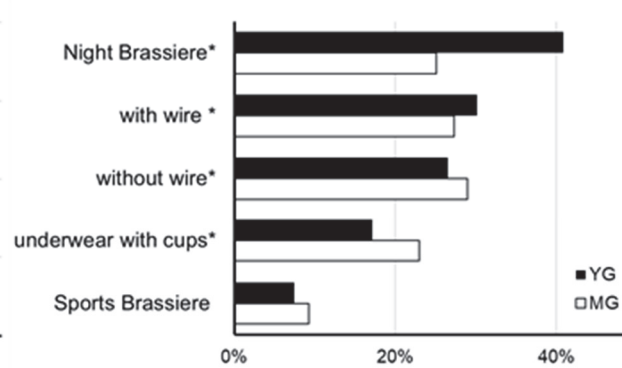
Fig .2 Type Brassiere during sleep (N = 545) *P<0.05

brassieres were higher in YG than in the MG.

The most frequently reported reason for wearing a brassiere during sleep was the prevention of losing the bust shape in both groups (YG, 46%; MG, 38%). The second most frequently cited reasons in the YG were comfort (34%) , while it was habits (32%) in the MG. Among the reported reasons, bust enhancement and better sleep were significantly higher in the YG than in the MG, whereas habit and bust transparency (to prevent the bust from being seen through nightwear) were higher in the MG than in the YG. The most frequently reported reason for not wearing a brassiere during sleep was brassiere tightening in both groups (70%). The most frequently observed requirement for brassieres during sleep was tightening in both groups. The requirements for the width of the strap, slip-off of the cups, and design were significantly higher in the YG, whereas the size, wire, material, and subjective handling of the material were higher in the MG. The most frequently observed factors for dissatisfaction with the brassiere during sleep were slip-off and floating of the cups in the YG, and tightening of the brassiere and slip-off of the cups in the MG. The starting age of using a brassiere during sleep was highest in the 20s and junior high school years in both the YG and MG. Subjective sleep estimation was significantly worse in the MG than the YG.

There are two possible reasons for the greater use of brassieres during sleep in the YG than in the MG. First, losing the bust shape and slipping off of the bust during sleep may create more unease in the YG than in the MG, since the size of the brassiere was significantly greater in the YG than in the MG. This is also supported by the result that the main reason for wearing a brassiere during sleep was the prevention of losing bust shape, and the required factor for brassieres during sleep included slip-off of the cups in the YG. Second, the MG might be vulnerable to tightening of the brassiere due to the aging process, since tightening was the most frequently cited requirement factor and cause of dissatisfaction, and usage of the brassiere with wire was significantly lower than that of the YG. Another possibility may be related to the fact that MG do not wear brassieres during sleep.

Conclusion

These results suggest that the high usage of brassieres during sleep in the YG is related to the prevention of loss of bust shape during sleep and maintenance of comfort due to greater bust size. Furthermore, the lower brassiere usage during sleep in the MG may be due to the habit and discomfort caused by brassiere tightening. Night brassieres that do not slip off the cups or lead to floating cups, avoid subjective tightening, and exert clothing pressure levels that do not affect melatonin or the autonomic nervous system are warranted, especially for the YG who have greater bust sizes.

Acknowledgment

References

Nishiyama, K., Mizuno, K., Mizuno, Y., Kuji, R., Inoue, M., & Matsuoka, A. (2021). Nightwear use survey among students in the Tohoku region: Gender difference in spring from clothing hygiene viewpoint. *Bulletin of Clothing Hygiene*, (40), 2-8.

Lee, Y. A., Hyun, K. J., & Tokura, H. (2000). The effects of skin pressure by clothing on circadian rhythms of core temperature and salivary melatonin. *Chronobiology international*, *17*(6), 783-793.

Tamura, T. (1999). *Sleep Environment* (Tori S Eds), Asakurashoten, Tokyo.

Miyatsuji, A., Matsumoto, T., Mitarai, S., Kotabe, T., Takeshima, T., & Watanuki, S. (2002). Effects of clothing pressure caused by different types of brassieres on autonomic nervous system activity evaluated by heart rate variability power spectral analysis. *Journal of physiological anthropology and applied human science*, *21*(1), 67-74.

Lee, Y. A., Kikufuji, N., & Tokura, H. (2000). Field studies on inhibitory influence of skin pressure exerted by a body compensatory brassiere on the amount of feces. *Journal of physiological anthropology and applied human science*, *19*(4), 191-194.

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PHYSICAL PROPERTY OF 3D PRINTED STRUCTURE USING CARBON MATERIAL/THERMOPLASTIC POLYURETHANE COMPOSITE FILAMENT WITH VARIOUS 3D PRINTING PROCESSING CONDITIONS

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Introduction

Carbon materials are resources obtained from nature and exhibit various forms and physical properties. It also has excellent strength and electrical properties, and has been applied to a variety of fields in recent years. Especially when used in composite materials with thermoplastic polyurethane (TPU), carbon materials can be made of flexible and elastic materials in conjunction with the excellent physical properties of carbon materials. In recent years, carbon/TPU composite materials have been applied to the manufacture of various sensors, and when applied to 3D printing, they can be output with desired modeling and used to manufacture soft and conductive sensors, actuators, etc. has been done. And FFF(fused filament fabrication) 3D printing can be output under various processing conditions. Among the 3D printing process conditions, infill conditions such as infill pattern and infill density control the movement of the nozzle. Depending on the infill conditions, the output time, weight, and physical properties of the output product can be expressed in a variety of ways. Therefore, in this research, it purposed to develop various 3D printed structure for soft sensor using carbon materials/TPU composite filament.

Research Method

First, three carbon/TPU filaments were analyzed. Then, structures in various forms were printed using three types of carbon/TPU filaments and analyzed at their physical and electrical performance. Three types of carbon were used: dotted types of carbon black (CB, Filaflex, Recreus, Spain), linear types of carbon fiber (CF, TPU CF, Smart materials 3D, Spain), and planar types of graphene (GR, Fili, AIMPLAS, Spain), and the carbon material most suitable for 3D printing was confirmed. Structures were modeled and printed a planar structure, a linear three-dimensional structure, and a curved three-dimensional structure, and confirmed the physical and electrical performance of each structure. In the case of the curved 3D structure, foot low pressure analysis was performed to evaluate how it performs when worn on the body. We also compared the performance of each structure in estimating how it will be output depending on the FFF 3D printing process conditions using 3D printer (Cubicon Single Plus 320C, Cubicon Co., Ltd, Korea). The printing process conditions included infill density (20%, 50%, 80%), infill pattern (Zigzag, Triangle, Honeycomb), and output direction (Horizontal, Vertical) as variables. Also, 3D printing conditions was layer height of 0.2 mm, nozzle temperature of 250℃, bed temperature equal to room temperature around 25 ℃, printing speed of 60 mm/s.

Results & Discussion

The experimental results are as follows. The analysis results of three carbon/TPU filaments showed that dotted CB and TPU had excellent output performance and were the most suitable when applied to 3D printing. In the case of CF/TPU, a clogging phenomenon occurred during printing. It was also confirmed that it has the best elasticity and electrical performance among the three carbon materials. Among the following structures, a auxetic re-entrant structure was applied to the planar structure. As a result of outputting with three Carbon/TPU filaments, the tensile strength results were confirmed at 0.08J for GR/TPU, 1.79J for CF/TPU, and 0.56J for CB/TPU; It has high elongation and low strength and elasticity. In addition, the electrical properties were 27.54 mA, which was three times more excellent than CF/TPU. The linear 3D structure was output in Cubic form. Cubic is manufactured in two types, GR/TPU and CB/TPU, which have good output performance, and three infill patterns were applied and compared. In terms of compressive strength, at 50% compression, GR/TPU was more than twice as strong as CB/TPU

at 1.0-2.8 MPa, and the Honeycomb structure had the best strength. In the case of electrical characteristics, the GR/TPU showed twice as much at 50 mA and the CB/TPU at 100 mA. When compressed to a compression elongation of 10 to 50%, it was confirmed that the higher the compression elongation, the better the conductivity. Among carbon/TPU filaments, CB/TPU was judged to have the most suitable physical properties for 3D printed electrodes, and was selected and used as the material. In addition, in the case of the re-entrant midsole as curved 3D structure, we compared the physical performance by output direction, infill density, and region of the midsole. As a result, the infill density 50% in the horizontal output direction is soft. And 100 mA appeared when 19 to 29 V was applied. Furthermore, it was confirmed that when 10V was applied during 5 compressions at 30%, the output ranged at 40-100mA. In the case of plantar pressure analysis, it was shown that the compression performance of the lateral output direction sample with horizontally stacked layers due to the re-entrant structure was smooth and the electrical performance during compression was excellent. It was also confirmed that the low foot pressure was distributed over a wider area, making it more stable.

Conclusion

This study attempted to manufacture various types of soft sensors using three types of carbon/TPU filaments in FFF 3D printing. Accordingly, three types of carbon filaments and three structures were printed. As a result, it was confirmed that carbon black/TPU has excellent elasticity and conductivity, and is most suitable for FFF 3D printing, allowing soft sensors to be manufactured with various structures. In addition, in terms of 3D printing process conditions, the physical and electrical performance of the honeycomb infill pattern was the best, and the horizontal direction was found to be suitable for the sensor in the output direction. Therefore, it was confirmed that this can be used as basic research for sensor manufacturing using FFF 3D printing.

Acknowledgements

References

Kim, N. P. (2020). 3D-printed conductive carbon-infused thermoplastic polyurethane. *Polymers*, *12*, 1224.

Li, B., Zhang, S., Zhang, L., Gao, Y., & Xuan F. (2022). Strain sensing behavior of FDM 3D printed carbon black filled TPU with periodic configurations and flexible substrates. *Journal of Manufacturing Processes*, *74*, 283-295.

Li, Z., Li, B., Chen, B., Zhang, J., & Li, Y. (2021). 3D printed graphene/polyurethane wearable pressure sensor for motion fitness monitoring. *Nanotechnology*, *32*, 395503.

Samarentsis, A. G., Makris, G., Spinthaki, S., Christodoulakis, G., Tsiknakis, M., & Pantazis, A. (2022). A 3D-printed capacitive smart insole for plantar pressure monitoring. *Sensors*, *22*(24), 9725.

Shin, E. J., Son, J. H., Lee, H. S., & Lee, S. (2024). Manufacturing of conductive filaments for 3D/4D printing through in situ polymerization of biobased thermoplastic polyurethane/multiwall carbon nanotube composites. *ACS Applied Polymer Materials*, *6*, 1751-1762.

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FOLKLORE TRADITIONS TO TREND: INCORPORATING LOCAL TEXTILE PROCESSING KNOWLEDGE WITH CONTEMPORARY FASHION

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Introduction

Localism is a contemporary fashion movement, part of which highlights multiple alternatives for local empowerment- local crafts, skills, stories, and traditions. Localism has a specific ecosystem that is unique and opposite to what was commonly known as globalism. Preserving local traditions, practices, rituals, and crafts that are on the verge of extinction is encouraged by localism. As such folklore extends intangible cultural heritage that is related to specific communities and becomes a part of localism. The story of *Kuweni* is such an entrancing folk narrative from Sri Lanka which is historically significant for the origin of Sinhalese and the contemporary indigenous community *(Vedda)*. According to folklore, *Kuweni* was a young native Princess who supported Prince *Vijaya* form North India to conquer the power of Sri Lanka. When *Vijaya* arrived *Thambapanni* Beach on the island, *Kuweni* was spinning cotton. This specific phenomenon sheds light on the establishment of a local textile industry in Sri Lanka that can now be appreciated as one of the hyper-localized trends. Moreover, the story has been documented in ancient literature, lending factual credibility to the character of *Kuweni* (Geiger & Bode, 1912). Considering these facts, a creative practice-led research (PLR) approach has been taken to identify and experiment with the traditional knowledge that is inherited from Sri Lankan craft culture through folklore. As such, the practice of traditional Sri Lankan scouring and bleaching techniques for greige cotton yarns has been experimented within the study. We relied on folklore, field visits, discussions, and observations in identifying these traditional techniques. The outcomes of the study contribute to the preservation of traditional knowledge and practices, therefore establishing connections with the hyper-localized fashion trends.

Literature Review

According to Mahavamsa, the great chronicle of Sri Lanka, *Kuweni* was spinning cotton in the form of a female hermit (Geiger & Bode, 1912, pp. 54–64). The findings of this study reveal that the folklore of *Kuweni* is supported by many regional stories that rigorously imply evidence for the existence of weaving and traditional crafts as folk practices. These findings are effective in revealing the materials, principles, and processes of craft traditions underlying this narrative. Creative industries often use such intangible cultural heritage for their creative practice.

The story highlights that cotton manufacturing existed in ancient Sri Lanka (Ramasinghe, 1969). With the nationalist movements against the colonizers, the Sri Lankan Handloom textile industry reached its climax providing livelihoods to many local craftsmen. Therefore, handloom weaving can be identified as a significant textile manufacturing in Sri Lanka (Gopura and Wickramasinghe, 2022). Although cotton is not grown in Sri Lanka at a commercial level, it is identified that cotton can be successfully grown in the North and North-central provinces (Ramasinghe, 1969). Currently, cotton is imported to the country from India and synthetic dyes are used for dyeing. The process of natural dyeing is still practiced in rural areas of the country and knowledge is transmitted from generation to generation through hands-on experience (Ranathunga et al., 2020). Natural dyes offer a multitude of advantages, benefiting both the environment and the wearer in significant ways. These dyes are inherently biodegradable which means that they break down naturally over time without leaving harmful residues or polluting ecosystems. Their decomposition process is gentle, ensuring minimal ecological impact compared to synthetic counterparts. Moreover, natural dyes boast a non-toxic composition, making them safe for the environment, wildlife, and human health alike. Unlike synthetic dyes that often contain hazardous chemicals, natural dyes are derived from plant, mineral, or animal sources, avoiding the release of harmful substances into the environment during

production or disposal (Ratnayaka, 2022). In localism, land ethics are highly taken into consideration which avoids harmful activities to the environment and pays attention to waste reduction (Fletcher, 2018). Since natural scouring, mordanting, and dyeing techniques are deeply concerned with the well-being of nature, place, and community, the natural processes of textile preparation and dyeing is strongly attached to localism.

Research Method

The initial stage of this study has taken a Qualitative approach to investigate the symbolic values of the folklore through a contextual understanding of the story. Semi-structured interviews with open-ended questions, discussions, and observations were used to gather data from the participants which led them to share their experiential knowledge (Sekaran & Bougie, 2013). Experiential knowledge can be identified as explicit, tacit, and ineffable and the tacit content contains experimental components (Biggs, 2004). All the data of the study were obtained from handloom weaving communities and natural dye practitioners in Sri Lanka. Next, a creative practice-led research (PLR) approach was used to experiment with the identified techniques of collected data. Experiments and self-reflections are common in PLR to come up with tangible outcomes (Haseman & Mafe, 2009). Through active and creative practices, the researcher generated new knowledge of using traditional techniques as well as materials (Choi, 2016). In this specific study, scouring of the greige yarns was done using cow dung and bleaching was done using charcoal and ashes of coconut husks and petiole.

Techniques & Results

Scouring a fabric is very important since it directly affects the mordanting as well as dyeing processes. Dyeing does not become successful due to impurities, if the yarns are not scoured properly. Fresh Cow dung and water are the only raw materials used for this process and it takes around three to four days to achieve a successful outcome. Sunny weather (27-35 degree Celsius) and the availability of fresh flowing water without any chemicals or impurities are crucial factors that affect the success of the scouring outcome. The scoured yarns were bleached using the coconut husk and petiole which gave a significant white color to the greige yarns. This whole process can be identified as a total eco-friendly product development chain since it is closely attached with the natural and easily available materials.

Conclusion

Sri Lanka is enrich with folklore-rich traditional wisdom and abundant natural resources. Without recognizing and actively engaging with the traditional tacit knowledge passed down through generations, its preservation for future generations remains uncertain. This study highlights the potential of harnessing traditional knowledge embedded in society for processes like scouring and bleaching greige yarns, utilizing an experimental approach. Such efforts aid in identifying and safeguarding traditional tacit knowledge. A follow-up study will be conducted regarding this study as well as natural dyeing techniques of Sri Lanka. The findings underscore how traditional wisdom fosters an eco-friendly narrative bridging the past and present, paving the way for a resilient future.

References

Biggs, M. A. R. (2004). Learning from experience: approaches to the experiential component of practice-based research. *Www.academia.edu*, 1–16.
    https://www.academia.edu/672150/Learning_from_experience_approaches_to_the_experiential_component_of_practice_based_research

Choi, K.-H. (2016). Practice-led origami-inspired fashion design: out of the frame: flight by paper plane. *International Journal of Fashion Design, Technology and Education*, *9*(3), 210–221. Taylor & Francis Online . https://doi.org/10.1080/17543266.2016.1158872

Geiger, W., & Bode, M. (1912). *THE MAHAVAMSA OR THE GREAT CHRONICLE OF CEYLON* (pp. 54–64). Oxford University Press.
    https://archive.org/details/mahavamsagreatch00geigrich/page/62/mode/2up

Gopura, S., & Wickramasinghe, A. (2022). Dreams of Weaving: Creative Practice-Led Approach to Handloom Product Development in Sri Lanka Using Artisans' Socio-Emotional Identities. *Fashion Practice*, *0*, 1–22. https://doi.org/10.1080/17569370.2022.2127537

Haseman, B., & Mafe, D. (2009, January). *Acquiring know-how: Research training for practice-led researchers*. ResearchGate.
https://www.researchgate.net/publication/41201658_Acquiring_know-how_Research_training_for_practice-led_researchers

Ramasinghe, A. (1969). *Warna Sanyojana Widyawa - Pesha Karma ha Sayam Pewime widyawa* (2nd ed.). M.D Gunasena.

Ranathunga, G. M., Kaluarachchi, I. H. R., Wijayapala, U. G. S., & Karunarathne, P. V. M. (2020). A Survey of traditional natural dye practice of Sri Lanka Today: A possible path pointing towards the development of the natural dye industry. *Journal of Advanced Research in Social Sciences and Humanities*, *5*(6), 233–241. https://jarssh.com/ojs/index.php/jarssh/article/view/6

Ratnayaka, N. (2022). Colors from Ceylon: A Design Exhibit of Sustainable Textiles Dyed with Coconut Husk Waste. In *krex.k-state.edu* (pp. 6–10). https://krex.k-state.edu/handle/2097/42229

Sekaran, U., & Bougie, R. (2013). *Research Methods for Business* (7th ed., pp. 1–352). John Wiley & Sons Ltd. www.wileypluslearningspace.com

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Special Topic
Oral Presentation Session 1
: Consumer Response to Market Dynamics

Chair: Dr. Minjeong Kim, Indiana University

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APP ATTRIBUTES AND PERCEIVED VALUES DETERMINING CHINESE CONSUMERS' INTENT TO REUSE FASHION SHOPPING APPS

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Introduction

Mobile commerce in China is valued at approximately $1 trillion, primarily driven by more than 713 million Chinese app users (Bernard, 2018). Moreover, there is an increasing trend in the usage of fashion shopping apps within China. Research conducted by Asia Distribution & Retail indicates that Chinese millennials make clothing purchases at least once every two to three weeks, and over 82% of this demographic utilize brand apps to explore new clothing items, purchase apparel, or discover the latest promotions. Despite this, research on Chinese consumers' usage of fashion apps remains spares, with only a handful of studies examining the fashion app usage patterns of Korean or American consumers. Hofstede (2001) highlighted that Chinese consumers are distinctly different from their counterparts in other countries in several domains, including cultural values. Similarly, Lu et al. (2017) identified variances in the cultural factors that affect the repurchase intentions of Chinese versus American consumers using mobile devices. Furthermore, while many studies have focused on the content and functionality of fashion apps, investigation into consumer behavior of mobile fashion apps are confined to analyses of important app attributes, motivations for use, and usability evaluation. Only a limited number of studies explore consumer behavior related to the use of fashion shopping apps. The purpose of our study is to ascertain, based on the S-O-R model, how specific attributes of fashion shopping apps affect Chinese female consumers' reuse intentions of the apps.

Literature Review

The Stimuli(S)-Organism(O)-Response(R) theory, originally introduced by Mehrabian and Russell (1974), provides a framework for understanding how specific attributes of fashion shopping apps contribute to consumers' continuous adoption of these applications. Perceived value is categorized into two distinct types: utilitarian and hedonic values. Utilitarian shopping value is defined by its task-related, goal-oriented, rational, and practical nature within the shopping context, while hedonic value stems from the pleasure, enjoyment and satisfaction derived during the shopping process. Prior research has predominantly focused on non-fashion related apps, including coupon, catering, retail, social shopping curation, and food and beverage brand applications. Studies across various platforms have identified that features such as download and search functions, privacy protection, security measures, payment system, background design and colors, and other visual elements are correlated with users' perceptions of usefulness and convenience, as well as experiences of enjoyment and frustration. Consequently, we hypothesize that the system-related attributes of fashion shopping apps will influence the perceived utilitarian value (H1) and hedonic value (H2) associated with these apps. Moreover, earlier investigations on apps, websites and smartphones have verified that aspects like information quality, service quality, user interactivity, augmented reality, and location-based services impact perceived ease of use, perceived usefulness, and pleasure experience. Therefore, we hypothesize that the service-related attributes of fashion shopping apps will affect the perceived utilitarian value (H3) and hedonic value of these apps (H4). Existing research also indicates that website and app features such as product images, product assortment, product quality, pricing, discount events, and push notification sales promotions influence shoppers' enjoyment, emotional experiences, and perceptions of usefulness and practical value. Thus, we hypothesize that the marketing mix-related attributes of fashion shopping apps will impact the perceived utilitarian value (H5) and hedonic values (H6) of these apps. In the realm of fashion website and non-fashion related mobile app usage, perceived ease of use and usefulness, along with experienced enjoyment and flow, have been shown to affect the intention to use the websites and apps, and these findings were supported by research applying the Technology Acceptance

Model (TAM) and studies extending the TAM model. Consequently, we hypothesize that the perceived utilitarian value(H7) and hedonic value(H8) elicited by the apps will influence users' reuse intentions of fashion shopping apps.

Research Method

Initially, through qualitative exploratory research employing focus group interviews with Chinese consumers, we identified crucial app attributes pertinent to their shopping experience. The measurement items for assessing the attributes, perceived values, and reuse intention of fashion shopping apps were either adapted from previous studies and modified, or newly devised based on the insights from focus group interviews undertaken prior to the survey. Subsequently, quantitative research was conducted.

Data were collected from Chinese female consumers residing in China. The mobile version of the survey questionnaire was distributed via a Chinese survey agency (WJX.CN). A total of 304 usable questionnaires were subjected to statistical analysis. The majority of respondents fell into their 20s (36.2%), 30s (33.9%), and 40s (22%). The sample predominantly comprised married women (75.7%), employees (85.9%), and college graduates (75.4%). Metropolitan residents from (14.1%), Shanghai (15.8%), and Guangdong (18.4%) constituted approximately half of the sample. Around 54.3% of respondents reported their household monthly income ranging from 5,000 yuan (US$ 723) to less than 10,000 yuan (US$ 1,446). A 5-point Likert scale was utilized to assess research variables, including the attributes, perceived values, and reuse intention of fashion shopping apps. Demographic variables were assessed through forced-choice questions and open-ended responses. Exploratory factor analysis, regression analysis, and frequency and percentage analysis were performed using SPSS 21.0.

Results & Discussion

Among twelve attributes of fashion shopping apps, the app design, fashion information, and product assortment had positive affect on the perceived utilitarian value associated with fashion shopping apps. These findings indicate that hypothesis 1, 3 and 5 partially supported. Five attributes specifically, payment system, customer reviews, entertainment features, product assortment, and cost-saving price were found to exert significantly positive impacts on the perceived hedonic value of the apps. These findings indicate that hypothesis 2, 4 and 6 partially supported. Based on the results of these analyses, product assortment was identified as a very important attribute influencing both the perceived utilitarian and hedonic values. The perceived utilitarian value and hedonic value of fashion shopping apps were determined to positively influence the reuse intention of these apps, thereby confirming hypothesis 7 and 8. To better understand the underlying dynamics, we analyzed the mediating effect of perceived utilitarian value. Our findings revealed that the app attributes such as app design, fashion information and product assortment had significantly indirect effects on the intention to reuse fashion shopping apps through perceived utilitarian value associated with such apps. In analyses identifying the mediating effects of perceived hedonic value, it was statistically confirmed that payment system, product assortment, entertainment features and cost-saving price indirectly influence the reuse intent of fashion shopping apps through perceived hedonic value of the apps. In further analyses identifying the direct effects of app attributes on the intention to reuse fashion shopping apps, we discovered that five attributes of payment system, real-time communication, live streaming sales events, photo sharing via SNS and cost-saving price directly influenced the intention to reuse such apps. From the results of direct and indirect effect analyses, we found that the attributes of payment system and cost-saving price are significant predictors of the reuse intention of fashion shopping apps, by having direct impact and indirect impact through perceived hedonic value on app reuse intent.

Conclusion

The findings of this research lend support to the Stimuli(S)-Organism(O)-Response(R) theory, and offer insights into Chinese female consumers' fashion app shopping behavior. In addition, they shed light on strategies for the management of fashion shopping apps. In particular, our findings highlight the mediating roles of perceived utilitarian and hedonic values in the impacts of app attributes on shoppers' intent to reuse fashion shopping apps. These results suggested that app retailers and managers should be paying attention

to the significance of both utilitarian and hedonic values as perceived from fashion shopping apps and should dedicate considerable effort towards enhancing consumers' perception of these values within their applications. In particular, fashion shopping apps should emphasize attributes which directly or indirectly affect the reuse intention of the apps among system, services, and marketing mix-related attributes. For example, app retailers should strategically manage important app attributes such as product assortment which affects shoppers' perception of both utilitarian and hedonic values of apps, and payment system and cost-saving-price which directly and indirectly influenced shoppers' intent to reuse of apps. App retailers also need to actively adopt and strategically manage service-related attributes such as real-time communication, live streaming sales events, and photo sharing via SNS, which directly influence the intention to reuse of fashion shopping apps. Furthermore, app marketers should manage these attributes effectively and strategically to ensure that consumers can fully appreciate the utilitarian and hedonic values of fashion shopping apps, thereby nurturing their loyalty towards the apps.

References

Bernard, Z. (2018, August 24). It's a recipe for dominance that should drive fear into Silicon Valley': Here's why experts say China has an edge over the US when it comes to making money from smartphone users. *Business Insider* Retrieved March 12, 2019, from
https://www.businessinsider.com/why-china-mobile-apps-market-is-ahead-of-us-experts-2018-8

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. Sage publications.

Lu, Q., Wong, C. C. Y., Gallagher, M. W., Tou, R. Y., Young, L., & Loh, A. (2017). Expressive writing among Chinese American breast cancer survivors: A randomized controlled trial. *Health Psychology*, *36*(4), 370.

Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology.* The MIT Press.

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CONSUMER DETERMINANTS OF PLANT-BASED LEATHER PRODUCTS: A CONCEPTUAL MODEL

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Introduction

Leather, largely produced from animal skin, has been considered a non-sustainable and cruel fabric. Synthetic leathers are also developed as alternatives, but there is controversy if these are truly sustainable. More recently, thus, well-known brands, such as Fossil, H&M, and Tommy Hilfiger released their products made from plant-based leather to show their sustainable performance. The plant-based leather is made from bananas, apples, grapes, cactus, pineapples, etc. (Tewari et al., 2024). This gained a huge popularity. According to Grand View Research (2020), the global plant-based leather market is projected to reach more than 13.6 growth percent from 2022 to 2027.

Consumers perceive that plant-based leather products are sustainable, but sustainability is not known to be the only or primary factor in purchasing fashion items. Brands need to understand what drives consumers to purchase plant-based products. However, previous studies on plant-based leather products mainly dealt with sustainable aspects. It is worth grasping the determinants of purchasing plant-based leather products as more businesses start competing in the market. Thus, we aim to understand this by building a conceptual model. Based on the literature review, we explore the perceived product attributes of plant-based leather products that can be attractive to consumers. We also find consumers' characteristics that may moderate their intention to purchase plant-based leather products. The conceptual model constructed upon perceived value and the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) will provide a foundation for plant-based leather research and practices.

Literature Review

Perceived value refers to the consumers' perception of benefits earned by the products, compared to the expected benefits (Chen & Dubinsky, 2003). Customer perceived value can be formed by how consumers evaluate a product based on product attributes and performances (Woodruff, 1997). These perceptions are important factors in predicting user attitudes. Thus, we propose a conceptual model to explore the consumers' attitudes toward plant-based leather products driven by perceived product attributes. Furthermore, TRA explains that consumers' attitudes and subjective norms influence behavioral intentions. These relationships are often moderated by other factors, such as consumers' characteristics. Thus, we examine such factors that can positively moderate consumers' attitudes toward and purchase intention to plant-based leather products.

Research Method

We conducted conceptual research to understand the reasons behind purchasing plant-based leather. We suggest a theoretical framework based on the review of previous studies (Jaakkola, 2020). To identify the perceived product attributes of plant-based leather products, we examined journal articles in the science fields that developed or tested plant-based leather (e.g., Mazotto, 2022; Tewari et al., 2024). We also investigated journal articles in marketing and fashion fields to understand consumer behaviors in relation to the identified perceived product attributes of plant-based leather products (e.g., Hetet et al., 2020; Lee et al., 2022).

Results & Discussion

As a result of conceptual research, we built a proposed conceptual model (see Figure 1). The model expects relationships among concepts. Based on the TRA and perceived value, the perceived product attributes of plant-based leather products lead to a positive attitude toward, and ultimately purchase intention to, plant-based leather products.
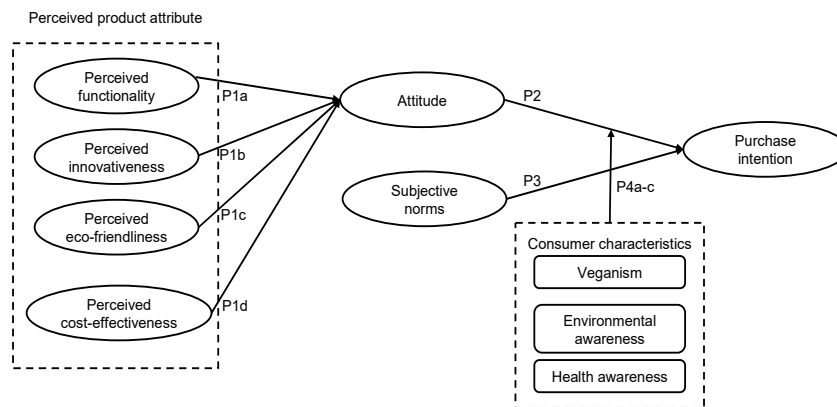
Figure 1. Proposed conceptual model.

Because the sources of plant-based leather products are diverse, the products are often evaluated to have various functions (Tewari et al., 2024). These varied functions include water resistance, durability, abrasion resistance, softness, and so on. Besides, most plant-based leather has common functional benefits, such as being lightweight and non-toxic. Thus, plant-based leather products are versatile and flexible in different uses. Thus, P1a: A perceived functionality can increase consumers' positive attitudes toward plant-based leather products.
Developing plant-based leather and creating products with it requires new ideas and novel tests and trials. Plant-based leather products, thus, are considered innovative (Tewari et al., 2024). Consumers have positive attitudes toward a brand when the brand is perceived to be innovative (Hetet et al., 2020). Accordingly, P1b: A perceived innovativeness can increase consumers' positive attitudes toward plant-based leather products. Unlike traditional leather products, plant-based leather is often believed to be more eco-friendly (Mazotto, 2022; Tewari et al., 2024). This is because many materials are recycled from peels or waste of fruits. As the ingredients are plant-based, they are biodegradable. The production process of plant-based leather is also relatively free from animal cruelty. Hence, P1c: A perceived eco-friendliness can increase consumers' positive attitudes toward plant-based leather products. Plant-based leather products are less expensive than traditional leather in general. This is because the materials require less time to mature than growing animals (Mazotto, 2022). Also, plant-based leather is often produced by waste parts of plants. Thus, consumers can obtain these leather products at a more affordable price. Once purchased, maintaining and caring for plant-based leather products also require less extra money. Therefore, P1d: A perceived cost-effectiveness can increase consumers' positive attitudes toward plant-based leather products.

Based on TRA, we propose P2 and P3: Consumers' (P2) positive attitudes and (P3) higher subjective norms can increase their purchase intention to plant-based leather products. Then, we explored consumers' characteristics that can moderate P2. Veganism restricts the consumption of animal products in favor of plant-based foods (Sneijder & Te Molder, 2009). We expect veganism to also influence fashion product consumption. Therefore, veganism is anticipated to increase consumers' purchase intention for plant-based leather products driven by positive attitudes. Thus, P4a: Consumers' veganism can positively moderate the P2. Previous studies found that consumers with higher environmental awareness and concerns increase their environmental behaviors (Lee et al., 2022). Thus, we expect environmental awareness to lead to purchase intentions driven by consumers' positive attitudes toward plant-based leather products. Hence, P4b: Consumers' environmental awareness can positively moderate the P2. Due to the non-toxic and safe ingredient features of plant-based leather, we presume it can be considered a healthier product than traditional leather, like synthetic leather. Consumers' concerns about their health especially increased recently (Lee et al., 2022). Consumers with higher health awareness may have higher purchase intention for plant-based leather products driven by their positive attitudes. Therefore, P4c: Consumers' health awareness can positively moderate the P2.

Conclusion

The proposed conceptual model explored the perceived product attributes (i.e., perceived functionality, perceived innovativeness, perceived eco-friendliness, and perceived cost-effectiveness) of plant-based leather products that can lead to consumers' positive attitudes. This offered a foundation for future research on plant-based leather products in highlighting their product attributes. We also add academic value to TRA by enlarging its use to understand plant-based leather products. We further explored the consumer characteristics (i.e., veganism, environmental awareness, and health awareness) that may moderate the relationship between attitude and purchase intention. The findings will provide useful implications for brands to sell their plant-based leather products. Future studies are to empirically test the conceptual model. Moreover, not only plant-based leather but also other plant-based fabrics can be considered in future research.

References

Chen, Z., & Dubinsky, A. J. (2003). A conceptual model of perceived customer value in e-commerce: a preliminary investigation. *Psychology & Market, 20*(4), 323–347.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research.* Addison-Wesley.

Grand View Research. (2020). *Vegan Women's Fashion Market Size Report, 2020-2027.* (Report No. GVR-4-68038-929-6). https://www.grandviewresearch.com/industry-analysis/vegan-womens-fashion-market

Hetet, B., Ackermann, C. L., & Mathieu, J. P. (2020). The role of brand innovativeness on attitudes towards new products marketed by the brand. *Journal of Product & Brand Management*, *29*(5), 569-581.

Jaakkola, E. (2020). Designing conceptual articles: four approaches. *AMS review*, *10*(1), 18-26.

Lee, S. E., Kim, S. J., Oh, K. W., & Lee, K. H. (2022). Purchase intention toward sustainable masks after COVID-19: the moderating role of health concern. *Fashion and Textiles*, *9*(1), 1-18.

Mazotto, A. M. (2022). Biopolymers in the leather industry. *Biopolymers*, 245–270.

Sneijder, P., & Te Molder, H. (2009). Normalizing ideological food choice and eating practices, identity work in online discussions on veganism. *Appetite, 52*(3), 621-630.

Tewari, S., Reshamwala, S. M., Bhatt, L., & Kale, R. D. (2023). Vegan leather: A sustainable reality or a marketing gimmick? *Environmental Science and Pollution Research*, *31*(3), 3361–3375.

Woodruff, R. B. (1997). Customer value: the next source for competitive advantage. *Journal of the academy of marketing science*, *25*, 139-153.

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AN INVESTIGATION OF CONSUMER RECEPTIVITY TO AI ADS VERSUS ARTWORK

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Introduction

Generative AI is causing disruption and transformation across various businesses through its capability to decipher and interpret vast volumes of data, enabling the production of creative content. The fashion industry is not an exception. In the same way that generative AI is actively used for creating noncommercial content such as artwork, paintings, and poetry, it also generates new market value by reshaping content creation processes for consumer-facing fashion marketing strategies, including ads, campaigns, communications, and promotional messages. However, research is still insufficient to fully understand what factors influence consumer acceptance of AI-generated content for commercial purposes. It is important to explore these factors because, although people lean toward supporting brands that use AI content creation, the majority do not prefer it or even form negative reactions (Brüns & Meißner, 2024; Dentsu, 2023). To address this research gap, this exploratory study investigates the differential perceptions of consumers toward AI-generated ads versus artwork and the reasons behind these perceptions, with a specific focus on AI-generated images.

Literature Review

When comparing AI-generated commercial to noncommercial images, it is possible to argue different directions for consumer receptivity toward either content type. On one hand, consumers are likely to respond to AI commercial content more favorably. People tend to believe art is a human area, attribute lower competency to AI for art creation, or experience weak emotions when artworks are made by AI (Agudo et al., 2022; Demmer et al., 2023). In this scenario, consumers may feel less inclined to AI-generated noncommercial content and favor commercial content more. On the other hand, consumers may respond to AI-generated noncommercial content more positively. This might be the case due to the general ad distrust tendency; recognizing an intention of commercial persuasion from stimuli makes people feel suspicious, form less favorable attitudes, or reduce conversions and behavioral intentions (An et al., 2019; Boerman, 2020; Boush et al., 1994). Since AI content creation aims to boost productivity by maximizing machine automation and inevitably decreasing human work, consumers may question the legitimacy of AI content creation for commercial purposes. Thus, a research question is formulated: How do consumers differently form receptivity toward commercial versus noncommercial images generated by AI? (RQ1)

The mechanisms explaining consumer receptivity are hypothesized to answer the reasons behind the differences between the two AI image types. First, perceived appropriateness of using AI to create content is posited to mediate the relationship between AI image type and receptivity (H1). AI is often viewed as an alien species perceived as untrustworthy and potentially threatening (Turel & Kalhan, 2023). If consumers are more willing to accept AI content creation for commercial purposes, it is likely because there is a conception that AI creating content in purely noncommercial areas, which typically require human involvement, violates accepted norms. If AI content creation is more favorably accepted for noncommercial purposes, it is likely due to the appropriateness perception; creating images using AI without human labor, with the intent of maximizing profits, may be considered an improper practice. Second, the relationship between AI image type and consumer receptivity will be serially mediated by perceived appropriateness and temporary skepticism toward AI creation (H2). Regardless of perceived appropriateness of different AI image types, uncertainty about the legitimacy of AI content creation will lead to skepticism, consequently affecting receptivity. Lastly, one's tendency of advertising mistrust is proposed as a boundary condition of the mediation of perceived appropriateness and skepticism toward AI creation. Unlike a temporary state of

skepticism toward a particular stimulus, advertising mistrust is one's trait-based, general distrust in the content of ads (Bae, 2018; Obermiller & Spangenberg, 1998). Thus, the more a consumer mistrusts ads in general, the less the consumer will be receptive to AI commercial images, explained by perceived appropriateness and skepticism toward AI creation. Therefore, the indirect effect of AI image type on receptivity through appropriateness and skepticism toward AI creation will be moderated by advertising mistrust (H3).
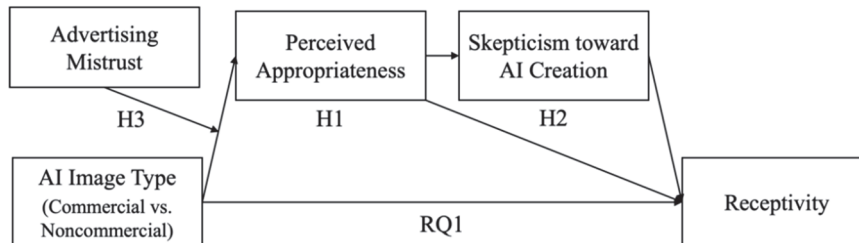
Figure 1. Research Model

Research Method

A single-factor two-level (AI image type: commercial vs. noncommercial) online experiment was conducted. AI image type was manipulated, and advertising mistrust was measured. Three hundred U.S. adults were recruited via Prolific. After consent, participants viewed a fashion image created by Midjourney, which was introduced as either an AI-generated ad or artwork. Those who failed the attention check questions were deleted, and 281 data remained for final analysis (Age: M=39.67 (13.70); 61.9% female). The instruments were adopted from the literature and modified to measure perceived appropriateness (Dahlén et al., 2009), skepticism toward AI creation (Bae, 2018; Taylor et al., 2010), receptivity (So et al., 2023), and dispositional advertising mistrust (Obermiller & Spangenberg, 1998). AI familiarity was measured as one of the covariates using a scale from previous literature (Belanche et al., 2019). Exploratory factor analysis was performed to confirm the measurement validity, during which two items from appropriateness were removed due to the low loadings or the duplicate loadings. The reliability of all constructs was confirmed (αs > .87).

Results & Discussion

The results of MANCOVA, controlling for the effect of age and AI familiarity, showed a marginal effect of AI image type on combined dependent variables (Pillai's V=.30, F=2.09, p=.07, partial η^2=.03). The following ANCOVAs revealed that participants perceived higher appropriateness from the AI-generated ad than artwork (M_{ad}=4.68 vs. M_{art}=4.29; F=3.99, p=.047, partial η^2=.01). Skepticism toward AI creation did not differ between the two conditions (p=.429). Participants in the commercial (vs. noncommercial) condition were more receptive to using AI for content creation (M_{ad}=4.19 vs. M_{art}=3.78; F=4.73, p=.031, partial η^2=.02).

PROCESS macro (version 4.2) was used to test the mediating effects. The results of Model 4 showed a significant mediation of perceived appropriateness between AI image type and receptivity (b=0.16, 95% CI=[0.0065, 0.3021]), supporting H1. This means that participants were more receptive to AI content creation for commercial purposes than noncommercial purposes due to the perception of appropriateness. Model 6 confirmed the serial mediation of appropriateness and skepticism (b=0.03, 95% CI=[0.0014, 0.0719]) and the sole mediation of appropriateness (b=0.12, 95% CI=[0.0051, 0.2477]), but the sole mediation of skepticism toward AI creation was nonsignificant (b=-0.01, 95% CI=[-0.0514, 0.0188]). While H2 was supported, the results should be interpreted with caution because neither the significant mediation of skepticism nor the differences in skepticism between the two conditions was found. Lastly, Model 83 showed nonsignificant indices of moderated mediation by advertising mistrust. The serial mediation of appropriateness and skepticism explaining the effect of AI image type on receptivity was consistent across the level of advertising mistrust. Thus, H3 was rejected.

Conclusion

The usage of generative AI in content creation is gaining more attention. This exploratory study advances the understanding of consumer perception of generative AI usage in fashion businesses. Specifically, the findings answered RQ1 by showing that consumers tend to be more receptive to using AI for ads than artwork, mainly because they believe AI creating images is more proper and appropriate for commercial content creation than noncommercial ones. The serial mediation revealed that this perception of appropriateness affects skepticism toward AI creation and consequently forms receptivity toward AI content creation. Still, the indirect effects of image type on receptivity through appropriateness or appropriateness-skepticism toward AI creation do not differ depending on one's dispositional advertising mistrust. The results suggest that generative AI usage especially for noncommercial purposes, at least for artwork, should be developed and introduced with a value to compensate for the lowered appropriateness perception. Fashion practitioners who aim to emphasize the artistic aspects of their content (e.g., fashion ads, films, catalogs) are recommended to highlight the benefits of AI-assisted content creation processes while maintaining human involvement. Future studies are called to test the robustness of skepticism toward AI content creation in explaining the receptivity to AI ads versus artwork. Also, given that the current study used AI images as the stimuli, future studies can utilize diverse content types (e.g., texts, videos) to examine the higher receptivity to AI commercial (vs. noncommercial) content within various research settings.

References

Agudo, U., Arrese, M., Liberal, K. G., & Matute, H. (2022). Assessing emotion and sensitivity of AI artwork. *Frontiers in Psychology, 13.* 879088.

An, S., Kerr, G., & Jin, H. S. (2019). Recognizing native ads as advertising: Attitudinal and behavioral consequences. *Journal of Consumer Affairs*, *53*(4), 1421-1442.

Bae, M. (2018). Overcoming skepticism toward cause-related marketing claims: the role of consumers' attributions and a temporary state of skepticism. *Journal of Consumer Marketing*, *35*(2), 194-207.

Belanche, D., Casaló, L. V., & Flavián, C. (2019). Artificial Intelligence in FinTech: understanding robo-advisors adoption among customers. *Industrial Management & Data Systems, 119*(7), 1411-1430.

Boerman, S. C. (2020). The effects of the standardized Instagram disclosure for micro-and meso-influencers. *Computers in Human Behavior*, *103*, 199-207.

Boush, D. M., Friestad, M., & Rose, G. M. (1994). Adolescent skepticism toward TV advertising and knowledge of advertiser tactics. *Journal of Consumer Research*, *21*(1), 165-175.

Brüns, J. D., & Meißner, M. (2024). Do you create your content yourself? Using generative artificial intelligence for social media content creation diminishes perceived brand authenticity. *Journal of Retailing and Consumer Services*, *79*, 103790.

Dahlén, M., Granlund, A., & Grenros, M. (2009). The consumer-perceived value of non-traditional media: effects of brand reputation, appropriateness and expense. *Journal of Consumer Marketing*, *26*(3), 155-163.

Demmer, T. R., Kühnapfel, C., Fingerhut, J., & Pelowski, M. (2023). Does an emotional connection to art really require a human artist? Emotion and intentionality responses to AI-versus human-created art and impact on aesthetic experience. *Computers in Human Behavior, 148*, 107875.

Dentsu. (2023). *Dentsu consumer navigator: Generative AI 2023*.

Obermiller, C., & Spangenberg, E. R. (1998). Development of a scale to measure consumer skepticism toward advertising. *Journal of Consumer Psychology*, *7*(2), 159-186.

So, K. K. F., Kim, H., Liu, S. Q., Fang, X., & Wirtz, J. (2023). Service robots: the dynamic effects of anthropomorphism and functional perceptions on consumers' responses. *European Journal of Marketing, 58*(1), 1-32.

Taylor, V. A., Halstead, D., & Haynes, P. J. (2010). Consumer responses to Christian religious symbols in advertising. *Journal of Advertising*, *39*(2), 79-92.

Turel, O., & Kalhan, S. (2023). Prejudiced against the machine? Implicit associations and the transience of algorithm aversion. *MIS Quarterly*, *47*(4).

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CUSTOMER EXPERIENCE WITH LUXURY BRANDS: UNCOVERING LATENT TOPICS USING STRUCTURAL TOPIC MODELING

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Introduction

Online customer reviews have emerged as a prominent resource for brands seeking to comprehend customer sentiment and reactions toward their products or services. Particularly, luxury brands, acknowledging the significance of digital platforms, effectively engage with consumers by leveraging online customer reviews, which mirror consumer interactions and inform marketing strategies (Cai & Choi, 2023). In addition, as AI and big-data-driven customer analysis evolve in the retail industry, the surge of consumer-generated data on digital platforms has sparked a growing interest in employing text-mining techniques to extract insights into consumer behavior and brand marketing (Liu et al., 2021). Nevertheless, there remains a notable scarcity of research utilizing text-mining methods to comprehend consumer experiences within the luxury sector. Therefore, this study aims to leverage third-party big data, specifically customer reviews sourced from consumer reports websites, to delve into the customer experiences within luxury brands. Grounded in Lemon and Verhoef's (2016) customer journey framework, this research endeavors to explore topical customer experiences during the luxury retail shopping journey by addressing the research inquiries: what are key customer experiences salient during the pre-purchase, purchase, and post-purchase phases of the customer journey in the luxury retail context.

Literature Review

The concepts of the customer experience and shopping journey began to gain attention from earlier experiential theorists (e.g., Hirschman et al., 1982) asserting that consumer shopping behavior goes beyond product acquisition and emphasizes emotional fulfillment. Later scholars (e.g., Verhoef et al., 2009) added that customer experience encompasses social interactions, brand reputation, and emotional connections. Subsequently, Lemon and Verhoef (2016) proposed a conceptual framework for customer journey (CJ), which maps consumer interactions with a firm across pre-purchase, purchase, and post-purchase stages. The pre-purchase stage centers around need recognition, consideration, and information search (e.g., brand reputation, products, and services); the purchase stage includes decision-making, ordering, and payment; and the post-purchase stage involves consumption/usage, engagement, and service requests. With the advent of non-structured information freely accessible on the internet, Lemon and Verhoef (2016) further urged to approach a new avenue of exploring customer journey through utilizing big data (e.g., text analytics) in order to empirically elucidate the behavioral, psychological, and emotional aspects of consumer experiences throughout the pre-, during-, and post-purchase phases.

Research Method

To collect the data, we scraped online consumer reviews, dates, and ratings for ten luxury brands from the customer review website, Trustpilot. The review period was from September 2012 to November 2023. The total number of reviews was 3732, including Gucci (n=811), Louis Vuitton (n=714), Dior (n=701), Hermès (n=442), Chanel (n=347), Balenciaga (n=272), Burberry (n=216), YSL (n=134), Prada (n=75), and Cartier (n=20). RStudio software was used for data analysis. Before assessing data analysis, data pre-processing was employed by conducting tokenization, text cleaning (e.g., lowercase, stemming, stopwords, punctuation, and white space), and document term matrices. After removing 18,519 of 92,988 tokens due to the frequency within 25 documents, the total corpus was 3,691 documents, 4,176 terms, and 74,469 tokens.

Results & Discussion

Structural topic model (STM) analysis was assessed to find topics associated with data. Unlike the Latent Dirichlet Allocation (LDA) method, STM enables to setting up of a model of how document-level covariates influence the parameter of topical prevalence under the generalized linear model. By setting the review date as a covariate in our model, we compared semantic coherence and exclusivity, held-out likelihood, residuals, and lower bound to find the optimized numbers of topics. As a result, 20 topics were shown to be the best to describe the dataset. Each topic was enumerated into three stages in the customer journey. In brief, the results reveal three topics associated with pre-purchase, seven topics related to purchase, and ten topics associated with the post-purchase stage (Table 1). In the pre-purchase stage, consumers stayed in an online channel while revealing their searching behaviors (e.g., connecting with brands and finding information about brands) (Topic 11). In addition, consumers look for intangible value, such as brand reputation, over product information (Topic 10). The findings are consistent with traditional marketing literature that customers seek out need recognition to justify purchase decisions by increasing expected satisfaction by reading others' experiences on the web (Lemon & Verhoef, 2016). In the purchase stage, individuals prefer to go to physical stores to gain experiential values (e.g., store atmosphere) (Topic 7), while they use online channels to achieve utilitarian values (e.g., order) (Topic 16). Consumers also revealed an extreme service inconsistency (Topic 1 versus Topic 5). This result may explain how retailers can strategize each channel in an omnichannel context. For example, to mitigate showrooming and webrooming effects, luxury retailers utilize prestigious in-store experiences that consumers are compelled to make purchases on-site. Simultaneously, store managers can leverage these positive in-store experiences to guide customers towards online channels for unavailable items in-store. Lastly, the topics related to the post-purchase stage show that customers are interested in recovery service requests such as fixing the products (Topic 4). Based on our results, luxury brands have mostly failed to offer a good quality of after-services (Topic 9). The literature notes that the post-purchase stage is a loyalty loop where consumers may trigger brand love or hate (Lemon & Verhoef, 2016). Therefore, luxury brand managers should meticulously treat after-service to draw repurchases from existing customers and attract potential customers who view these reviews.

Table 1. STM Results

Topic #	Main Themes	Top Words	Topic Proportions
Pre-Purchase Stage			
Topic 10	Information Seeking	brand, like, make, made, better, think, feel	5.29%
Topic 11		call, email, week, contact, tri, later, time	6.85%
Topic 13		compani, review, read, speak, write	4.71%
Purchase Stage			
Topic 1	Delightful Service	love, peopl, price, know, person, need, sale	5.48%
Topic 3		great, thank, amaz, beauti, free, excel, perfect	6.80%
Topic 7		store, look, staff, want, rude, like, boutique	5.34%
Topic 5	Horrid Service	said, help, custom, totla, refus, ignor, spok	4.03%
Topic 6		terribl, disgust, support, star, tri, sick	4.53%
Topic 16	Purchase Experience	order, onlin, arriv, ship, place, gift, websit	7.27%
Topic 8		purchase, product, bought, everi, recommend, sever,	4.35%
Post-Purchase Stage			
Topic 2	Repair	sotre, repair, exchang, client, ask, told, sale	3.79%
Topic 4		good, year, high, expect, design, replac, recent	4.51%
Topic 9		phone, month, number, answer, last, messag	4.44%
Topic 12	Service Failure	mney, want, disappoint, happen, away, took,	4.78%
Topic 14		qualiti, poor, wear, time, month, cost, start	5.81%
Topic 15		worst, shop, issu, mang, team, clear, care	4.55%
Topic 17		wait, send, time, told, horribl, card, cancel	4.50%
Topic 18	Return Process	receiv, refund, deliveri, packag, deliv, next track	5.71%
Topic 19		return, process, pleas, inform, say, collect, polici	3.91%
Topic 20	Parcel	parcel, label, investig, open, provid, case, left	2.90%

Conclusion

Using a big data-driven method, this study contributes to the theory of customer experience and customer journey by empirically exploring prominent consumer experiences at each stage of the luxury fashion brand shopping. Practically, managers can prioritize intangible assets like brand reputation during the pre-purchase stage. Additionally, addressing service inconsistencies across various channels during the purchase stage is crucial. For online channels, enhancing service quality through improved AI-enhanced chatbot systems and employee education is recommended.

References

Cai, Y. J., & Choi, T. M. (2023). Omni-channel marketing strategy in the digital platform era. *Journal of Business Research*, *168*, 114197.

Hirschman, E. C., & Holbrook, M. B. (1982). Hedonic consumption: emerging concepts, methods and propositions. *Journal of Marketing*, *46*(3), 92-101.

Lemon, K. N., & Verhoef, P. C. (2016). Understanding customer experience throughout the customer journey. *Journal of Marketing*, *80*(6), 69-96.

Liu, X., Shin, H., & Burns, A. C. (2021). Examining the impact of luxury brand's social media marketing on customer engagement: Using big data analytics and natural language processing. *Journal of Business Research*, *125*, 815-826.

Verhoef, P. C., Lemon, K. N., Parasuraman, A., Roggeveen, A., Tsiros, M., & Schlesinger, L. A. (2009). Customer experience creation: Determinants, dynamics and management strategies. *Journal of Retailing*, *85*(1), 31-41.

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INVESTIGATTING CONSUMER PERCEPTION OF PRICE, QUALITY, AND VALUE AS ANTECEDENTS OF ADOPTING WEARABLE TECHNOLOGY PRODUCTS AMONG GEN Z

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Introduction

Wearable technology refers to smart electronic devices that can be integrated into clothing or worn on the body as an accessory or as a component of material used in clothing (Chandel et al., 2022; Chotiyaputta & Shin, 2022; Dehghani et al., 2018). Wearable devices have attracted consumers' attention and adoption as the wearable devices market continues to grow with a variety of wearable products. However, there is a lack of understanding of consumers' perceptions and adoption toward wearable devices, since these are still in the introduction stages of new innovative products' lifecycles (Chotiyaputta & Shin, 2022; Kim & Shin, 2015). Despite recent attention and growth given to wearable devices, consumer-driven factors influencing adoption and use of wearable devices have been overlooked (Choi & Kim, 2016). Therefore, the purpose of this study is to investigate factors that influence consumers' perceptions and adoption of these wearable devices, based on Zeithaml's model (1988) related to consumer perceptions of price, quality, and value. Attributes of consumers' perceived price, quality, and value were also comprehensively examined as antecedents of adoption of wearable devices.

Literature Review

Zeithaml's model (1988) proposes when consumers engage in making purchase decisions, they are influenced by perceptions of various levels, which range from simple product quality attributes to complex personal values. This model suggests consumer perceptions of value influence purchase decisions and their perceived value are determined, based on perceptions of quality and price. Perceived quality is filtered through perceived value, which affects the relationship between perceived quality and purchase. Additionally, perceived price consisting of monetary and nonmonetary components are regarded as a potential indicator of product quality. Based on Zeithaml's model (1988), a conceptual model was developed to hypothesize that perceived price, quality, and value significantly influence users' adoption of wearable devices. This model postulates (1) perceived price is determined by users' perceived monetary price and perceived non-monetary price which includes privacy and security concerns; (2) perceived quality is represented by aesthetics, comfort, functionality, and durability; (3) perceived value is signified by utilitarian value, hedonic value, ease of use, aesthetic value, and health value. An empirical test of these hypothesized attributes in users' perceived quality, price, and value could provide a valuable, comprehensive understanding of the antecedents of users' perceptions and adoption of wearable devices.

Research Method

A total of 2,000 female and 2,000 male college students at a large Midwestern university were recruited for a web-based survey. Participants were asked to browse information about Apple Watch Series 8 for five minutes. In the survey, participants were asked to check off the browsing website and wearable device they reviewed as a validity check. Established or modified instruments with reliabilities above .70 were used to measure the attributes of perceived price, quality, value, attitude toward wearable devices, and purchase Intention. For example, utilitarian and hedonic values of wearable devices were assessed by modified Babin et al.'s (1994) hedonic and utilitarian shopping value scales with reliabilities of .93. Data analysis consisted of descriptive sample analysis, preliminary analysis for reliability and construct validity, exploratory and confirmatory factor analyses, and structural equation model (SEM) using IBM SPSS 29 and AMOS 25.

Results

A total of 177 college students responded with a usable response rate of 4.42%. After list-wise deletion of missing data, a total of 103 responses were deemed acceptable for further analysis. The ages of the

respondents ranged from 18 to 24, and the respondents' mean age was 21.07 years (SD = 1.27). Female student respondents were 82.4%, and male student respondents were 17.6%. A majority of the respondents were European American (80.8%), followed by Asian or Asian American (9.6 %), Black or African American (5.8%), Latino or Hispanic American (1.9%), and other ethnicities (1.9 %). Results showed the measurement model did fit the data well: χ^2 (118, n = 103) = 156.20, p < .05; SRMR = .10, RMSEA = .06, CFI = .96, IFI = .96. Although χ^2 was significant and the SRMR value was greater than .08, the other fit indices, such as the RMSEA value of .06 and the CFI value of .96, provide evidence of an adequate fitting model (Hu & Bentler, 1999). The results implied the parameters for the five constructs reflect the hypothesized dimensionality with validity measures, supporting the postulations of the conceptual model. The hypothesized model consisted of one exogenous variable (perceived price) and four endogenous variables (perceived quality, perceived value, attitude toward product, and purchase intention). Each latent construct was represented with multiple parameters in each observed construct created through item parceling. Results showed the proposed model revealed χ^2 (130, n = 103) = 179.30, p < .001 with SRMR of .06, RMSEA of .06, CFI of .95, and IFI of .95. The χ^2 goodness-of-fit statistic was significant, detecting a difference between the observed sample covariance and the model-estimated covariance. However, SRMR, RMSEA, CFI, and IFI showed the proposed model yielded a good fit with the data. There were positive, significant effects of perceived quality on perceived value (β = .49, t = 3.90, p < .001). Consumers who perceived higher value responded with a more favorable attitude toward a product (β = .51, t = 3.67, p < .001). As hypothesized, attitude toward product positively influenced purchase intention (β = .31, t = 2.55, p < .01). That is, respondents who perceived higher quality of the product perceived more value of the product, resulting in more favorable attitude toward the product and greater purchase intention. No significant effect of perceived price was found on perceived quality, perceived value, attitude toward product, and purchase intention.

Discussion

Results indicate consumers' perceived quality and value of the smart watch significantly and positively influenced attitude toward product and purchase intention. Interestingly, perceived quality influenced attitude toward product and purchase intention, mediated through perceived value. Unexpectedly, consumers' perceived price of the smart watch did not influence perceived quality and value of the smart watch nor attitude toward product and purchase intention. Inconsistent with previous studies (Arias et al., 2015; Li et al., 2016), this study shows an insignificant price-quality relationship for the wearable tech product. But, findings verified the significant, positive effect of perceived quality, attributed by aesthetics, comfort, functionality, and durability, on attitude toward the wearable tech product and purchase intention, consistent with previous studies (Dvorak, 2007; Duval & Hashizume, 2005; Kuru & Erbuğ, 2012).The results also support consumers' perceived value of the wearable technology product, attributed by hedonic, utilitarian, ease of use, aesthetic, and health values, mainly drove their purchase intention in line with the previous studies (Chuah et al., 2016; Spagnolli et al., 2015; Yang et al., 2016). This study theoretically contributes to development of theoretical linkages previously untested—among consumer perceptions of perceived price-quality-value in the process of purchasing wearable tech products—based on Zeithaml's model (1988). Findings from this study have managerial implications for wearable technology manufacturers, marketers, and retailers in relation to wearable technology products. As many wearable technology products from smart watches to fitness trackers are flooding the market, wearable technology marketing needs to highlight values (e.g., hedonic, utilitarian, ease of use, aesthetic, and health values) and qualities (e.g., aesthetics, comfort, functionality, and durability) that could capture the attention of potential customers. It is crucial to identify which values and qualities can effectively market wearable technology products. As target consumer segments can vary, such as fitness enthusiastic, health-valued, tech-savvy, aesthetic-valued consumers, wearable technology-related marketers and retailers should develop a deeper understanding about their target consumers' needs, based on key attributes of product qualities and values.

References

Arias, O., Wurm, J., Hoang, K., & Jin, Y. (2015). Privacy and security in internet of things and wearable devices. *IEEE Transactions on Multi-Scale Computing Systems*, *1*(2), 99-109.

Babin, B. J., Darden, W. R., & Griffin, M. (1994). Work and/or fun: measuring hedonic and utilitarian shopping value. *Journal of consumer research*, *20*(4), 644-656.

Choi, J., & Kim, S. (2016). Is the smartwatch an IT product or a fashion product? A study on factors affecting the intention to use smartwatches. *Computers in Human Behavior*, *63*, 777-786.

Chotiyaputta, V., & Shin, D. (2022). Explicating consumer adoption of wearable technologies: A case of smartwatches from the ASEAN perspective. *International Journal of Technology and Human Interaction,* 18(1), 1-21.

Chandel, R. S., Sharma, S., Kaur, S., Singh, S., & Kumar, R. (2022). Smart watches: A review of evolution in bio-medical sector. *Materials Today: Proceedings*, *50*, 1053-1066.

Chuah, S. H. W., Rauschnabel, P. A., Krey, N., Nguyen, B., Ramayah, T., & Lade, S. (2016). Wearable technologies: The role of usefulness and visibility in smartwatch adoption. *Computers in Human Behavior*, *65*, 276-284.

Dehghani, M., Kim, K. J., & Dangelico, R. M. (2018). Will smartwatches last? Factors contributing to intention to keep using smart wearable technology. *Telematics and Informatics*, *35*(2), 480-490.

Duval, S., & Hashizume, H. (2005, December). Perception of wearable computers for everyday life by the general public: impact of culture and gender on technology. In *International Conference on Embedded And Ubiquitous Computing* (pp. 826-835). Berlin, Heidelberg: Springer Berlin Heidelberg.

Dvorak, J. L. (2007). *Moving wearables into the mainstream: Taming the Borg*. Springer Science & Business Media.

Kim, K. J., & Shin, D. H. (2015). An acceptance model for smart watches: Implications for the adoption of future wearable technology. *Internet Research*, *25*(4), 527-541.

Kuru, A., & Erbuğ, Ç. (2013). Explorations of perceived qualities of on-body interactive products. *Ergonomics*, *56*(6), 906-921.

Li, H., Wu, J., Gao, Y., & Shi, Y. (2016). Examining individuals' adoption of healthcare wearable devices: An empirical study from privacy calculus perspective. *International Journal of Medical Informatics*, *88*, 8-17.

Spagnolli, A., Guardigli, E., Orso, V., Varotto, A., & Gamberini, L. (2015, October). Measuring user acceptance of wearable symbiotic devices: validation study across application scenarios. In *International Workshop on Symbiotic Interaction* (pp. 87-98). Springer, Cham.

Yang, H., Yu, J., Zo, H., & Choi, M. (2016). User acceptance of wearable devices: An extended perspective of perceived value. *Telematics and Informatics*, *33*(2), 256-269.

Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence. *The Journal of marketing*, 2-22.

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Graduate Student Research Competition
Session 1. Clothing Science / Textile Science

Chair: Dr. Changsang Yun, Ewha Womans University

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† : Student presenter

AUTOMATIC GENERATION OF ZERO-WASTE MARKER USING CONVENTIONAL PATTERNS

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Introduction

The fashion industry is considered one of the most polluting industries due to a high consumption of energy and raw materials as well as of waste generation. Approximately 1 billion tons of clothing are produced worldwide each year, with only about 15% being recycled, while the remaining 75% is either incinerated or disposed of in landfills, posing a significant impact on the environments. Therefore, a global solution is urgently needed.

Sustainable product development is a key to achieve sustainable fashion (M Aakko, 2013), and especially pattern making could be one key to reducing unnecessary waste. In cut-and-sew garment production, the average waste of fabric from the cutting process is 10-20% (Rissanen, 2013). The reason for the waste is that pattern pieces for most apparel items have irregular shapes that do not perfectly join together like puzzle pieces. The concept of ZWPC (zero-waste pattern cutting) emerged to overcome the problems of waste, which is a concept and a design philosophy that aims to utilize the whole area of fabric within a given length for making one or more garments (Carrico & Kim, 2014). Creative pattern cutting is imperative to achieve zero-waste fashion design and it is challenging since it requires mathematical thinking to get pieces interlocked perfectly and get the proportions right simultaneously. In this study, we developed an automated zero-waste pattern CAD system that can automatically transform conventional patterns into zero-waste patterns.

Literature Review

Professionals in apparel design and product development face a major challenge in integrating innovative patternmaking techniques, fashion design aesthetics, and fabric waste reduction (McKinney et al., 2020). Despite the fashion industry's efforts to use various technologies to reduce fabric waste, it has not yet been succeeded in completely eliminating waste during the fabric cutting process. Various approaches to ZWPC, such as the tessellation, jigsaw, embedded jigsaw, multiple cloth and minimal cut have been introduced (Carrico & Kim, 2014), but many of these approaches are tied to the particular fabric width and finished garment size they are presented in. It has great limitation in that the zero-waste design cannot be maintained even with small changes such as the width of the fabric, clothing size, and changes of small design details. Furthermore, it has the limitation of relying heavily on the pattern designer's skills for achieving the desired final appearance. Previous research attempted to transform conventional patterns into zero-waste patterns but these attempts primarily focused on improving efficiency in marker for specific styles only (Simões & Almendra, 2018). Furthermore, previous research mainly limited itself to introducing various design examples (Carrico & Kim, 2014) and categorizing various ZWPC approaches (McKinney, E. et al, 2020) or developing new designs within the framework of ZWPC (Saeidi & Wimberley, 2018).

Zero waste pattern making can be an impactful solution to the textile waste problem in the clothing industry. However, it comes with significant challenges, including the need to redesign patterns for each minor change in fabric width or slight alterations in pattern shapes, which can be cumbersome and time-inefficient. Hence, research into automating zero waste pattern creation is essential. However, there has been no existing research that has developed a new CAD system capable of automatically transforming conventional patterns into zero waste patterns.

Research Method

The normal actual sized conventional patterns were used and the preparation process included unfolding the fold lines and duplicating the symmetrical patterns. We allowed users to set the fabric width and length as the parameter and manually place the conventional patterns on the fabric. In this study, morphological image processing was utilized to recognize conventional patterns and an image expansion method of dilation was used to completely fill all the discarded spaces of the rectangular fabric. A new algorithm was developed which conventional pattern pieces' edges repeatedly expand until they meet each other or reach the edge of the fabric. When new pixels generated from different patterns meet each other, a new cutting lines are created.

This study also designated some rules to find the changed sewing lines in order to track where the sewing lines from the original pattern went in the new dilated zero-waste pattern. The starting position of the vertices from a reference point and the ratio of the length of the sewing lines to the total outline of the original pattern pieces were obtained. Obtained location and ratio values were applied to the modified zero-waste pattern to enable the creation of new sewing lines. This study also explored the conditions of the open parts (unsewn areas) and closed parts (sewn areas) of pattern edges to ensure that garments are properly simulated without falling off the body. Patterns were classified into main patterns and detail patterns based on their area, to be sewn onto the bodice. Rules were established for the main patterns to have openings for the head, arms, and legs, and minimum and maximum values were set to create new sewing lines. Detail patterns were designed to connect to one or more edges of the main pattern, allowing for the creation of new designs. After that, the newly developed patterns were extracted in DXF format to proceed with virtual fittings. Afterward, we enabled pattern modifications through dart creating, seamline additions, and seamline adjustments and sewing specification modification functions.
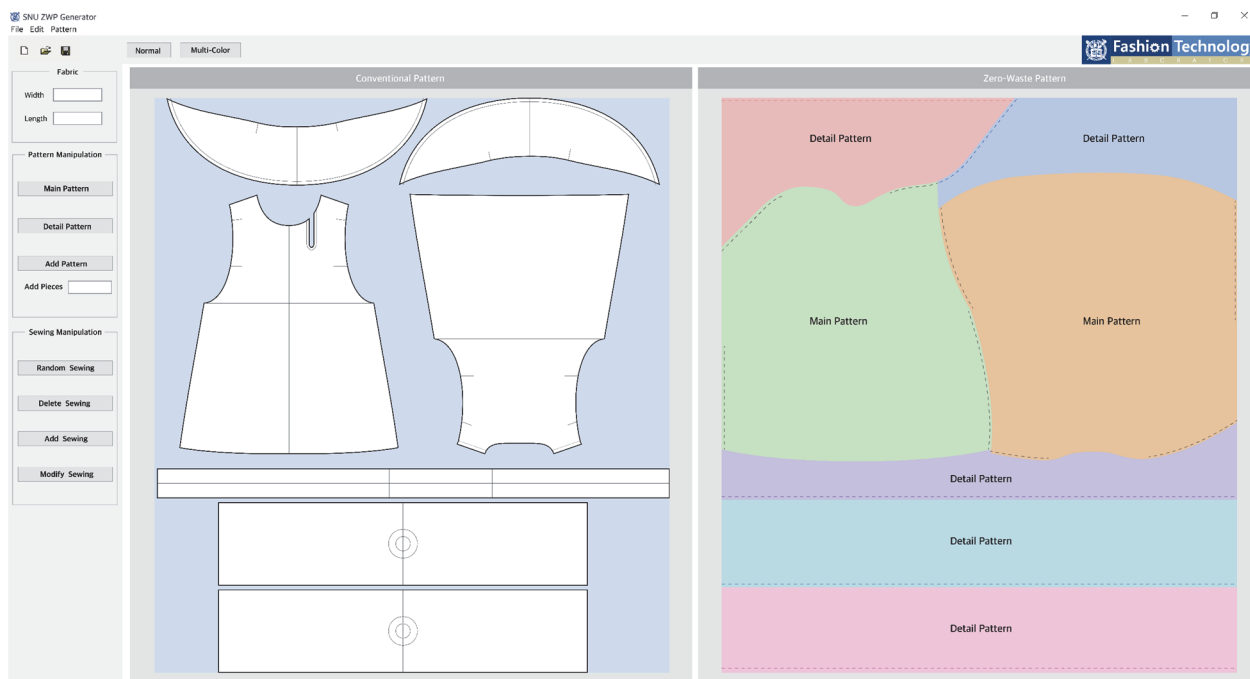
Results & Discussion

Depending on the initial pattern placement by the user, a new zero-waste marker can be created. This allows for the comparison of patterns that vary with different arrangement, enabling the selection of the most suitable ones to generate creative designs. By using this program, the efficiency of the marker is significantly increased as it brings any pattern up to 100% efficiency, regardless of the pattern used.
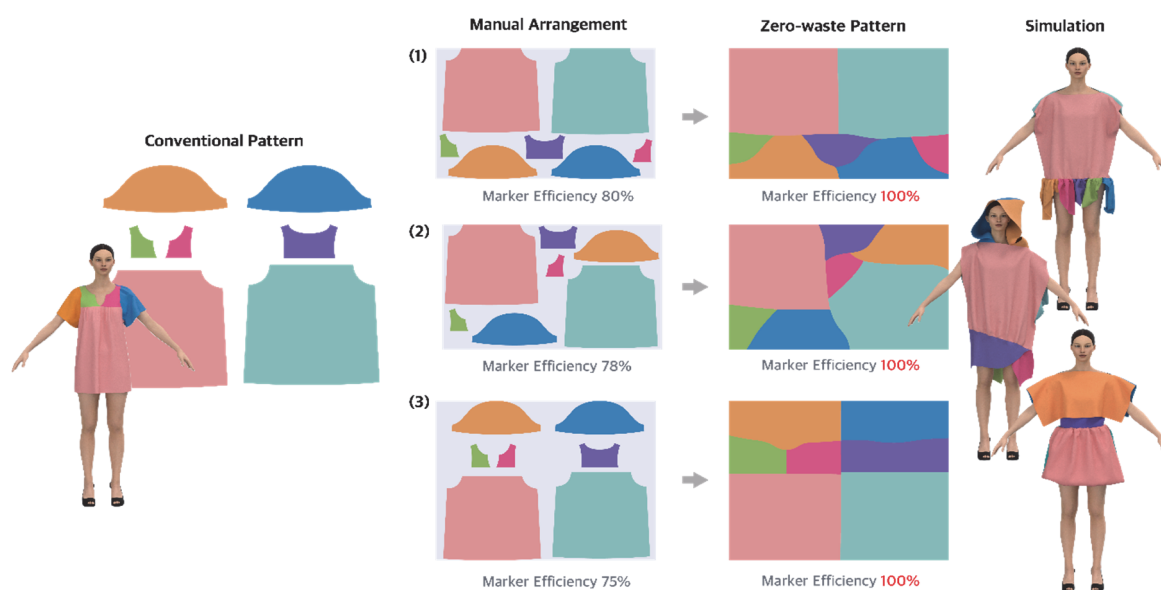
Conclusion

In this study, we developed a pattern CAD system that automatically transforms conventional patterns into zero-waste patterns according to the user's desired fabric width. Previously, a significant time investment was required to develop a new zero-waste pattern. However, using the program developed in this study, it is expected to significantly reduce the time needed for this process. Moreover, this research holds significance as the first attempt to automatically transform conventional patterns into zero-waste patterns. The utilization of this research result is expected to significantly reduce fabric waste in the garment production stage in apparel industry, and it is anticipated that both fashion designers and non-professionals will find it easier to think creative designs within the framework of ZWPC.

Acknowledgement

References

Aakko, M., & Koskennurmi-Sivonen, R. (2013). Designing sustainable fashion: Possibilities and challenges. Research Journal of Textile and Apparel, 17(1), 13-22.

Carrico, M., & Kim, V. (2014). Expanding zero-waste design practices: A discussion paper. International Journal of Fashion Design, Technology and Education, 7(1), 58-64.

McQuillan, H., Archer-Martin, J., Menzies, G., Bailey, J., Kane, K., & Fox Derwin, E. (2018). Make/Use: a system for open source, user-modifiable, zero waste fashion practice. Fashion Practice, 10(1), 7-33.

McKinney, E., Cho, S., Zhang, L., Eike, R., & Sanders, E. (2020). Analysis of zero waste patternmaking approaches for application to apparel. Sustainability in the textile and apparel industries: Sustainable textiles, clothing design and repurposing, 31-51.

Rissanen, T. I. (2013). Zero-waste fashion design: a study at the intersection of cloth, fashion design and pattern cutting (Doctoral dissertation).

Saeidi, E., & Wimberley, V. S. (2018). Precious cut: exploring creative pattern cutting and draping for zero-waste design. International Journal of Fashion Design, Technology and Education, 11(2), 243-253.

Simões, A., & Almendra, R. (2018). Pilot study to convert an existing model into a zero waste pattern and cutting system. In Textiles, Identity and Innovation: Design the Future (pp. 29-34). CRC Press.

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DEVELOPMENT OF LIFTING-ASSISTIVE PANTS DESIGNS TO PREVENT FROM MUSCULOSKELETAL DISEASE AND DISORDERS FOR SENIORS

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Introduction

Construction work involves diverse tasks, irregular hours, manual handling of materials or tools in awkward positions, and fast-paced work in dynamic environments (Antwi-Afari et al., 2021; Kim et al., 2019). Musculoskeletal disorders constitute approximately 77% in construction workers (Reddy et al., 2016). Low back pain is prevalent at 83% (Purani et al., 2016), and construction workers commonly experience musculoskeletal pain in the lower extremities, with hip (13.2%), and knee (16.6%) (Bashir et al., 2020). To combat these issues, wearable assistive systems aim to augment, enable, assist and/or enhance physical activity by providing physical support through torque (Antwi-Afari et al., 2021; Kim et al., 2019). Therefore, this study aimed to develop a fabric-based lifting-assistive pants for seniors in industrial sites to prevent from musculoskeletal diseases and disorders.

Literature Review

Compared to traditional exoskeletons, passive soft wearables replace hard, large, and rigid components with soft, lightweight, thin, and flexible materials. These wearables, lacking actuators, are entirely passive systems, utilizing elastic materials like springs, bands, or dampers to store energy from human movement. This stored energy assists with posture or movement when needed (de Looze et al., 2015). These devices are trending in wearables due to their flexibility, adaptability, portability, comfort, compatibility, and multifunctional capabilities (Chiaradia et al., 2018; Xing et al., 2020). With aging, especially between 50-60 years, skeletal muscle force generation declines due to fewer motor units and muscle atrophy, leading to challenges in common physical tasks for older adults, such as lifting and carrying objects (Hollmann et al., 2007; Williams et al., 2002). Hence, soft lifting assistive pants for seniors should prioritize comfort and ease of wear, with a focus on minimizing weight to reduce energy expenditure.

Research Method

The lifting assistive pants were developed to prevent musculoskeletal disorders in elderly individuals, using various literature such as apparel design for elders, studies related to flexible exosuits, and evaluation systems. Additionally, workwear is subjected to a rigorous industrial washing process during distribution. To ensure proper care and maintenance during the wash cycle, the materials were tested for dimensional change to washing, tensile strength, and pilling resistance (European Textile Service Association [ETSA], 2016). Thus, the study evaluated the performance of PFPs for workwear, focusing on a polyester /cotton blend fabric and elastic bands. To verify the effectiveness of the weightlifting assistive trousers, electromyographies (biceps femoris, rectus femoris) were attached to each of the participant's muscles in order to compare the electromyography (EMG) values of specific muscles. Additionally, to confirm the physical condition (e.g., comfort) while wearing the PFP, participants wore an electroencephalograph (EEG) machine, model DSI-24 (Wearable Sensing, Inc.), for brainwave testing.

Results & Discussion

The fabric (P 63%, C 37%) meets the ETSA (2016) requirement, with polyester content not less than 30%. Pilling test results (ISO 12945-2:22) score 4-5, indicating excellent performance. Washing dimension change rates align with ISO 5077:2011 and ISO 6330:2012 standards (-0.7% warp, -1.5% weft) for fabrics with less than 50% cotton. Tensile strength meets industrial worker wear requirements (1800 N warp, 670 N weft) (Kim et al., 2022). The fabric is suitable for construction industry garments. Elastic banding, common in garments, has not been used in textile robot development (Suulker et al., 2022). Comprising braided polyester and thin rubber, it is durable and flexible. Tensile and elasticity tests (ISO 13934-1:2013

and ISO 20932-1:2022-02) confirm excellent performance, supporting 5cm and 6.5cm elastic bands as PFPs for aiding worker movement during lifting tasks. Two PFP versions include waist protectors, knee pads, and elastic bands. Adjustable supportive elements fit individual body shapes, and zippers allow convenient removal. An orthogonal elastic band between bi-articular tendons supports lateral movement and angle adjustment (Yun et al., 2021). Considering muscle dimensions, 5cm and 6.5cm elastic bands are used in the waist protector and legs, respectively (Lamers et al., 2018). I-type pants feature straight elastic bands for consistent lower extremity muscle support, while Y-type pants have Y-shaped bands for broader support, stabilizing muscles and evenly distributing forces.

Conclusion

This study developed a fabric-based lightweight PFPs using fabric and elastic materials to reduce thigh muscle activities including biceps femoris and rectus femoris during deep squat lifting for seniors. The elastic band was used to store energy collected during the squatting action and then release the stored energy to help the worker stand up. These pants provide strength assistance to industrial workers to reduce musculoskeletal diseases and disorders caused by repetitive or sustained squatting tasks. Future work will focus on examining the comparison of wearing different types of PFPs with thigh muscle surface electromyographic activity to determine the adjunctive effects of PFPs, and evaluating the sense of wear and effectiveness of PFPs via brain waves and questionnaires.

References

Antwi-Afari, M. F., Li, H., Anwer, S., Li, D., Yu, Y., Mi, H.-Y., & Wuni, I. Y. (2021). Assessment of a passive exoskeleton system on spinal biomechanics and subjective responses during manual repetitive handling tasks among construction workers. *Safety Science*, *142*, 105382. https://doi.org/10.1016/j.ssci.2021.105382

Chiaradia, D., Xiloyannis, M., Solazzi, M., Masia, L., & Frisoli, A. (2018). Comparison of a soft exosuit and a rigid exoskeleton in an assistive task. *Biosystems & Biorobotics*, 415–419. https://doi.org/10.1007/978-3-030-01887-0_80

de Looze, M. P., Bosch, T., Krause, F., Stadler, K. S., & O'Sullivan, L. W. (2015). Exoskeletons for industrial application and their potential effects on physical work load. *Ergonomics*, *59*(5), 671–681. https://doi.org/10.1080/00140139.2015.1081988

European Textile Service Association [ETSA]. (2016). *ETSA requirements for workwear fabrics*. European Textile Service Association.

Hollmann, W., Strüder, H. K., Tagarakis, C. V. M., & King, G. (2007). Physical activity and the elderly. *European Journal of Cardiovascular Prevention & Rehabilitation*, *14*(6), 730–739. https://doi.org/10.1097/hjr.0b013e32828622f9

Kawamoto, H., & Sankai, Y. (2002). *Comfortable power assist control method for walking aid by HAL-3*. https://doi.org/10.1109/icsmc.2002.1173328

Kim, Y., Kim, J., Lee, D., Piao, J., Bae, J., & Koo, S. (2022). Development of clothing-type platforms considering pressure and user satisfaction: focusing on industrial workers who tend to lift loads. *Textile Research Journal*, *93*(9-10), 2226-2241.

Lamers, E. P., Yang, A. J., & Zelik, K. E. (2018). Feasibility of a biomechanically-assistive garment to reduce low back loading during leaning and lifting. *IEEE Transactions on Biomedical Engineering*, *65*(8), 1674–1680. https://doi.org/10.1109/tbme.2017.2761455

Purani, r., Shah, n., & Sharma, S. (2016). Prevalence of musculoskeletal disorders in construction workers in gujarat: a cross sectional survey. *International Journal of Therapies and Rehabilitation Research*, *6*(3), 52. https://doi.org/10.5455/ijtrr.000000283

Reddy, GopireddyM. M., Nisha, B., Prabhushankar, T., & Vishwambhar, V. (2016). Musculoskeletal morbidity among construction workers: A cross-sectional community-based study. *Indian Journal of Occupational and Environmental Medicine*, *20*(3), 144. https://doi.org/10.4103/0019-5278.203134

Sung, S. Y., Kim, K., Ahn, J., & Cho, K.-J. (2021). Body-powered variable impedance: An approach to augmenting humans with a passive device by reshaping lifting posture. *Science Robotics*, *6*(57). https://doi.org/10.1126/scirobotics.abe1243

Suulker, C., Skach, S., & Althoefer, K. (2022). Soft robotic fabric actuator with elastic bands for high force and bending performance in hand exoskeletons. *IEEE Robotics and Automation Letters*, *7*(4), 10621–10627. https://doi.org/10.1109/lra.2022.3194883

Williams, G. N., Higgins, M. J., & Lewek, M. D. (2002). Aging skeletal muscle: physiologic changes and the effects of training. *Physical Therapy*, *82*(1), 62–68. https://doi.org/10.1093/ptj/82.1.62

Xing, L., Wang, M., Zhang, J., Chen, X., & YE Xiao-dong. (2020). A survey on flexible exoskeleton robot. *2020 IEEE 4th Information Technology, Networking, Electronic and Automation Control Conference (ITNEC)*. https://doi.org/10.1109/itnec48623.2020.9084920

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DEVELOPMENT OF 3D HUMAN MODELING SYSTEM CONSIDERING BODY SHAPE DIVERSITY

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Introduction

Apparel industry has recently undergone a rapid digitization, driven by the introduction of automated production systems to meet the evolving demands of individual consumers in the e-commerce landscape. However, providing services online that accurately reflect customers' body shapes and sizes remains a challenge. With the increasing awareness of the potential of virtual reality and 3D technology to address return issues, there is a growing demand for 3D body generation that incorporates customers' body shapes. While the National Institute of Standards and Technology provides 3D human body data, including dimensions and shapes, for clothing design, additional manual mesh cleaning is required due to issues such as occlusion during scanning. Therefore, there is a need for the development of technology that can easily generate avatars closely resembling actual body shapes from information obtained through 3D full-body scanners.

Literature Review

Recently, technologies such as Virtual Fitting Rooms (VFR) and personalized virtual bodies have gained attention as means to increase consumer curiosity about products and reduce return rates (Holte, 2020; Beck & Crié, 2018; Song et al., 2018). Utilizing a 3D full-body scanner, which provides the most accurate dimensional and shape information, is an essential method for creating virtual bodies that consider the actual characteristics of the human body (Lee & Xu, 2020; Balach et al., 2020). However, 3D full-body scanners face challenges in obtaining precise data due to inaccuracies in posture or occlusion issues (Gill, 2015). In the field of garment design, 3D virtual bodies are actively used to reflect the characteristics of body shapes. Still, avatars created within 3D software programs often fail to accurately replicate real-world shapes (Alfredo & Rodriguez, 2016; Lee & Jang, 2020). Consequently, there is an increasing level of inaccuracy in garment pattern design. Therefore, there is a growing need for research on avatar creation technologies that utilize 3D body scan information to reproduce actual body shapes (Hong, 2020).

Research Method

In this study, a technique was developed for modeling a 3D human body with a regular mesh structure while preserving the actual body shape. To achieve this, 3D shape data of 734 women aged 20 to 55 from Size Korea, provided by the Korean Agency for Technology and Standards, was used and outliers were not removed to encompass various body shapes. Measurement reference points were set at the shoulders, chest, waist, abdomen, and hips, with additional considerations for circumferences related to some body types, such as hip circumference and waist circumference at the navel level. Additionally, key factors addressed in previous research, such as height and weight, were included. Sleeves, deemed less crucial for considering body shape changes despite their impact on the garment's fit, were excluded in this study (Rita, A. A., 2021). Next, the human body was modeled while preserving the 3D body shape and smoothing the mesh. Mesh smoothing was applied to address empty spaces occurring in local areas. Finally, to assess the similarity between 3D scan data and the generated body model, they were overlapped, and the similarity was verified. This process was automated using artificial intelligence algorithms, allowing for a quantitative evaluation of the differences and similarities between the two body models.

Results & Discussion

In this study, based on waist, chest, and hip circumferences, three major clusters were identified, classifying them into [3] upper, [2] half, and [1] regular hourglass shapes. The BMI and age within each cluster showed

similar patterns at the P < 0.001*** level. Cluster 1 (n = 248) exhibited a body shape where hip and chest circumferences were nearly identical, but the chest was larger than the hips, predominantly featuring [5] rectangular (31.5%), [7] oval (39.1%), and [9] inverted triangle (29%) shapes. Notably, a unique body shapes in Cluster 1, an oval shape with a significantly larger waist circumference than the chest and hips was observed. Cluster 2 (n = 161) generally displayed a chest-to-waist ratio lower than the hourglass shape, with the [4] spoon (78.9%) shape being the most prevalent among the nine body types analyzed. Among the unique body shapes, an hourglass shape with a noticeable difference in chest and hip proportions compared to the waist was identified in Cluster 2. Cluster 3 (n = 325), representing the highest distribution of Koreans among hourglass shapes, predominantly featured [6] diamond (9.8%) and [8] triangle (90.2%) shapes. Korean body shapes typically involve larger hips than the chest, aligning with Cluster 3, which accounted for approximately 70% of the entire clusters. Among the unique body shapes in Cluster 3, a triangular form with waist and hip circumferences nearly identical and larger than the chest was identified. Using the results of body shape analysis, this study generated 3D real and virtual body models using artificial intelligence algorithms, demonstrating a high degree of similarity between the two bodies through an automated body creation system.
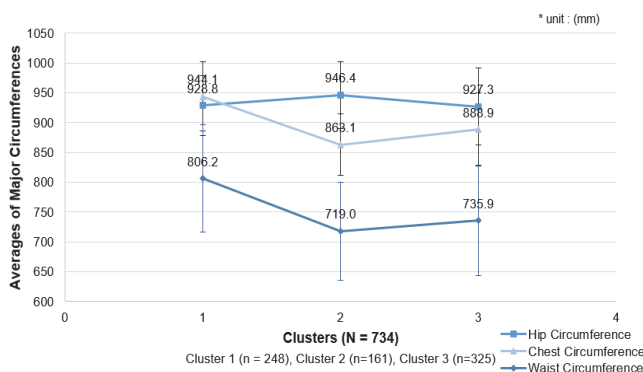
Figure 1. Cluster Analysis based on
Key Body Dimensions (Hip, Chest, Waist)
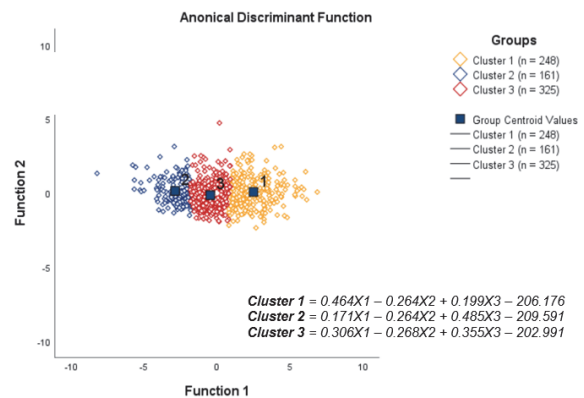
Figure 2. Discriminant Functions and
Analytical Results by Clusters

Plus, most importantly, the study introduces a system designed to offer personalized services by leveraging the process of generating 3D models from real scanned human bodies. Initially, the mesh derived from 3D scan data undergoes surface optimization to achieve smoothness, followed by segmentation to distinguish various body parts. Subsequently, the system employed a comparison method using edge points between the Real Body and the Ideal Body to introduce variations from the real body into the regenerated 3D body. This innovative approach addresses a common limitation in similar software, where incomplete mesh shapes are entirely removed during rendering or smoothing processes. By superimposing real bodies and customized real body models for comparison, the study observed a remarkably high similarity in the cross-sectional area and proportions of major body regions. Building upon the findings of this study, future endeavors will integrate an algorithm that aligns with classes grouping individuals sharing similar characteristics. This algorithm will enable seamless coordination with Body Classification, facilitating automatic classification of body types based on users' body shapes. Furthermore, the aim is to incorporate individual body shapes and patterns automatically to offer mass-customized patterns. This initiative seeks to provide realistic, personalized 3D body models, thereby enhancing consumer engagement across various domains such as Virtual Fitting Rooms (VFR) or Augmented Reality (AR). Moreover, by realizing a more efficient apparel design and production system, this solution aims to elevate consumer satisfaction through tailored solutions that precisely cater to their fit preferences and requirements.
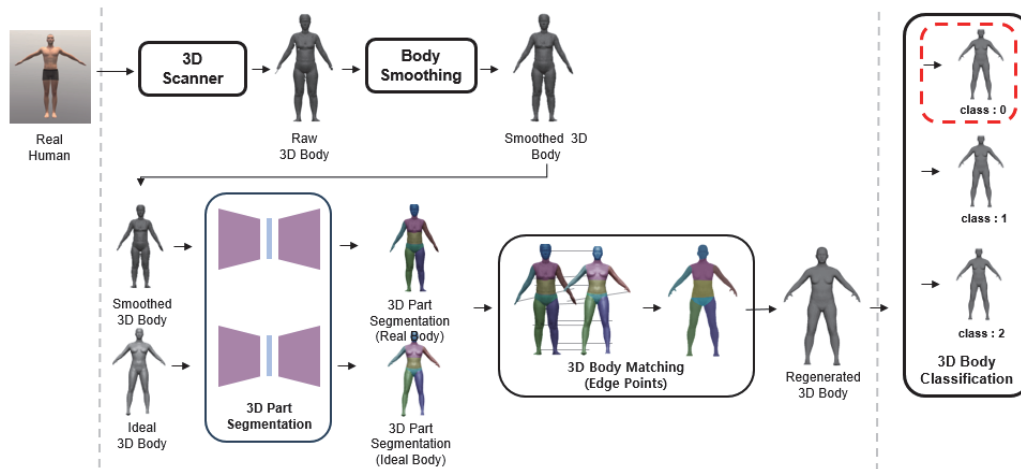
Figure 3. Architecture Diagram of the 3D Human Modeling System

Conclusion

In this study, we developed a program that automatically generates realistically regenerated 3D body models, considering various age groups and unique body shapes of women aged 20 to 55, utilizing 3D body shape data provided by Size Korea. The similarity assessment results demonstrated a high level of concordance between the 3D real body and the virtual body models, affirming that the proposed program offers more realistic and accurate simulations. By using this program, users can perform automated body modeling with 3D shape data, enhancing the realism of clothing simulations. Additionally, it maximizes the efficiency of accurate clothing pattern design.

This novel technology addresses the common limitations of existing software by resolving issues where incomplete mesh shapes are completely removed during rendering or smoothing processes. Unlike previous body generation programs that allow arbitrary adjustments of length and angle, our program provides enhanced control over body shape parameters, which allows for meeting the requirements of clothing pattern production. However, existing programs face limitations such as the inability to include key body measurements and the inability to achieve fully automated generation. Additionally, even when specific dimensions are inputted, there are cases where other dimensions are arbitrarily altered, making it difficult for users to accurately control the desired shape. These limitations result in the failure to consider crucial body measurements essential for clothing design and production. Developed with consideration of these constraints, our program aims to enhance personalized experiences in online clothing purchases and increase consumer satisfaction during the product acquisition process.

Building upon these research findings, future endeavors will integrate an algorithm aligning with classes grouping individuals sharing similar characteristics. This algorithm, working in tandem with Body Classification, is anticipated to facilitate automatic classification of body types based on users' body shapes. Additionally, the goal is to automatically incorporate individual body shapes and patterns to offer mass-customized patterns. This initiative seeks to provide realistic, personalized 3D body models, thereby enhancing consumer engagement across various domains and realizing more efficient clothing design and production systems to improve customer satisfaction.

Acknowledgement

References

Gill, S. (2015). A review of research and innovation in garment sizing, prototyping and fitting. *Textile Progress*, 47(1), 1-85.

Balach, M., Cichocka , A., Frydrych , I., Kinsella , M.,(2020) Initial investigation into real 3D body scanning versus avatars for the virtual fitting of garments, *AUTEX Research Journal,* DOI 10.2478/aut-2019-0037

Beck, M., & Crié, D. (2018). I virtually try it… I want it! Virtual Fitting Room: A tool to increase on-line and off-line exploratory behavior, patronage and purchase intentions. Journal of Retailing and Consumer Services, 40, 279-286.

Holte, M. B. (2020, July). The Virtual Dressing Room: A Return Rate Study. *In International Conference on Human Computer Interaction (pp. 80-90*). Springer, Cham.

Hong, E. H. (2020). Usability verification of virtual clothing system for the production of a 3D avatar reproduced from 3D human body scan shape data-focusing on the CLO 3D program. *Journal of the Korea Fashion and Costume Design Association*, 22(1), 1-13.

Istook, C. L., Simmons, K. P. & Devarajan, P. (2004). Female figure identification technique (FFIT) for apparel. 147–173. Retrieved from https://www.iffti.com/downloads/past_conference s/HKPU, %20200 2/A/147-173.pdf

Rita, A. A. Understanding the Basic Dress Foundation of Pattern Making: A Complete Study of Darting and Fitting of the garment.

Rodríguez, B., & Alfredo, C. (2016). *Virtual Fitting Rooms* (Master's Thesis). Retrieved from oa.upm.es/ 42311/1/TFM_BECERRA_RODRIGUEZ_CARLOS_a.pdf. Madrid.

Song, D., Tong, R., Du, J., Zhang., Y., Jin, Y(2018) Data-driven 3D human body customization with a mobile device, *IEEE Access*, 6, 27939-27948.

Lamport, I. (2008, August 22). To belt or not to belt? [Web log post]. Retrieved from https ://insideoutstyleb log.com/2008/08/to-belt-ornot-to-belt.html.

Lee, H., & Xu, Y. (2020). Classification of virtual fitting room technologies in the fashion industry: from the perspective of consumer experience. *International Journal of Fashion Design, Technology and Education*, 13(1), 1-10.

Lee, Y. R., & Jang, J. A. (2020). A Comparative of the Different between Virtual Fashion 3D Avatar and Size Korea of Adult Women's Body Shapes. *Fashion & Textile Research Journal*, 22(1), 87-93.

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PROPOSAL OF PRODUCT NAMES SEARCH BASED ON RESEARCH OF CASUAL HANBOK

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Introduction

The study investigates the lower purchase and wearing rates of casual Hanbok compared to ready-to-wear apparel despite the rising global interest in Korean culture. Notably, Korean culture is gaining prominence worldwide through movies, dramas, and popular music, heightening the appeal of traditional clothing like Hanbok. Despite this heightened interest, Hanbok's actual purchase or wearing rate remains lower. So, the research examines three major casual hanbok brands—Dolsilnai, Leesle, and Isae—alongside Zara, a leading global SPA brand. The investigation focuses on price, composition, washing method, and product names. Findings indicate a significant keyword disparity between casual Hanbok and ready-to-wear brands, with only 7.04% overlap out of 1,861 types, and highlight the need to identify universally accessible and high-search keywords to improve casual Hanbok visibility and accessibility.

Literature Review

The primary challenge confronting Hanbok, akin to ready-to-wear brands, is attaining widespread popularity and cultural acceptance. In this context, selecting ZARA as a comparative benchmark holds considerable significance. Zara's position as a trendsetter among Korea's youth underscores its cultural sway and market reach. This study endeavors to unveil strategies for augmenting Hanbok's visibility and cultural resonance within the contemporary fashion landscape by juxtaposing Hanbok's developmental aspirations with Zara's allure and market footprint. Given the inherent difficulty in quantitatively comparing brand selection criteria, brands were chosen based on the number of products subjected to comparison. This pragmatic approach enabled a feasible method within the study's parameters for assessing brand dynamics.

The decision to explore the factors influencing the purchase rate of Hanbok, including product name, price, washing method, and composition, stems from established theories such as the theory of planned behavior(TPB) and previous research findings. These elements and other factors like interactivity, psychological ownership, decision-making comfort, and provision of accurate product information significantly impact purchase intention. Prior studies have highlighted the positive perception of Hanbok among most Koreans(Yeo Jin Na, 2019) and revealed a notable willingness to wear and purchase Hanbok (Young Mi Kim, 2003).

Moreover, younger individuals exhibited higher interest levels and propensity to purchase Hanbok. Notably, the degree of interest in Hanbok and the unique pleasure derived from involvement with Hanbok play pivotal roles in shaping preference and purchase behavior(Soon Ah Kim, 2022).

Hence, this study seeks to bridge this gap by examining the quantitative attributes of Hanbok that are accessible to consumers, aiming to elucidate the underlying factors influencing purchase behavior beyond those previously explored.

Research Method

The study examined the average price, washing method, and composition of 1,044 casual hanbok products from "Dolsilnai," "Leesle," and "Isae," alongside 3,447 ready-to-wear products from "ZARA." A total of 11,881 keywords from casual hanbok brands, including "Dolsilnai," "Leesle," "Isae," and "Naver Shopping," were analyzed and compared with 10,632 keywords from the ready-to-wear Brand, "ZARA." The price analysis included outer, top, bottom, and dress, while the washing method was categorized primarily based on the core method, and the composition was classified according to fiber type. Following the removal of serial numbers and neologisms, keywords were categorized by design, pattern, fabric, color, category, modifier(objective), and modifier(adjective). To enhance the validity of our findings, we deliberately excluded serial numbers, brand names, and modifier(creative) in the results. The rationale

behind this exclusion stems from the inability to generalize the identified keywords and apply them universally across different brands. All procedures involved in this study, including data collection, analysis, and organization, were performed manually without using automated tools or software. This manual approach ensured meticulous attention to detail and accuracy throughout the research process.

Keywords with variations in spelling were aggregated into terms with relatively high search volumes using "Google Trends." Additionally, keywords with a monthly average search count of less than 100 were eliminated using "Google Ads."

Results & Discussion

The study compared the average prices of casual Hanbok and ready-to-wear apparel. The average prices for casual Hanbok were 333,172 KRW for outer, 158,096 KRW for tops, 164,938 KRW for bottoms, and 232,569 KRW for dresses. In contrast, the average prices for ready-to-wear apparel were 97,174 KRW for outer, 29,674 KRW for tops, 37,422 KRW for bottoms, and 40,932 KRW for dresses. It was observed that the average price of casual Hanbok was notably higher than that of ready-to-wear apparel.

The washing methods for the outer, top, bottom, and dress were analyzed by a significant standard. In casual Hanbok, outer exhibited the highest proportion of washable+dry cleaning (64.52%), followed by dry cleaning only (33.02%), washable (2.34%), and hand-washing (0.12%). For tops, washable+dry cleaning was predominant (53.45%), followed by washable (29.52%), hand-washing (17.02%), and dry cleaning only (1.67%). In bottoms, washable+dry cleaning had the highest percentage (58.41%), followed by washable (31.83%), hand-washing (9.76%), and dry cleaning only (4.02%). Regarding dresses, washable+dry cleaning ranked highest (75.15%), followed by washable (16.53%), hand-washing (8.32%), and dry cleaning only (1.55%). In contrast, for ready-to-wear brands, outer was predominantly dry clean only (76.17%), followed by hand-washing (14.95%), washable (4.67%), dry cleaning with exclusive detergent (2.8%), and hand-washing with exclusive detergent (1.4%). Tops had the highest percentage of dry cleaning only (32.23%), succeeded by hand-washing with exclusive detergent (22.25%), dry cleaning with exclusive detergent (20.46%), hand-washing (15.86%), and washable (9.21%). For bottoms, dry cleaning only ranked highest (34.74%), followed by hand-washing with exclusive detergent (31.58%), hand-washing (17.54%), washable (9.12%), and dry cleaning with exclusive detergent (7.02%). Lastly, dresses showed a predominant rate of dry cleaning only (33.12%), followed by hand-washing (25.32%), dry cleaning with exclusive detergent (17.53%), hand-washing with exclusive detergent (14.94%), and washable (9.09%). Compared to ready-to-wear, casual Hanbok exhibits a notably lower 'washable' rate.

In the analysis of casual Hanbok brands, the fabric composition for outer garments reveals a predominance of polyester at 20.47%, followed by cotton at 8.84% and linen at 4.65%. Tops exhibit a higher proportion of cotton at 19.69%, followed by polyester at 18.67% and linen at 9.97%. Bottoms show polyester as the primary material at 19.01%, followed by a blend of cotton and polyurethane at 11.62% and linen at 9.86%. Dresses display a significant polyester content at 30.32%, followed by cotton at 14.84% and linen at 9.68%. Conversely, within the ready-to-wear brand category, outer garments feature a higher composition of polyester, viscose, and elastane blend at 22.14%, followed by polyester at 12.86% and a blend of polyester and elastane at 3.39%. Tops are predominantly composed of cotton at 30.86%, followed by polyester at 16.67%, and a blend of polyester and elastane at 5.51%. Bottoms show a higher proportion of cotton and elastane blend at 16.41%, followed by polyester, viscose, and elastane at 14.5% and pure cotton at 14.5%. Dresses within this category reveal a significant presence of polyester at 31.86%, followed by a blend of polyester and elastane at 14.75% and viscose at 12.68%. Notably, casual Hanbok brands prefer natural fibers such as cotton and linen compared to ready-to-wear brands. However, they also incorporate a notable amount of polyester, akin to the practices observed in ready-to-wear brands.

Keywords were selected based on categorical classification. Design keywords were proposed, such as "see-through, SS, half, stitch, long, Git, open, big size, china collar, Goreum," etc. Pattern keywords were proposed, such as "flower, tulip, plain, Hun-min-jeong-eum, skull, embroidery, checkered, straight, stripe," etc. Color keywords were proposed, such as "black, white, khaki, sky blue, colorway, navy, color, blue, pink, grey," and so on. Fabric keywords were proposed, such as "flax, knit, cotton, linen, lace, silk, rayon, wool, ramie, vintage yarn-dyeing," etc. Category keywords were proposed, such as "one-piece, pants,

clothes, shirts, hanbok, skirt, coat, top, blazer, jeans," etc. Modifier(adjective) keywords were proposed with "set, madame, Switzerland, fusion, life, daily, jar, waist, light, pretty," etc. Modifier(objective) keywords were proposed, such as "Chuseok, grandmother, summer, men, women, children, mom, spring, winter, couple," etc. Both casual hanbok brands and ready-to-wear brands have the most keywords in 'Category' and have similar rates. Still, casual hanbok brands' keywords are evenly distributed. In contrast, ready-to-wear brand keywords have a relatively low ratio of Color, Modifier(objective), and Others, and relatively high ratio of Design, Pattern, and Modifier(adjective).

Conclusion

In this study, the average price, washing methods, composition, and product names of casual Hanbok and ready-to-wear brands were investigated, and we have proposed a set of keywords derived from consumer search trends, mainly focusing on those frequently utilized in casual Hanbok and ready-to-wear brands. These keywords offer valuable reference points for crafting product names in the fashion industry. Our analysis reveals distinct patterns in the naming conventions between ready-to-wear brands and casual Hanbok brands. While ready-to-wear brands tend to emphasize aspects such as Design, Pattern, Category, and Modifier(adjective) in their product names, casual Hanbok brands exhibit a broader range of keyword usage. Color, Brand, Modifier(objective), and Modifier(creative) emerge as prominent keywords in casual Hanbok brand naming practices.

However, it is essential to note that while Modifier(creative) may serve a similar function to Brand by embodying a unique identity, its usage alone may not adequately convey the essence of the product. Thus, it is advisable to mitigate the overuse of Modifier(creative) and prioritize clarity and specificity, particularly in conveying design and pattern characteristics. By integrating the proposed keywords into product names, sellers can enhance visibility and attract consumer interest. Moreover, leveraging these keywords may yield additional promotional benefits and contribute to overall sales growth in the competitive fashion market.

Acknowledgment

References

1. Yeo Sun Kang. (2023). A Study on Keyword Information Characteristics of Product Names for Online Sales of Women's Jeans Using Text Mining. JOURNAL OF THE KOREAN SOCIETY OF CLOTHING AND TEXTILES, 47(1), 35-51. 10.5850/JKSCT.2023.47.1.35
2. Yeo Jin Na. (2019). Visual preference survey using the Instagram for globalization of Hanbok. Sejong University Graduate School.
3. Young Mi Kim, Ae Jin Boo, & Jung Min Hong. (2003). A Study on Wearing Behavior & Design Preference for Saenghwal Hanbok - Focusing on Daegu-. Journal of Fashion Business, 7(5), 54-65.
4. Su Ji Moon. (2024). A study on the Determinants of Purchase Intention in Online Shopping Through Augmented Reality Application. Journal of the Electronics and Telecommunications Society of Korea, 19(1), 257-266.
5. Soon Ah Kim. (2022). The Influence of Consumer's Involvement and Arousal Seeking Tendency on Preference of Hanbok and Purchasing Behavior of Hanbok. JOURNAL OF THE KOREAN SOCIETY OF CLOTHING AND TEXTILES, 46(2), 349-366. 10.5850/JKSCT.2022.46.2.349

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BOTTOM GARMENT PATTERNMAKING FOR KOREAN WOMEN IN THEIR 40S USING A VIRTUAL TRY-ON SYSTEM

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Introduction

Body measurements and shape are important factors for middle-aged women when they choose bottom garments. To produce bottom garments that make women look good, it is crucial to understand their bodies and design patterns that fit them well. In clothing science, virtual try-on technology is increasingly used in the patternmaking review stage. By analyzing the human body and try-on shape of middle-aged women using this technology, patterns that fit them well can be proposed. This study compares the human body and bottom clothing try-on shape of Korean women in their 40s with data of women in their 20s based on a virtual try-on system, and proposes bottom garment patterns that fit women in their 40s well.

Literature Review

As women age, their bodies undergo physical changes due to their physiological characteristics. For instance, a pair of pants designed for women in their 20s may fit longer and pull at the rise if worn by a middle-aged woman (Kim, 2014). In other words, patterns that simply reflect measurements alone cannot be used to produce well-fitting garments. Many fashion companies now use virtual try-on technology to review their garments' design and fit, and also measure clothing pressure virtually to quantify the fit

Research Method

CLO Virtual Fashion Inc. (CLO) was selected as the virtual try-on system. To begin with, we modeled the whole body of female avatars in their 20s (N=1,439) and 40s (N=1,046) based on anthropometric data from the 8th Korean Anthropometric Survey. Then, we set up the Mollison relational deviation line with women in their 20s as the reference group. We visually analyzed the lower body characteristics of women in their 40s. Thereafter, based on pattern data from a college textbook (Industrial Pattern Design: Women's Clothing 1), we drew skirt and pants patterns with the measurements of women in their 20s and 40s. We then used the patterns to produce a virtual garment and tried it on the avatars. After fitting the garment on the avatars, we compared the try-on shape of those in their 20s and 40s and analyzed problems and factors, considering the characteristics of the human body. Thereafter, we modified the patterns to improve the fit and confirmed the improved fit from the modified patterns with a stress map. For the stress map, we selected the parts of the garment that did not fit well and put pressure on the body. Stress was measured five times on the front, side, and back of the garment, and the mean and standard deviation of the measurements were calculated. Finally, we proposed pattern dimensions for a well-fitting bottom garment for women in their 40s.

Results & Discussion

The results of modeling full body avatars with the virtual try-on system are as follows.

1. We confirmed that the body shapes of women in their 20s and 40s differed visually. Regarding the Mollison relational deviation line, the height items showed a deviation distribution of -0.21 to -0.34σ, and the circumference items showed a deviation distribution of 0.01 to 0.58σ, with a large distribution observed in medial malleolus circumference (0.45σ), calf circumference (0.26σ), and top-hip circumference (0.58σ). Among the length items, total crotch length (0.45σ) also showed a large distribution. In other words, women in their 40s had smaller body dimensions in the height items and larger body dimensions and higher total crotch length in the circumference items than those in their 20s.

2. The following results were obtained for a basic skirt and pants drawn and fit on the avatars: The analysis of problems with the basic skirt showed that there were wrinkles on the stomach, hip side lines (outseam), and hips, and the hem was pulled up in the back and not level. The skirt length was also longer for those in their 40s compared with those in their 20s. Wrinkles at the stomach were due to the lack of extra

circumferential margins in the stomach area of the front of the skirt as the stomach circumference of women in their 40s was larger. Wrinkles at the hip side lines and the hem being pulled up at the back were due to the lack of extra circumferential margins at the hip area in the back of the skirt because of the abdominal curvature caused by the difference between the waist circumference and hip circumference. Wrinkles at the hips were due to unnecessary extra circumferential margins because of sagging hips among those in their 40s. For the skirt length, it was due to unnecessary extra lengthwise margins as the height of those in their 40s was lower. To address these problems, we increased the hip circumference line in the front and back by 1.0 cm from the outseam to address unnecessary extra margins in the hip area and set a dart at the back centerline (dart amount: 1.0 cm, dart length: to the hip circumference line) while cutting the back waist point by 0.3 cm from the back centerline to eliminate unnecessary extra margins in the hip area. The skirt length was shortened by 1.0 cm from the hem to remove unnecessary extra margins. We analyzed problems with the basic pants and found wrinkles on the side lines below the thighs (outseam) and the back of the thighs. Under the rise, the stress distribution was higher for those in their 40s than for those in their 20s, indicating that there were not enough extra margins under the rise. The length of the pants was also longer for those in their 40s than for those in their 20s. Wrinkles on the side lines (outseam) below the thighs were due to the lack of extra circumferential margins in the thigh area as the thigh circumference was larger for those in their 40s. For the back of the thighs, it was due to unnecessary extra lengthwise margins as the height dimension was lower for those in their 40s. For the pants length, it was also due to unnecessary extra lengthwise margins as the height of those in their 40s was lower. To address these problems, the front crotch point was extended by 1.0 cm and the back crotch point was extended by 0.5 cm to make the crotch length longer. Furthermore, we made an incision at the bisecting point from the rise line to the knee line, added a 1.0 cm dart, cut the back waist point by 1.0 cm, and extended the knee line and bottom width of the front and back by 0.5 cm on both sides. By doing so, we removed the unnecessary extra margins in the back thigh area and addressed the lack of extra margins in the thighs and calves. The pants length was shortened by 1.0 cm from the hem to remove unnecessary extra margins.

3. The analysis of the stress distribution in the virtual try-on after reflecting the modified patterns showed the following results: The modified patterns resulted in lower stress in several areas of the garment. Regarding the basic skirt, the stress distribution among women in their 40s was reduced greatly and similar to that among women in their 20s at the front waist band (23.0±0.0 kPa), front abdomen (1.6±0.1 kPa), front thigh (0.0±0.0 kPa), side waist band (4.6±0.0 kPa), side femur (1.7±0.3 kPa), side thigh (1.6±0.2 kPa), back waist band (24.7±0.8 kPa), and back gluteal fold (2.0±0.3 kPa). For the basic pants, the stress distribution among women in their 40s was greatly reduced and even lower than that among women in their 20s at the front waist band (36.3±3.6 kPa), front abdomen (27.1±1.5 kPa), front inseam (4.5±1.0 kPa), front thigh (5.79±0.2 kPa), side waist band (35.1±3.5 kPa), back buttock protrusion (7.4±0.1 kPa), and back gluteal fold (9.4±0.8 kPa).

4. We suggest the following patterns for Korean women in their 40s: regarding basic bottom garment patterns, we suggest 75.9 cm for the waist circumference, 97.4 cm for the hip circumference, 65.0 cm for the basic skirt length, and 37.9 cm for the knee circumference and 94.0 cm for the length of basic pants.

Conclusion

On the basis of the findings of this study, we will create bottom garments for women in their 40s and evaluate their real-world fit in a follow-up study.

References

Kim, E. K. (2014). Comparative Study on Size and Type of Lower Body of Women in Their 20s and 30s-40s: Focusing on Determining Problems by the Phenomenon of Purchasing Down-aging Cloth. *Journal of the Korea Fashion and Costume Design Association, 16*(3), 201-217.

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FOAMING CHARACTERIZATION OF LIGHTWEIGHT POLYLACTIC-ACID FILAMENTS WITH VARIOUS HEATING CONDITIONS

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Introduction

Recently, the demand of lightweight foam materials are increasing for a variety of applications with FDM 3D printing technology. The lightweight materials are referred to as the materials with low density which can be rigid or flexible according to its component. Polymer foams are materials containing small cells/pores inside the polymer matrix, which offer several benefits such as shock absorbance, thermal insulation, damping, effective sound insulation, high specific strength, and corrosion resistance. In case of development of foaming materials PLA, TPU, ABS are commonly used polymers. In a previous study, a 3-pointed star shape was manufactured by FDM 3D printing with LW-TPU filament to check their mechanical properties, where it was observed the presence of microspheres with foaming performance at extrusion temperature above 200 ℃. This study aims to analyze the shapes and foaming tendencies of different PLAs to investigate the thermal property of PLA filaments.

Research Method

Polylactic acid (PLA) and lightweight PLA filament of 1.75 mm diameter, namely ePLA-LW, LW-PLA, LW-PLA-HT and PLA/PHA was used for this study. One sample of 3 mg and one sample of 25 mm length of each filament was cut for DSC test and rheology test respectively. Three samples of each filament of 25 mm length for five different temperatures were cut for heating test. First DSC analysis was done by DSC 8500 thermal analyzer (USA) on the filaments at the condition of 10 ℃ / min from 30 ℃ to 300 ℃. Rheology test was done by Anton Paar MCR (102e) (Austria) under the condition of 40 ℃ - 250 ℃ to investigate the rheological properties. For thermal properties it was done by SINAN (SAS LAB, Sin An Science Industry Co. Ltd.) oven, three samples of each filament were put under 200 ℃, 210 ℃, 220 ℃, 230 ℃, 240 ℃ at 10 ℃ / 10 min interval. After the rheology and heating test, their morphology was checked under the NTZ-6000 (Nextecvision Co. Ltd., Korea) microscope under the magnification condition of ×4.55 to analyses the foaming tendency of the filaments.

Results & Discussion

The DSC test results show that PLA_PHA has the lowest Tg and double melting points, while PLA_ES has the highest Tg and a single melting point. PLA and PLA_ES share similar Tg values. PLA_HT has a higher Tm and solidification temperature compared to PLA_CL. PLA_CL and PLA_HT exhibit characteristics more aligned with foaming, with PLA_HT having the highest melting drop point.

The rheology analysis across temperatures ranging from 40 ℃ to 250 ℃ for samples reveals distinct properties among PLA-based filaments. At 200 ℃, PLA_ES shows lower storage and loss moduli compared to others, while PLA_CL and PLA_HT display higher values. At 210 ℃, PLA and PLA_ES exhibit lower moduli, while PLA_CL and PLA_HT demonstrate higher values. At 220 ℃, PLA_ES has lower moduli, whereas PLA_PHA shows higher values. At 230 ℃ and 240 ℃, PLA and PLA_PHA exhibit lower moduli compared to PLA_CL and PLA_HT. PLA_CL and PLA_HT consistently display higher storage moduli. Moreover, PLA_CL and PLA_HT exhibit lower loss factors, indicating a higher probability of foaming performance compared to PLA.

For the lightweight PLA with various heating temperature, PLA_HT had the highest diameter while PLA_PHA had the lowest. PLA_CL showed a consistent diameter increase, unlike PLA_HT, which experienced an increase after a drop at 210 ℃. Regarding length, all filaments except PLA_HT and PLA_ES increased uniformly. PLA_HT had the greatest increase in thickness. After heating, PLA melted, appearing transparent with a smooth surface and increased length. PLA_ES showed a roughening surface, color changes, and irregular deformation with temperature. PLA_CL displayed color changes, increased

length, and uniformly roughened surface. PLA_HT was similar to PLA_CL but with irregular deformation in length, while PLA_PHA resembled PLA with a smooth surface and increased length.

The results indicate that PLA_ES, PLA_CL, and PLA_HT started to foam from temperature 210 ℃, showing clearer cell formation at higher temperatures. However, PLA and PLA_PHA only melted without any observable cell formation. In terms of rheology, PLA and PLA_ES consistently showed lower G' and G" values, whereas PLA_CL and PLA_HT had higher values across most temperatures, except for PLA_PHA at 220 ℃. All filaments exhibited increased diameter, length, and thickness with temperature, with PLA_CL demonstrating uniform diameter increase and PLA_HT showing increased thickness but decreased length. Lastly, PLA_CL exhibited superior foaming ability in thermal tests due to its uniform appearance and shape compared to other filaments.

Conclusion

This study aims to analyze the shapes and foaming tendencies of different lightweight PLAs to investigate the foaming property of PLA. In DSC analysis it was seen that compared to all five filaments, PLA_CL and PLA_HT is somewhat closer to the foaming characteristics. However PLA_HT has the highest melting drop point compared to other four filaments. From Rheology analysis, it was observed that PLA and PLA_ES was most found to have lower SM and LM, while PLA_CL and PLA_HT was found to have high G' and G" during all five temperature (200, 210, 220, 230 and 240 ℃) changes except for 220 ℃. For 220 ℃ PLA_PHA has the high G' and G" value. It was found that PLA has the least tendency of foaming, while PLA_CL and PLA_HT has the high probability of foaming performance. From the heating analysis it was observed that PLA_CL has the better foaming ability compared to other four filaments with its uniformity in appearance and shape. Therefore it was observed that PLA_ES, PLA_CL and PLA_HT has the property of foaming materials among all five filaments, but PLA_CL has the better foaming property according to rheology and thermal analysis.

Acknowledgement

References

Damanpack et al., (2021). Porous PLAs with controllable dansity by FDM 3d printing and chemical foaming agent. *Micromachines*, *12*, 866.

Kanani et al., (2023). Additively manufactured foamed polylactic acid for lightweight structures. *Rapid Prototyping Journal*, *29*(1), 50-66.

Karun Kalia and Amir Ameli, (2023). Additive Manufacturing of Functionally Graded Foams: Material Extrusion Process Design, Part Design, and Mechanical Testing. *Additive Manufacturing*, *79*, 103945.

Xiaokui Chen and Sunhee Lee, (2022). Morphology and compressive property of 3d-printed 3-pointed star shape prepared using lightweight thermoplastic polyurethane. *Fibers and Polymers*, *23*, 1779–1788.

Xiaokui Chen and Sunhee Lee, (2022). Physical property of 3D-printed N-pointed star-shaped outsole prepared by FDM 3D printer using the lightweight TPU. *Polymers*, *14*, 3189.

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Proceedings

MECHANICAL PROPERTY OF LIGHT WEIGHT POLYLACTIC ACID PREPARED BY MICRO FOAMING 3D PRINTING PROCESS WITH VARIOUS EXTRUDING TEMPERATURES

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Introduction

There has been an increased interest in porous polymers in packaging, automotive, electronics, furnishing, footwear, aerospace and medical fields. Polymer foam, one of the porous polymer materials, is a material that has small pores/holes in the polymer matrix using a foaming agent and polymer(Yousefi Kanani et al., 2023). It is low density, good heat insulation, good sound insulation effects, high specific strength, and resistance to corrosion(Jin et al., 2019). The material extrusion process can be controlled through 3D printing slicing conditions and can be controlled to withstand mechanical and environmental stresses(Guddati et al., 2019). Therefore, in this study aims to confirmed mechanical property of Light Weight Polylactic Acid (LW-PLA) for micro foaming process with various extruding temperatures using FFF (Fused Filament Fabrication) 3D printing. And then, LW-PLA was extruded at 7 temperatures from 200℃ to 260℃ at 10℃ intervals, and a 3D printed cube was manufactured according to the specified temperature through surface analysis, and mechanical properties were analyzed through compressive properties.

Research Method

In this study, to confirm the mechanical properties of LW-PLA, LW-PLA (ColorFabb BV., Netherlands) with a diameter of 2.85 mm and FFF 3D printer (Ultimaker S5 Pro Bundle, Ultimaker B.V., Netherlands) with a nozzle of AA 0.4 mm were used. Using a FFF 3D printer capable of double extrusion, extrusion temperature tests were conducted in the range of 200℃ to 260℃ at 10℃ intervals. For the morphology analysis, the cross section and lateral section of the extruded filament were confirmed using a FIB(Focused Ion Beam)(Scios2, Thermo Fisher Scientific Inc., US). To manufacture the 3D printed samples, it was modeled to $10 \times 10 \times 10$ mm3 using a 3D modeling program (Fusion 360, Autodesk Inc., USA) and saved to a *.stl file. The *.g-code file for 3D printing was created in a slicing program (Ultimaker Cura 5.2.1, Ultimaker B.V., Netherlands) with nozzle temperature of 210℃, 220℃, 230℃ and 240℃, bed temperature of 60℃, printing speed of 70 mm/sec and infill pattern and density of zigzag and 25%, 50%, 75% and 100%. The sample code was designated as (LW-PLA)-(nozzle temperature)-(infill density). The compressive property was measured according to the KS M ISO 604 (KATS, 2018) standard using a universal mechanical testing machine (AGS-X, SHIMADZU Co. Ltd., Japan). A specimen of $10 \times 10 \times 10$ mm3 was prepared, and compression tests were conducted in the –z direction and up to maximum strain of the sample. Through this, the initial elastic modulus, strength and toughness during compression were confirmed and analyzed, and physical deformations such as foldability and shear transformation. During the compressive testing, experimental videos were taken using a digital camera (VCXU-123M.K06, GOM, Germany), and 2D Snap program (ARAMIS®-GOM, Germany).

Results & Discussion

The results according to the mechanical properties of LW-PLA are as follows. The extruding of LW-PLA filament was confirmed at nozzle temperature conditions of 200℃, 210℃, 220℃, 230℃, 240℃, 250℃, and 260℃. From 220℃, the foaming agent of the filament begins to foam and form bubbles. As the temperature increases, the bubbles increase and the thickness of the lateral section increases. The most uniform bubbles extruded at 230℃ and 240℃ were formed, and when it exceeds 240℃, non-uniform bubbles are formed and the lateral section are uneven. Regardless of the nozzle temperature, the actual printing time was confirmed to be 4 min 57 sec of LW-PLA-25, 5 min 04 sec of LW-PLA-50, 5 min 27 sec of LW-PLA-75,

and 5 min 53 sec of LW-PLA-100. Additionally, considering the case where the LW-PLA-25 as 1, the actual sample weight increased by 1.26-1.30 times of LW-PLA-50, 1.54-1.58 times of LW-PLA-75, and 1.75-1.80 times of LW-PLA-100 as the infill density increased. Between Infill density and print time and weight are directly proportional. When examining the external characteristics, In the case of LW-PLA-210, the surface was found to be uneven due to insufficient flow rate between extruded filaments. But the samples of LW-PLA-230-100, LW-PLA-240-50, LW-PLA-240-75, and LW-PLA-240-100 have foam protruding due to overflow rate from the outer wall and are imperfectly shaped into cube. By analyzing the compressive properties, the initial modulus, maximum strength, and toughness values according to LW-PLA cube with various extruding temperatures can be known. The initial modulus, as the infill density increases, increased from 402.88(±87.36) MPa to 498.06(±30.15) MPa of LW-PLA-210, from 296.41(±31.86) MPa to 508.14(±38.87) MPa of LW-PLA-220, and from 228.19(±15.13) MPa to 376.91(±23.47) MPa of LW-PLA-230-25,50,75. For LW-PLA-210, LW-PLA-220, and LW-PLA-230, the initial elastic modulus increases as the infill density increases. This shows that as the infill density increases, the connection density between filaments increases. However, the initial modulus confirmed 121.39(±3.72) MPa of LW-PLA-230-100, from 195.75(±5.91) MPa to 26.68(±5.65) MPa of LW-PLA-240. In the case of LW-PLA-230-100 and LW-PLA-240, despite the high infill density, they show low initial modulus. This is because the extruded LW-PLA protruded into the outer wall and the foaming, not the solid outer wall, absorbed the force applied during compression. As a result, it was confirmed that the nozzle temperature and infill density increased, the amount of foaming protruding from the outer wall increased, and the initial elastic modulus also became smaller. Additionally, compressive elongation decreases from a maximum of 74.67(0.89)% to a minimum of 12.73(±0.68)% for LW-PLA-210, LW-PLA-220, and LW-PLA-230 as the infill density increases. However, LW-PLA-240 is confirmed to be 72.67(±0.35)-84.51(±1.41)%.

Conclusion

This study confirmed mechanical property of LW-PLA for micro foaming process with various extruding temperatures using FFF 3D printing. The foaming agent of the filament begins to foam and form bubbles at 220°C. Also, the bubbles and the thickness of the lateral section increases as the temperature increases. For LW-PLA-210, LW-PLA-220, and LW-PLA-230, the initial elastic modulus increases as the infill density increases. It shows that the connection density between filaments increases. However LW-PLA-230-100 and LW-PLA-240 has low initial modulus. It was confirmed that the nozzle temperature and infill density increased, the amount of foaming protruding from the outer wall increased, and the initial elastic modulus also became smaller. LW-PLA-220 and LW-PLA-230, which maintain their appearance and have foaming properties, are considered suitable. In addition, depending on the usage characteristics of the 3D printing sample, the physical properties can be controlled by adjusting the foaming characteristics using the nozzle temperature.

Acknowledgements

References

Yousefi Kanani, A., Rennie, A. E., & Abd Rahim, S. Z. B. (2023). Additively manufactured foamed polylactic acid for lightweight structures. Rapid Prototyping Journal, 29(1), 50-66.

Jin, F. L., Zhao, M., Park, M., & Park, S. J. (2019). Recent trends of foaming in polymer processing: A review. Polymers, 11(6), 953.

Guddati, S., Kiran, A. S. K., Leavy, M., & Ramakrishna, S. (2019). Recent advancements in additive manufacturing technologies for porous material applications. The International Journal of Advanced Manufacturing Technology, 105, 193-215.

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HETEROSTRUCTURED PHOTOCATALYTIC FABRIC WITH Ag$_3$PO$_4$ AND NH$_2$-MIL-88B (Co/Fe) FOR ENHANCED CATALYTIC REACTIVITY

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Introduction

The environmental concern caused by dye wastewater from various industries is escalating, and there are urgent demands for effective treatment to minimize the adverse impacts. The application of photocatalytic degradation is increasingly recognized for its remarkable efficacy in the perspective of reusability. Metal-organic frameworks (MOFs) have garnered significant attention for their photocatalytic functionality with highly porous characteristics. To enhance the catalytic efficiency of MOFs, the heterojunction has been attempted as a way to improve the charge transfer ability and hinder electron-hole recombination. Bimetallic MOF is also attempted as a way to improve the charge transfer ability, but the combined effect of bimetallic MOF and heterojunction is not fully understood so far. Herein, heterojunction-loaded cellulose fabric using bimetallic NH$_2$-MIL-88B (Co/Fe) MOF and Ag$_3$PO$_4$ was fabricated to investigate the influence of bimetallic MOF within the heterojunction on adsorption and photocatalytic performance towards rhodamine B (RhB). This study is significant in providing in-depth empirical evidence of adsorption mechanisms and interfacial charge transfer pathways that are insightful for designing a complex co-catalytic system.

Literature Review

For enhancing the catalytic reactivity of photocatalytic materials, efficient production of •O$_2^-$, •OH$^-$ radicals is significant, and it can be achieved through constructing a heterojunction or adjusting band structure. To facilitate the engagement of electrons in the conduction band (CB) and holes in the valence band (VB) toward radical generation, CB should be lower than O$_2$/•O$_2^-$ redox potential, and VB should be higher than H$_2$O/•OH$^-$ redox potential [1]. Given that electron-hole recombination constrains radical generation, constructing a Z-scheme by integrating two photocatalytic materials emerges as a solution to hinder electron-hole recombination. Also, in the Z-scheme, the charge transfer pathways are adjusted to lower the CB and raise the VB in the spatially separated position, promoting the redox potential [2].

Research Method

The Ag$_3$PO$_4$/NH$_2$-MIL-88B (Co/Fe)-loaded cellulose fabric (Ag/MIL$_x$@C, x represents the molar ratio of Co/Fe) was fabricated by synthesizing Ag$_3$PO$_4$ on MIL$_x$@C. MIL$_x$@C was prepared in a solvothermal method by mixing Co(NO$_3$)$_2$·6H$_2$O, FeCl$_3$·6H$_2$O, and 2-aminoterephthalic acid in a mixed solvent of dimethylformamide and hydrogen chloride, and the molar ratio of Co/Fe was adjusted at 0, 0.1, 0.15, 0.2, and 0.25. Following this, MIL$_x$@C was immersed in a NaH$_2$PO$_4$ solution, and AgNO$_3$ solution was added dropwise to synthesize Ag$_3$PO$_4$ crystals on MIL$_x$@C. The characterization of the fabrics was analyzed by x-ray diffraction (XRD), scanning electron microscopy (SEM), Brunauer-Emmett-Teller analysis (BET), X-ray photoelectron spectroscopy (XPS), and thermogravimetric analysis (TGA). Photoelectrochemical characterization was employed using working electrode fabricated from photocatalytic materials, including electrochemical impedance spectroscopy (EIS), Mott-Schottky (M-S), and transient photocurrent (TPC). Rhodamine B (RhB) was employed as a model dye pollutant to evaluate adsorption and photocatalytic performance. Photocatalytic fabrics were immersed in RhB solution, and removed RhB concentration over time was analyzed using UV-vis spectroscopy.

Results & Discussion

From the morphological observation in Figure 1, Ag$_3$PO$_4$ crystals in 100 ~ 200 nm were grown on cellulose fibers for Ag@C. Ag/MIL$_x$@C shows uniform loading of MIL$_x$ in 30 ~ 50 nm for the Co/Fe

molar ratio of 0 and 0.2. From the elemental mapping by energy-dispersive spectroscopy (EDS) in Figure 1a-c, both MIL_x and Ag_3PO_4 crystals were distributed evenly on the fiber surface. In Figure 1d, the loaded weight of photocatalytic materials was calculated by the residual weight % from TGA. The loaded weight of Ag_3PO_4 on Ag@C was determined to be 6.33%. Upon the construction of heterojunction, the loaded weight of Ag/MIL_x on the fibers increased by ~ 11.5%. Results demonstrated that Ag_3PO_4 and MIL_x were successfully synthesized on the cellulose fibers.
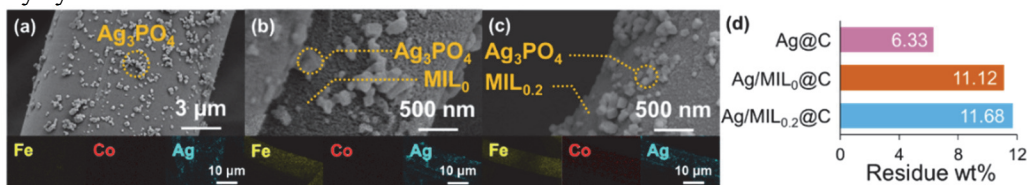
Figure 1. SEM and elemental mapping of (a) Ag@C, (b) Ag/MIL_0@C, and (c) $Ag/MIL_{0.2}$@C. (d) The loaded weight of MIL_x and Ag_3PO_4 calculated from TGA for photocatalytic fabrics.

Figure 2a displays the energy band structure of photocatalytic fabrics, which was calculated through the M-S plot and DRS. The VB and CB of Ag_3PO_4 were measured to be 3.0 and 0.27 eV, respectively. In comparison to MIL_0 with VB at 2.2 eV and CB at -0.08 eV, $MIL_{0.2}$ exhibited lower VB (1.72 eV) and CB (-0.58 eV), which was anticipated to increase the reducing power of CB's electrons. RhB adsorption performance was evaluated by 180 min adsorption process in dark (Figure 2b). Ag@C exhibited poor RhB adsorption performance due to its significantly lower surface area. MIL_x@C, with a higher specific surface area, demonstrated RhB adsorption performance of 28.7% (MIL_0@C) and 34.8% ($MIL_{0.2}$@C). Ag/MIL_x@C indicated a slight reduction in RhB adsorption performance from MIL_x@C, as Ag_3PO_4 partially covered the MIL_x's surface. Overall RhB removal performance by adsorption and photocatalytic degradation was evaluated by 60 min of adsorption process in dark followed by 120 min of photocatalytic reaction under light irradiation (Figure 2c). The overall RhB removal performance of MIL_0@C was dominantly contributed by the adsorption, indicating the negligible contribution of MIL_0 in photocatalytic reaction. Ag@C showed photocatalytic reactivity by removing a total of 48.3% of RhB. The heterojunction Ag/MIL_0@C exhibited enhanced overall RhB removal performance (61.1%) compared to single photocatalytic fabrics (Ag@C and MIL_0@C), with increased generation of $\bullet O_2^-$ radicals through stable charge separation. Furthermore, $Ag/MIL_{0.2}$@C exhibited enhanced RhB removal (80.3%), with the facilitated $O_2/\bullet O_2^-$ conversion due to the lowered CB in $MIL_{0.2}$.
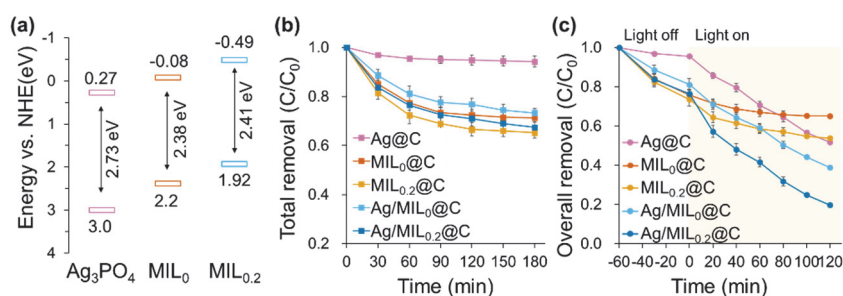
Figure 2. (a) Energy band diagrams for photocatalytic materials (Ag_3PO_4 and MIL_x). (b) RhB adsorption performance and (c) overall RhB removal performance by adsorption and photocatalytic degradation of Ag@C and Ag/MIL_x@C with varied Co/Fe molar ratios.

Conclusion

This work aimed to develop a Z-scheme heterojunction photocatalytic fabric incorporating bimetallic MOF, to enhance photocatalytic reactivity for efficient dye decomposition in water. Heterojunction $Ag/MIL_{0.2}$@C performed an accelerated photocatalytic reaction for RhB removal compared to single-photocatalytic fabrics (MIL_x@C and Ag@C) due to the promoted generation of $\bullet O_2^-$ radical by the

lowered CB and stable charge separation. This study provides empirical evidence that is crucial for advancing the future development of photocatalytic materials for effective mitigation of environmental hazards.

References

Yang J.; Hao, J.; Xu, S.; Wang, Q.; Dai, J.; Pang, X. (2019). $InVO_4/\beta$-$AgVO_3$ nanocomposite as a direct Z-scheme photocatalyst toward efficient and selective visible-light-driven CO_2 reduction. ACS Appl. Mater. Interfaces, 11(4), 32055.

Melillo, A.; Antonino, M. C.; Navalón, S.; Álvaro, M.; Garcia, H. (2020). Enhancing visible-light photocatalytic activity for overall water splitting in UiO-66 by controlling metal node composition. Appl. Catal. B: Environ, 278(11), 119345.

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SUSTAINABILITY OF CLOTHES DRYERS – FOCUSING ON MICROFIBER EMISSION, FABRIC DAMAGE, AND ENERGY CONSUMPTION: A REVIEW

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Introduction

The global market size for clothes dryers was valued at USD 12.01 billion in 2023, and it is predicted that the market will grow to USD 19.83 by 2028 (The Business Research Company, 2024). Though developed countries are leading in the use of clothes dryers, they have also become popular and widely used in developing countries (Spherical Insights, 2022). However, as the use of domestic clothes dryers is growing, related environmental concerns also arise. It was established that electric clothes dryers emit considerable amount of microfiber to the environment directly (Kapp et al., 2020). Certain experimental results indicated that repeated tumble-drying process leads to damages of fabric (Yu et al., 2023). In addition, drying procedure is energy-intensive, taking up about 9% of residential electrical energy in the United States (Wei et al., 2017). This study aims to investigate such concerns stemming from the use of clothes dryers in detail.

Research Method

Research articles were reviewed upon three main aspects. For microfibers, as the studies used different type of dryers, the amounts of microfiber emission upon dryer type were compared. In the case of fabric damage, the studies were also sorted upon dryer type. Then the shrinkage of fabrics was mainly evaluated. Similarly, for energy consumption, the academic works were classified by dryer type. Energy consumption of dryers was examined per kg of clothing dried.

Results & Discussion

The amount of microfibers released was compared among different dryer types. The amount of microfibers were expressed in ppm(mass of microfibers in mg/mass of original textile in kg). In order to achieve uniform conditions, only polyester textiles were considered for comparison. For condenser type dryer, total of 341.5±126.0 ppm was collected (Cummins et al., 2023). This total was from the sum of 313.3±120.8 ppm collected from the lint filter, 21.6±7.1 ppm from the condenser, and 6.7±2.0 ppm from the condenser water. In the case of heat pump type dryer, 50 ppm of microfibers were released by drying procedure (Choi et al., 2022). Other study mentioned that except for polyester technical sport t-shirts samples, all of the polyester samples emitted 340-1700pm of microfibers (Kärkkäinen et al., 2021). When vented type dryer was used, 105.48-113.41ppm microfibers were collected from the dryer lint and 31.57-48.47 ppm microfibers were collected from the dryer vent(Lant et al., 2022). In total, 137.05-161.88 ppm microfibers were collected from the dryer. Another study stated that 124-308 ppm microfibers were released by the use of vented type dryer (Tao et al., 2022). From these studies, it could be concluded that the vented type dryer emits the least amount of microfibers while condenser type dryer emits the greatest amount. In addition, since the type of polyester textile was not consistent between the studies, the type of polyester garment may have also given a substantial influence on the emission of microfiber. For studies about fabric damage caused by dryers, shrinkage of fabrics was mainly considered. Without the use of tumble dryers, when fabrics were line-dried, they exhibited the shrinkage of 7.2% in length, and 10.5% in area (Yun et al., 2017). In terms of vented type dryers, after 40 minutes of tumble drying, fabrics shrank by about 14.0% in both length and area (Bao et al., 2019). In another study, also using vented type dryers, the fabrics shrank by 1.51% after 5 drying cycles (Wei et al., 2017). Fabric shrinkage was also studied using heat pump type dryer. Under the drying condition of hot air with drum rotation by heat pump type dryer, the fabrics shrinkage was shown to be about 11.0% (Kim et al., 2023). Throughout these studies, it could be inferred that the use of dryers induce fabric shrinkage, but small difference was shown between different types of dryers. Energy consumption was

compared among different drying types. When clothing was line-dried, none of the energy was consumed. However when condenser type dryer was used, energy consumption per cycle per 1kg cycle was 1.075 kWh/cycle/kg (Yamaguchi et al., 2011). In the same study, for heat pump type dryer, the energy consumption was 0.485 kWh/cycle/kg. Another study referred that the use of heat pump type dryer consumed energy of 0.525 kWh/kg (Graban et al., 2021). For vented type dryer, energy consumption of about 0.826 kWh/kg on average was given (Wei et al., 2016). Other study stated that 0.945 kWh/kg of energy was consumed when using vented type dryer (Graban et al., 2021). From these findings, it could be said that condenser type dryer consumed the biggest amount of energy, followed by vented and heat pump type.

Conclusion

Throughout this research, environmental effects caused by the use of domestic clothes dryers were reviewed. More specifically, the effects of dryer type on such environmental concerns were compared. Vented type dryers emitted the least amount of microfibers. Fabric damage, in terms of shrinkage, exhibited minuscule difference upon dryer type. Heat pump type dryer consumed the smallest amount of energy. It was shown that depending on which perspective is taken, favorable dryer type was different from each other. For more precise comparison, future studies should include abrasion, color migration, and scorching for fabric damage. In addition to energy consumption, water consumption and need for aftercare related to dryer usage should also be included in upcoming research.

References

The Business Research Company. (2024). Dryers Global Market Report 2024 – By Type (Spin Dryers, Condenser Dryers, Heat Pump Dryers, Mechanical Steam Compression Dryers, Solar Clothes Dryer, Other Types), By Type of Vent (Vented Dryer, Ventless/Condenser Dryer), By Distribution Channel (Specialty Stores, Company-Owned Stores, Hypermarkets And Supermarkets, Online, Other Distribution Channels), By End User (Commercial, Residential) – Market Size, Trends, And Global Forecast 2024-2033. https://www.thebusinessresearchcompany.com/report/dryers-global-market-report

Spherical Insights. (2022). Global Electric Clothes Dryer Market Size, Share, and COVID-19 Impact Analysis, Segmented, By Type (Fully-Automatic & Semi-Automatic), By Dryer Type (Vented, Condensed & Heat Pump), By End User (Residential, Commercial), By Distribution Channel (Online, Offline); and By Region (North America, Europe, Asia-Pacific, Latin America, Middle East, and Africa), – Global Insights, Growth, Size, Comparative Analysis, Trends and Forecast, 2021-2030. https://www.sphericalinsights.com/reports/electric-clothes-dryer-market

Kapp, K. J., & Miller, R. Z. (2020). Electric clothes dryers: An underestimated source of microfiber pollution. PLoS One, 15(10), e0239165.

Yu, X., Cui, Y., & Ding, X. (2023). Investigation on damage behaviors of cotton fabric in different fabric motion patterns during tumble-drying process. Drying Technology, 41(7), 1183-1198.

Wei, Y., Hua, J., & Ding, X. (2017). A mathematical model for simulating heat and moisture transfer within porous cotton fabric drying inside the domestic air-vented drum dryer. The Journal of the Textile Institute, 108(6), 1074-1084.

Cummins, A. M., Malekpour, A. K., Smith, A. J., Lonsdale, S., Dean, J. R., & Lant, N. J. (2023). Impact of vented and condenser tumble dryers on waterborne and airborne microfiber pollution. Plos one, 18(5), e0285548.

Choi, S., Kim, J., & Kwon, M. (2022). The Effect of the Physical and Chemical Properties of Synthetic Fabrics on the Release of Microplastics during Washing and Drying. Polymers, 14(16), 3384.

Kärkkäinen, N., & Sillanpää, M. (2021). Quantification of different microplastic fibres discharged from textiles in machine wash and tumble drying. Environmental Science and Pollution Research, 28, 16253-16263.

Lant, N. J., Defaye, M. M., Smith, A. J., Kechi-Okafor, C., Dean, J. R., & Sheridan, K. J. (2022). The impact of fabric conditioning products and lint filter pore size on airborne microfiber pollution arising from tumble drying. Plos one, 17(4), e0265912.

Tao, D., Zhang, K., Xu, S., Lin, H., Liu, Y., Kang, J., ... & Leung, K. M. (2022). Microfibers released into the air from a household tumble dryer. Environmental Science & Technology Letters, 9(2), 120-126.

Yun, C., Ko, Y., Song, G. H., Shin, H., & Park, C. H. (2017). The effects of washing and drying on the dimensional stability of woven fabrics with and without spandex. Journal of the Korean Society of Clothing and Textiles, 41(3), 458-467.

Bao, W., Shen, J., Ding, X., & Wu, X. (2019). Dimensional change of wool fabrics in the process of a tumble-drying cycle. Textile Research Journal, 89(21-22), 4702-4709.

Wei, Y., Gong, R. H., Ning, L., & Ding, X. (2018). Research on physical properties change and damage behavior of cotton fabrics dried in drum-dryer. The Journal of The Textile Institute, 109(1), 121-132.

Kim, H., park, C. H., & Oh, J. H. (2023). Determining optimal drying conditions through analysis of the sample movement in a heat pump dryer. Textile Research Journal, 00405175231174640.

Yamaguchi, Y., Seii, E., Itagaki, M., & Nagayama, M. (2011). Evaluation of domestic washing in Japan using life cycle assessment (LCA). International journal of consumer studies, 35(2), 243-253.

Graban, A., Groll, E., Braun, J., & Ziviani, D. (2021). Review of Heat Pump Tumble Clothes Dryer Energy Efficiency and Related Technologies.

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THE CHARACTERISTICS OF CELLULOSE ACETATE AND POLYACRYLONITRILE NANOFIBERS UTILIZING IRON OXIDE

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Introduction

Electrospinning technology is known as a highly practical technique for efficiently implementing nanostructured materials, capable of successfully producing composite fibers such as polymer nanofibers containing polymers or metal oxides, enzymes or drugs, or functional nanoparticles at low cost. Particularly valued for its characteristics of high surface area and porosity, it is actively researched in various fields such as high-performance filter materials, chemical and biosensors, tissue engineering scaffolds, drug delivery systems, protective clothing, and energy storage and conversion components(Cho & Jang, 2007). Among the materials used to manufacture nanofibers via electrospinning, polyacrylonitrile can impart properties of high strength and elasticity(Kim & Yang, 2003), while cellulose acetate, where the hydroxyl(-OH) groups of cellulose are substituted with acetyl groups, allows for versatile solvent usage and presents no difficulties in the production of nonwovens via electrospinning(Park et al., 2001). A solution containing both CA and PAN can be utilized in electrospinning, and studies have reported the potential utilization of electrospinning nanofibers with another additive as lithium-ion battery(Yang et al., 2021) and supercapacitor electrode(Ma et al., 2018).

Iron oxide nanoparticles are utilized as key materials in various fields such as bio, energy, and environment due to their chemical stability and excellent magnetic properties, being employed in drug delivery systems, electromagnetic wave absorption, wastewater treatment, catalysis, magnetic heads, and pigments(Colonbo et al., 2012).

In this study, nanofibers fabricated from cellulose acetate(CA) and polyacrylonitrile(PAN) were coated with iron oxide nanoparticles, and their surface characteristics were examined.

Literature Review

Research on utilizing the functionality of iron oxide is being conducted in various fields. Studies include the fabrication of iron oxide nanotubes and investigations into their applications in capacitors and catalysis(Kim, 2019), as well as research aiming to utilize iron oxide nanoparticles for cancer treatment by exploiting the principle of releasing heat as magnetic spins relax when an alternating magnetic field is applied externally to magnetic nanoparticles(R.-Rodríguez et al., 2021). Furthermore, there are studies on the application of iron oxide-nanotube nanocomposites, which have characteristics of gas sensing ability and reversibility through electrical conductivity, as ammonia gas sensors by increasing the surface-to-volume ratio through nanostructuring(Lee et al., 2016). Additionally, research has confirmed an increase in radiation shielding efficiency in polyethylene films containing iron oxide particles of micro and nano sizes, demonstrating the versatility of iron oxide in various forms and its application in diverse fields.

Research Method

18% CA solution was prepared using DMAc and acetone as solvents, while a solution containing 18% CA + 5% PAN was prepared using DMAc as the solvent. Electrospinning was conducted using a 15 kV voltage, a spinning speed of 2ml/h, and a spinning distance of 12cm for the 18% CA solution. For the 18% CA + 5% PAN solution, electrospinning was performed at 13 kV voltage, a spinning speed of 1 ml/h, and a spinning distance of 12 cm. The produced 5x5cm nanofibers were subjected to deacetylation treatment by treating them three times for 5 minutes each in a 0.1g sodium hydroxide/50g distilled water solution at a ratio of 1:500. Subsequently, they were treated for 5 minutes in a solution of 1M NaOH + 1M chloroacetic acid. After rinsing, the nanofibers were immersed in Fe_2O_3 at a ratio of 1:500 for 2 hours and then dried in a constant temperature and humidity chamber at 35°C for 1 hour. Surface characteristics were analyzed using

scanning electron microscopy(SEM), and the diameter of 50 fibers was measured using the ImageJ program. Elemental analysis was conducted using energy dispersive spectroscopy(EDS).

Results & Discussion

The diameter of the nanofibers electrospun from an 18% CA solution was measured at 1051.30±359.63nm, while after immersion in the Fe_2O_3 of 5-15nm size solution, the diameter was measured at 986.32±318.38nm. Consequently, it can be asserted that there is no discernible variance in fiber diameter pre- and post-attachment of iron oxide. Hence, the attachment of iron oxide is assessed to have occurred without imparting any discernible influence on the fibers during the attachment process. Elemental analysis by EDS revealed the presence of carbon(C) and oxygen(O) from cellulose and iron(Fe) from iron oxide.

The diameter of 18% CA + 5% PAN nanofibers was measured at 489.78±136.59nm, while after immersion in the Fe_2O_3 solution, the diameter was measured at 582.33±135.32nm. SEM image analysis showed a melted appearance of the fibers, which appears to be a consequence of PAN degradation during the deacetylation process, resulting in an elongation of fiber diameter. Similar to the case of CA alone, EDS analysis showed the presence of carbon(C) and oxygen(O) from cellulose and iron(Fe) from iron oxide.

Conclusion

Iron oxide nanoparticles, which are being used as key materials in various fields such as bio, energy, and environment, possess chemical stability and excellent magnetic properties. In this study, the characteristics of iron oxide were examined by attaching it to cellulose acetate nanofibers and cellulose acetate + polyacrylonitrile nanofibers. Deacetylated cellulose acetate nanofibers showed no change in fiber morphology after iron oxide attachment, while cellulose acetate + polyacrylonitrile nanofibers underwent a change in fiber morphology during the deacetylation process, but iron oxide still attached well.
Therefore, the nanofibers produced in this study appear to be suitable for use in supercapacitors, and further measurement of functionality is needed in the future.

References

Cho, S. M. & Jang, S. Y. (2007). *에너지 및 센서 소자용 나노섬유의 응용 및 전망*[Applications and Outlook of Nanofibers for Energy and Sensor Components]. *Fiber Technology and Industry*, 11(3), 152-158.

Kim, C. & Yang, K. S. (2003), Electrochemical properties of carbon nanofiber web as an electrode for supercapacitor prepared by electrospinning. *Applied physics letters*, 83(6), 1216-1218.

Park, H. C., Kang, Y. S., Kim, H. Y., Lee, D. R. & Chung, Y. S. (2001). Preparation of Cellulose Acetate Nano Fiber Non-woven by Electro-spinning. The Korean Fiber Society, 34(2), 345-347.

Colombo, M., Carregal-Romero, S., Casual, M. F., Gutiérrez, L., Morales, M. P., Böhm, I. B., Heverhagen, J. T., Prosperi, D. and Parak, W. J. (2012). Biological applications of magnetic nanoparticles. *Chemical society reviews*, 11, 4306-434.

Kim, J. (2019). *Synthesis and characterization of Fe₂O₃ nanotubes for electrochemical capacitor and catalytic application*[Unpublished master dissertation]. University of Kumoh National Institute of Technology.

R.-Rodríguez, I., S.-Otero, A., Spassov, S., Tombácz, E., Johansson, C., Presa, P. D. L., Teran, F. J., Morales, M. P., V.-Verdaguer, S., Thanh, N. T. K., Besenhard, M. O., Wilhelm, C., Gazeau, F., Harmer, Q., Mayes, E., Manshian, B. B., Soenen, S. J., Gu, Y., Millán, A., Efthimiadou, E. K., Gaudet, J., Goodwill, P., Mansfield, J., Steinhoff, U., Wells, J., Weikhorst, F. and Orteag, D., *Materials*, 14(4) , 706-742.

Lee, H., Kim, D., Ko, D., Kim, D. & Kim, H. (2016). Iron oxide-carbon nanotube composite for NH3 Detection. *Materials Research Society of Korea*, 26(4), 187-193.

Ma, C., Chen, J., Fan, Q., Huo, J., Liu, W., Cao, E., Shi, J. & Song, Y. (2018). Preparation and one-step activation of nanoporous ultrafine carbon fibers derived from polyacrylonitrile/cellulose blend for used as supercapacitor electrode, *Energy materials*, 53, 4527-4539.

Yang, N., Liang, Y. & Jia. S. (2021). Enhanced thermal stability and electrochemical performance of polyacrylonitrile/cellulose acetate-electrospun fiber membrane by Boehmite nanoparticles: Application to High-performance lithium-ion batteris, Materials and Engineering, 306(10).

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Session 2. Fashion Marketing / Fashion Design

Chair: Dr. Hongjoo Woo, Yonsei University

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BRAND CRISIS MANAGEMENT: EFFECTIVE RESPONSE STRATEGIES FOR SOCIAL MEDIA INFLUENCERS (SMIS) IN TRADEMARK INFRINGEMENT SITUATIONS

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Introduction

As the social media influencer (SMI) marketing industry has grown and evolved enormously, SMIs' unethical or even illegal business practices have also been widely witnessed as business crises (Coombs & Tachkova, 2022). Of the various crises on social media, trademark infringement, which refers to the misappropriation of others' legitimate trademarks (e.g., words, brand logos, symbols, and slogans), has been emerging legal disputes in the SMI business field (Schimmel, 2023). In particular, according to SMIs' brand ownership type (i.e., SMI-owned brand; SOB, as a business owner vs. SMI-endorsed brand; SEB, as an endorser of a brand), the crisis effects are different (Kirkpatrick, 2022). In the SOB context, as SMIs are considerably involved in their business, consumers actively attribute the cause of the crisis to the business owner, SMIs (Kirkpatrick, 2022). On the other hand, in the SEB context, as SMIs act in endorser roles, promoting some brands' products, the responsibility for the crisis is attributed more to the brand itself rather than the SMIs (Schimmel, 2023). In a crisis situation, it is important to find a proper and effective strategy that can convert the negative opinion toward the wrongdoer (Coombs, 2007). However, there have been limited studies exploring what response strategies after SMIs' trademark infringement can repair SMIs' adverse images and lower the level of negative publicity. Therefore, to fill this gap, this study aims to investigate the working response strategies to navigate SMIs' trademark infringement according to SMIs' brand ownership types.

Literature Review

The situational crisis communication theory claims that wrongdoers attempt to convert the adverse situation that occurred through their misconduct with response strategies (Coombs, 2007; Youn et al., 2024). Coombs and Tachkova (2022) found that consumers express their moral outrage about the crisis on social media through their intentions to engage in negative word-of-mouth (N-WOM). Regarding the response strategies for the crisis that happened on social media, Coombs and Holladay (2012) found three strategies—i.e., refutation, reform, and refusal strategies. *The refutation strategy* can be used when wrongdoers are considerably engaged in the crisis and attempt to lower the crisis severity and claim their innocence by counterclaiming the accuser (Coombs & Holladay, 2012). Therefore, in the SOB context, this can lower the consumers' N-WOM intention, while in the SEB context, this can aggravate the situation by suggesting that the SMI may be engaged in this crisis more than her endorser role. *The reform strategy* is a widely investigated strategy that can lower consumers' adverse responses effectively and rapidly by fully admitting one's responsibility in the crisis (Coombs & Holladay, 2012). Therefore, regardless of SMI's brand ownership, the N-WOM will decrease after the response. Similarly, *the refusal strategy* that evades voicing the crisis situation and pretending nothing happened can reduce the consumers' N-WOM (Coombs & Holladay, 2012), which is able to work on both brand ownership situations. Therefore, this study posits three research hypotheses:

H1. In the trademark infringement crisis, refutation strategy will diminish N-WOM intentions in the SOB scenario while, conversely, amplifying these intentions in the SEB context.

H2-H3. In the trademark infringement crisis, regardless of SMI's brand ownership, reform (H2) and refusal (H3) strategy will diminish N-WOM intentions.

Research Method

We implemented a between-subjects online experiment with a 2 (brand ownership: SEB vs. SOB) by 3 (crisis response strategies: refutation, reform, refusal) factorial design. Participants were randomly distributed across six experimental conditions. First, participants were exposed to a fictitious news article about a social media influencer's trademark infringement allegation according to the brand ownership type (i.e., SEB: Brand ambassador vs. SOB: SMI personal brand). After this, they read one of the hypothetical response strategies on the SMI's social media posts after the crisis. In the refutation scenario, the SMI counterclaimed the original brand and asserted her creativity. In the reform strategies, the SMI fully acknowledged her responsibility for the trademark infringement. In the refusal strategy, the SMI did not respond to her allegation and pretended nothing happened. While reading these stimuli, participants were asked about their N-WON intention with three measurement items ($\alpha = .90$; Wangenheim, 2005), which were measured twice in pre- and post-response strategies. A total of 237 participants were collected through Amazon Mturk. The participants were female followers of the SMI we used in the stimuli, mostly in their 20s (48.6%) and Caucasians (63.7%). Each stimulus was successfully manipulated (e.g., mean values of crisis responsibility for the brand ownership conditions and participants' understanding of the given response strategies). In addition, convergent and discriminant validity and construct reliability were successfully confirmed (Hair et al., 2010).

Results & Discussion

To test our hypotheses, we conducted a two-way repeated measures ANOVA (i.e., pre- vs. post-crisis response toward N-WOM intnetion), using brand ownership (SEB = 0; SOB = 1) and crisis response strategies (refutation = 0; reform = 1; refusal = 2) as factors between subjects and N-WOM intention as a factor within subjects. As a result, an interaction effect was observed between brand ownership and crisis response strategies, influencing the variation in N-WOM intentions before and after the response. Specifically, pairwise comparisons revealed that, in the context of the SOB, refutation ($M_{pre} = 4.70$, $M_{post} = 4.39$, $p < .05$) and refusal ($M_{pre} = 4.72$, $M_{post} = 4.39$, $p < .01$) strategies led to a significant decrease in N-WOM. On the contrary, the reform strategy resulted in an increase in N-WOM, pushing it even higher than the pre-response level ($M_{pre} = 4.67$, $M_{post} = 5.11$, $p < .001$). In the SEB situation, pairwise comparisons showed that the refutation strategy led to a significant increase in N-WOM ($M_{pre} = 4.56$, $M_{post} = 4.98$, $p < .001$). However, reform ($M_{pre} = 4.57$, $M_{post} = 4.69$, $p > .05$) and refusal ($M_{pre} = 4.56$, $M_{post} = 4.46$, $p > .05$) strategies did not appear to alter the level of N-WOM significantly. Therefore, H1 was supported and H2 andH3 were rejected.

Conclusion

This study aimed to explore the effective response strategies for SMI's trademark infringement crisis based on SMI's brand ownership. This study's findings have several implications. We discovered the theoretical implication for SCCT. Specifically, we found that influencers' response strategies, such as the reform strategy for SOBs and the refutation strategy for SEBs, can potentially intensify negative publicity by signaling their engagement in the crisis. Implementing these strategies may make it easier for stakeholders to attribute blame to the influencers. These insights shed light on the dynamics of crisis communication in the context of trademark infringement situations involving SMIs specifically depending on the different types of brand situations (SEB vs. SOB). Although this study provides valuable insights, future research can further explore the effects of the effects of response strategy combinations in SMI trademark infringement situations.

References

Coombs, W. T. (2007). Protecting organization reputations during a crisis: The development and application of situational crisis communication theory. *Corporate Reputation Review 10*(3), 163-176.

Coombs, W. T., & Holladay, J. S. (2012). The paracrisis: The challenges created by publicly managing crisis prevention. *Public Relations Review*, *38*(3), 408-415.

Coombs, W. T., & Tachkova, E. R. (2022). Elaborating the concept of threat in contingency theory: An integration with moral outrage and situational crisis communication theory. *Public Relations Review*, *48*(4), 102234.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Prentice Hall.

Kirkpatrick, E. (2022, April 28). Judge rules Hailey Bieber can continue promoting Rhode Skin-Care line amid trademark infringement lawsuit. *Vanity Fair*. https://www.vanityfair.com/style/2022/07/hailey-bieber-rhode-skin-care-trademark-infringement-lawsuit-preliminary-injunction-denied

Schimmel, H. (2023). Walking, talking trademarks: How influencer marketing is affecting trademark enforcement on social media. *The Journal of Business Law*, *6*(1), 33-63.

Youn, S. Y., Ki, C. W. C., & Ha, S. (2024). Feeling close from Afar: Public reactions to racial profiling in retail and brand crisis management. *Journal of Retailing and Consumer Services*, 77, 103676. https://doi.org/10.1016/j.jretconser.2023.103676

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THE EFFECTS OF CLOTHING DONATION MOTIVATION ON BEHAVIORAL INTENTIONS RELATED TO CLOTHING DONATION THROUGH EMOTIONS

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Introduction

The trend of consumers donating unused clothing to events and charity shops, overseen by domestic and international charitable organizations, is steadily increasing. This clothing donation behavior is attracting considerable attention due to its influence on consumers' emotional well-being and happiness. When engaging in clothing donations, consumers shift their focus beyond the simple act of disposal, emphasizing the meaning and value of clothing donation as a more profound charitable action. Both domestic and international fashion companies, sensitive to changes in consumer behavior, actively leverage clothing donation campaigns as part of their marketing strategy, demonstrating a keen interest in this philanthropic trend. Therefore, this study sought to validate the connection with donation behavior by uncovering the sub-dimensions of clothing donation motivation and investigating how clothing donation motivation influences the emotions associated with clothing donation and behavioral intentions.

Literature Review

Clothing donation is part of socially responsible consumption, where the main motive is interest in others and the environment. It serves as a self-oriented and practical means to satisfy individual beliefs and the need to express values(Bubna & Norum, 2017). The sense of social responsibility and the burden of ethical consumption can evoke negative emotions, such as discomfort or guilt. At times, alleviating these negative emotions leads to perceiving our actions as morally correct, resulting in a sense of satisfaction(Ha-Brookshire & Hodges, 2009). Therefore, an individual's behavior is influenced by external factors, such as social, cultural, or economic elements, which are evaluated either negatively or positively and affect an individual's feelings(Lee & Song, 2012).

Research Method

This study sequentially conducted qualitative and quantitative research, aiming for a complementary investigation. In the first phase, qualitative research involved in-depth interviews with a total of 21 participants, including 14 individuals who had participated in clothing donations within the past year and seven practitioners from charitable organizations. Subsequently, in the quantitative phase, individuals, both men and women, who had participated in clothing donations within the past year and were aged between their 20s and 50s were targeted. A professional online survey company in Korea recruited participants. The questionnaire encompassed aspects such as motivation for clothing donation, emotions associated with clothing donation, and behavioral intentions related to donating clothes. Four hundred eighty-three valid responses, comprising 48.4% male and 51.6% female participants, were collected and used for analysis. Data analysis for this research employed exploratory factor analysis(EFA), confirmatory factor analysis(CFA), structural equation modeling(SEM), correlation, and descriptive statistics, with the use of SPSS 26.0 and AMOS 26.0.

Results & Discussion

The results of this study are as follows. First, in the factor analysis, the motivation for donating clothes was revealed to stem from five factors: environmental, charitable, relational, dispositional, and self-satisfied motivations. The emotions associated with clothing donation were identified through distress and happiness.

Additionally, behavioral intentions related to clothing donation were derived from the intention to re-donate, purchase donated items, and participate in time donations. Second, CFA validated the 10 constructs with acceptable model fit(χ^2=1558.748, df= 657/ GFI = 0.854, CFI = 0.949, NFI = 0.915, TLI = 0.943, RMSEA = 0.053). Convergent validity was obtained by ensuring that all items loaded significantly(t-value>1.96) on their corresponding latent constructs and exceeded the 0.50 threshold. Composite reliabilities ranged from 0.825 to 0.911, and AVEs ranged from 0.696 to 0.869. The square root of the AVE for each construct exceeded the squared(Φ^2) correlation for each pair of constructs. Therefore, convergent validity, discriminant validity, and reliability confirmed that the measurement model was adequate. Third, SEM examined the causal relationship between motivations, emotions, and behavioral intentions. The structured model proved an acceptable model fit(χ^2=1606.650, df=0.674, p<.001/GFI=0.854, CFI=0.947, NFI=0.913, TLI=0.942, RMSEA=0.054). The results, in terms of the relationship between clothing donation motivation and donation emotions, indicate that environmental(β=0.197***), charitable(β=0.408***), dispositional(β=0.100**), and self-satisfied motivations(β=0.277***) positively influenced happiness. Regarding distress, relational motivations(β=0.404***) had a positive influence, while environmental motivation(β=-0.174**) and charitable motivation(β=-0.199***) had negative effects. Furthermore, regarding the impact of emotions associated with clothing donation on the intention to engage in donation-related behaviors, happiness and distress significantly influenced the intention to re-donate, purchase donated items, and participate in time donations.

Conclusion

   This study holds academic significance as it comprehensively explores the phenomenon of clothing donation motivations and emotions from both personal and social perspectives, developing a new measurement tool and empirically validating it. Furthermore, the study demonstrated the importance of donors' emotional responses between moral decision-making drivers and actions by proposing clothing donations for reuse. Additionally, by investigating the process of clothing donation motivations, emotions, and behaviors, this research provides valuable insights for nonprofit organizations and fashion companies to understand clothing donation campaigns better. It also contributes practically by offering insights into more effective donation marketing strategies.

References

Bubna, J. M., & Norum, P. (2017). Male apparel disposal: case study of consignment versus donation. *Journal of Fashion Marketing and Management*. 21(2), 235-246

Ha-Brookshire, J. E., & Hodges, N. N. (2009). Socially responsible consumer behavior? : Exploring used clothing donation behavior. *Clothing & Textiles Research Journal*, 27(3), 179-196

Lee, Y. K., & Song, Y. C. (2012). *A Study on the factors affecting donation intentions: Focused on the theory of planned behavioral and motive theory. Korea Association for Public Management*, 26(3), 189-211.

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THE EFFECT OF BRAND-AVATAR IMAGE CONGRUITY ON PURCHASE INTENTIONS FOR VIRTUAL ITEMS OF FASHION BRANDS

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Introduction

The metaverse, a virtual realm where diverse activities are possible, gained prominence during the era of social distancing due to COVID-19. As the relevance and usage of the metaverse continue to grow, research into its marketing applications and avatars within it has increased. Research on avatars in the metaverse has mainly focused on the congruence between metaverse users and avatars(Lee et al., 2022; Park, 2022; Park & Kim, 2022; Shim, 2022), and little research has been done on avatars as consumption subjects. Despite the expanding market for virtual items used to decorate avatars in the metaverse, there has been limited exploration of consumer behavior related to these virtual fashion items and brands. In this study, we aimed to investigate whether Sirgy's (1982) concept of self-image congruity applies to the alignment between the avatar's image and the brand's image. Moreover, we sought to determine if the congruence between the brand and the avatar image influences the intention to purchase virtual items of the brand, while also exploring the potential factors that moderate this relationship.

Literature Review

Consumers use products as a means of expressing their self-image (Sirgy, 1979), select products with an image that matches their self-image, and consistency in maintaining a consistent self-image affects their intention to purchase a product (Onkvisit & Shaw, 1987; Sirgy, 1982). Since the avatar may be considered the literal user of the virtual items in the metaverse, it is expected that the congruity between the images of the avatar and the brand would influence consumers' intention to purchase virtual items.

In a study by Lee et al. (2021), identification between the game player and the avatar was found to influence the intention to purchase the game items for the avatar, and Van Looy et al. (2010) predicted that the more the user identify with the avatar, consumers are more likely to engage in decorating behaviors and act on the avatar to match his or her self-image. In a study by Jung and Yoon (2011), identification between the user and the avatar moderated the effect of self-image congruity on consumer satisfaction. This study seeks to determine whether identification between metaverse users and avatars affects the intention to purchase virtual items, and whether identification has a moderating effect on the impact of avatar-brand image congruity on the intention to purchase virtual items.

H1: Brand-avatar image congruity positively influences consumers' intentions to purchase the brand's virtual items.

 H1-a. Actual Image Congruity (AIC) —the alignment between the avatar's current image and brand image—positively influences consumers' intentions to purchase the brand's virtual items (INT).

 H1-b. Ideal Image Congruity (IIC) —the alignment between the avatar's idealized image and brand image—positively influences consumers' intentions to purchase the brand's virtual items (INT).

H2: Consumer identification with the avatar (ID) positively influences the intentions to purchase the brand's virtual items (INT).

H3: Consumer identification with the avatar (ID) is expected to moderate the relationship between brand-avatar image congruity (both AIC and IIC) and consumers' intentions to purchase the brand's virtual item (INT).

Research Method

A sample of MZ generation, the primary users of the metaverse, was selected from among Zepeto users, the largest domestic metaverse platform. In early May, 2023, an online survey targeting 500 Zepeto users was conducted through an online survey company. The questionnaire included measures of key variables

adopted from previous research: AIC and IIC(Kang, 2022; Malar et al., 2011; Sirgy et al.,1997), ID(Ho & Wu, 2012; Li et al., 2013; Mael & Ashforth, 1992), and INT(Park, 2022; Park & Kim, 2022; Seo, 2022), as well as demographics. The data were analyzed using SPSS 27.0 to assess the participants' characteristics, reliability, and the validity of the measures. A confirmatory factor analysis and structural equation modeling analysis were conducted with AMOS 29.0 to validate the research hypotheses.

Results & Discussion

To verify the research hypothesis, a structural equation model was developed. This model incorporates the congruity between actual avatar image and brand image (AIC), the congruity between ideal avatar image and brand image (IIC), and consumers' identification with the avatar (ID) as the independent variables. The dependent variable in the model is the intention to purchase virtual items (INT), with consumers' identification with the avatar (ID) also serving as a moderating variable. The results of the analysis showed that AIC and IIC, ID influenced the INT. There was no moderating effect of ID in the relationship between IIC and INT, while the AIC, unlike expected, the positive effect of AIC on INT is mitigated with higher levels of ID. When consumers have a strong identification with their avatars, they may aspire more toward an idealized image of their avatar rather than its current state. In this context, if a brand's image is congruent with the actual, rather than the idealized avatar image, it might be perceived as less appealing to the consumer. This incongruence between the brand's offerings and the consumers' aspirational self-image could lead to a decreased interest in purchasing virtual items from the brand, even if there is a high congruity between the brand's image and the avatar's current state.

Conclusion

To explain the consumer behavior of an avatar as a consumer subject, this study extends Sirgy's (1982) self-image congruity theory to the interaction between avatars and brands in the metaverse, demonstrating its applicability in this novel context. And it showed that identification between metaverse users and avatars can have an impact on interactions between avatars and brands. The findings reveal that marketing strategies which align a brands' image with the consumers' idealized avatar image can significantly boost the purchase of virtual items. Importantly, the influence of brand-avatar image congruity on purchase intentions is nuanced, being shaped not only by the level of consumer identification with the avatar but also by the nature of this identification—whether it is with the avatar's actual or idealized image. These insights underscore the potential for brands to leverage avatar customization and idealization trends in the metaverse to enhance consumer engagement and drive virtual item sales. Future research should delve into strategies for brands to effectively tap into this dynamic by aligning their virtual offerings with consumers' ideal avatar image to enhance attractiveness and purchase intentions.

References

Lee, Y., Hong, S., & Lee, W.-J. (2021). A study on the marketing performance of self-character identification and relation internalization in MMOPRPGs. Journal of Korea Game Society, 21(2), 111-121.

Jung, H. S., & Yoon, H. H. (2011). Effects of brand personality-self image congruence on customer satisfaction in quick service restaurants: Moderating effects of brand identification. Korean Journal of Food & Cookery Science, 27(1), 33-42.

Sirgy, M. J. (1982). Self-concept in consumer behavior: A critical review. Journal of Consumer Research, 9(3), 287–300.

Van Looy, J., Courtois, C., & De Vocht, M. (2010, September). Player identification in online games: Validation of a scale for measuring identification in MMORPGs. Proceedings of the 3rd International Conference on Fun and Games (pp. 126-134). https://doi.org/10.1145/1823818.1823832

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WHAT GLOBAL CSR COMMUNICATION STRATEGIES ARE EFFECTIVE FOR APPAREL FIRMS? COMPARISON BY STRATEGIC ORIENTATION, CONTENT DOMAIN, AND OPERATIONAL PERSPECTIVE

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Introduction

Over the years, the highly globalized apparel industry has consistently captured consumer attention due to concerns about environmental pollution, fair labor, and opaque supply chain issues. Thus, the development of effective international CSR communications has become imperative for global-targeted apparel firms. However, the existing literature focuses on exploring the effects triggered by specific CSR campaign and limited research compared different effects by multifaceted CSR communication strategies. Furthermore, how consumers' interpretation of such CSR communications, such as their CSR motivation perceptions, and behavioral response following those were limitedly examined. To close these gaps, based on the Activating Event-Beliefs-Consequences (ABC) cognitive theory (Ellis, 1957) and Tri-Dimensional (3D) CSR model (Arthaud-Day, 2005), this study aims to examine consumers' CSR motivation perceptions and behavioral responses differing by three dimensions of CSR communications: strategic orientation (global vs. local CSR), content domain (environmental vs. social vs. consumer CSR) and operational perspective (philanthropic vs. promotional CSR).

Literature Review

The ABC cognitive theory (Ellis, 1957) provides a theoretical framework that CSR communications (activating event) provoke consumers' motivation perceptions toward them (beliefs), and these perceptions result in behavioral response (consequence). In terms of how different CSR communications affect as an activating event, Arthaud-Day's (2005) 3D CSR model proposed that CSR communications differ by three dimensions: strategic orientation, content domain, operational perspective. Strategic orientation deals with to where the CSR communication targets, such as, globally-targeted or locally-targeted. Content domain pertains to what specific content that the CSR communication emphasizes, such as, the environment, social, or consumer issues. Operational perspective relates to whether the CSR communication is explicitly tied to sales (promotional CSR) or purely dedicated to philanthropic purpose (philanthropic CSR). From these CSR communications, consumers can develop CSR motivation perceptions, interpreting the firm's intention, as the beliefs toward the activating event. Zhao et al. (2020) posited that CSR motivation perceptions are divided into three dimensions: value-driven (interpreting that the CSR communication is based on the moral intention), performance-driven (intention to enhance corporate performance), and stakeholder-driven (intention to meet the stakeholder expectations). Lastly, as the consequence, these perceptions can affect consumers' behavioral response, specifically, in-role (i.e., support for the firm and product purchases) and extra-role (i.e., recommend and promote to others) behavioral intention. Previous research suggested that consumers' CSR motivation perceptions could differ by the CSR communication's strategic orientation, content domain, and operational perspective (e.g., Miska et al., 2016; Nickerson et al., 2021; Shahzad et al., 2020), and these perceptions increase their in-role and extra-role behavioral response (e.g., Kim et al., 2023; Skarmeas & Leonidou, 2013). Based on these, hypotheses were developed as follows.

H1: Consumers' value-driven (H1a), performance-driven (H1b), and stakeholder-driven (H1c) motivation perceptions will differ by the CSR communication's strategic orientation.

H2: Consumers' value-driven (H2a), performance-driven (H2b), and stakeholder-driven (H2c) motivation perceptions will differ by content domain.

H3: Consumers' value-driven (H3a), performance-driven (H3b), and stakeholder-driven (H3c) motivation perceptions will differ by operational perspective.

H4: Consumers' CSR motivation perceptions will significantly influence their in-role (H4a) and extra-role (H4b) behavioral intentions.

Research Method

To test the hypotheses, a 2 (strategic orientation: global vs. local CSR) x 3 (content domain: environmental vs. social vs. consumer CSR) x 2 (operational perspective: philanthropic vs. promotional CSR) online experiment was conducted. A fictitious apparel firm's CSR campaign images representing each of environmental, social, and consumer issues were selected via a pretest. Upon IRB approval, Chinese consumers in their 20s-60s participated in the experiment. As manipulation check, only the participants who correctly identified the manipulations of the image (global vs. local, environmental vs. social vs. consumer, and philanthropic vs. promotional) were proceeded to evaluate motivation perceptions and in-role and extra-role behavior intentions. The measures were adapted from previous studies (e.g., Deng et al., 2023; Zhao et al., 2020). A total of 600 responses (50 per condition) were analyzed.

Results & Discussion

EFA and CFA confirmed three factors (value-driven, performance-driven, and stakeholder-driven) for CSR motivation perceptions and two for behavioral intentions (in-role and extra-role). To test H1-H3, MANOVA was conducted. Table 1 showed that consumers' CSR motivation perceptions were significantly different in strategic orientation, content domain, and operational perspective. Specifically, value-driven was significantly higher in local CSR (vs global CSR), social or consumer CSR (vs environmental CSR), and philanthropic CSR (vs promotional CSR). Performance-driven was significantly higher in global CSR (vs local CSR), environmental CSR (vs social or consumer CSR), and promotional CSR (vs philanthropic CSR). Stakeholder-driven was significant higher in consumer CSR (vs social CSR) and philanthropic CSR (vs promotional CSR). Thus, partially supporting H1, H2, and fully supporting H3. The PLS-SEM results indicated that value-driven and stakeholder-driven positively influence consumers' in-role (β_{value}=.24, p<.01; $\beta_{stakeholder}$=.21, p<.01) and extra-role behavior intention (β_{value}=.23, p<.01; $\beta_{stakeholder}$=.24, p<.01). In contrast, performance-driven negatively influence on extra-role behavior intention ($\beta_{performance}$=-.20, p<.01), whereas no significant influence on in-role behavior intention, thus, partially supporting H4a and H4b.

Table 1 Results of testing *H1 – H3*: MANOVA

Independent Variables	Mean			Results
	Value-driven (a)	Performance-Driven (b)	Stakeholder-driven (c)	
H1: Strategic Orientation: Wilk's λ=.93, $F_{(3,586)}$=14.65, p<.01				
Global (G)	4.60	3.35	5.44	Supported H1a, H1b Rejected H1c
Local (L)	5.38	2.73	5.52	
p-value	< .001	< .001	.57	
Post-hoc test	L > G	G > L	G = L	
H2: Content Domain: Wilk's λ=.86, $F_{(6,1172)}$=15.48, p<.01				
Environment (E)	4.37	3.73	5.54	Partially Supported H2a, H2b, H2c
Social (S)	5.13	2.81	5.23	
Consumer (C)	5.47	2.58	5.68	
p-value	< .001	< .001	< .05	
Post-hoc test	C = S > E	E > S = C	C = E > S	
H3: Operational Perspective: Wilk's λ=.90, $F_{(3,586)}$=22.97, p<.01				
Philanthropic (Ph)	5.26	2.54	5.68	Supported H3a, H3b, H3c
Promotional (Pr)	4.72	3.55	5.28	
p-value	< .001	< .001	< .01	
Post-hoc test	Ph > Pr	Pr > Ph	Ph > Pr	

=: no significant difference

Conclusion

This study integrates the ABC theory and 3D CSR model to assess consumers' different responses by apparel firm's multifaceted CSR communications. As predicted, consumers' CSR motivation perceptions differed by strategic orientation, content domain, and operational perspective. This indicates that for globally-targeted apparel firms, conducting local, social or consumer, and philanthropic CSR can better reflect company values and concern for stakeholders, thereby inducing consumers' intentions for purchase and recommendations. On the other hand, global, environmental, and promotional CSR can lead consumers to perceive firm's intention as being based on self-interest (e.g., profit maximization), which can trigger negative behavioral intentions. The findings of this study contribute to the literature by providing a holistic comparison of apparel firm's CSR communications by strategic orientation, content domain, and operational perspective, and offer practical insights for apparel firms about how different CSR communications are grasped by consumers.

References

Arthaud-Day, M. L. (2005). Transnational corporate social responsibility: A tri-dimensional approach to international CSR Research. *Business Ethics Quarterly, 15*(1), 1-22.

Deng, N., Jiang, X., & Fan, X. (2023). How social media's cause-related marketing activity enhances consumer citizenship behavior: the mediating role of community identification. *Journal of Research in Interactive Marketing, 17*(1), 38-60.

Ellis, A. (1957). Rational psychotherapy and individual psychology. *Journal of Individual Psychology, 13*(1), 38.

Kim, T., Yang, J., & Yim, M. C. (2023). The effect of institutional CSR on brand advocacy during COVID-19: The moderated mediation effect of CSR expectancy and value-driven motivation. *Journal of Product & Brand Management, 32*(1), 37-58.

Miska, C., Szőcs, I., & Schiffinger, M. (2018). Culture's effects on corporate sustainability practices: A multi-domain and multi-level view. *Journal of World Business, 53*(2), 263-279.

Nickerson, D., Lowe, M., Pattabhiramaiah, A., & Sorescu, A. (2022). The impact of corporate social responsibility on brand sales: An accountability perspective. *Journal of Marketing, 86*(2), 5-28.

Shahzad, M., Qu, Y., Javed, S. A., Zafar, A. U., & Rehman, S. U. (2020). Relation of environment sustainability to CSR and green innovation: A case of Pakistani manufacturing industry. *Journal of Cleaner Production, 253*, 119938.

Skarmeas, D., & Leonidou, C. N. (2013). When consumers doubt, watch out! The role of CSR skepticism. *Journal of Business Research, 66*(10), 1831-1838.

Zhao, Y., Qin, Y., Zhao, X., Wang, X., & Shi, L. (2020). Perception of corporate hypocrisy in China: the roles of corporate social responsibility implementation and communication. *Frontiers in Psychology, 11*, 595.

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SECONDARY MARKET VALUATION OF CO-BRANDED LIMITED EDITIONS IN FASHION: A CASE STUDY FOCUSING ON SUPREME

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Introduction

This study aims to examine the valuation dynamics of Supreme's co-branded products in the secondary market. Supreme's significant success and impact within co-branded ventures have notably influenced market dynamics, consumer perceptions, and valuations, making it an ideal subject for this research. Supreme's status as a prominent streetwear brand, whose co-branded series often possess unique cultural relevance and scarcity, provides the rationale for focusing on its collaborations, as they not only enhance brand visibility but also stimulate consumer demand, thereby driving exceptional secondary market performance. The varying positioning of the partnering brands across luxury, fashion, or streetwear domains will offer valuable insights into the differential impact on secondary market valuations.

This research intends to identify the factors influencing the secondary market valuation of co-branded goods and how collaborations with differently positioned brands affect market performance. It will assess the price appreciation rate, resale volume, and overall valuation of Supreme's co-branded limited editions in the secondary market. By analyzing sales performance, appreciation levels, and market demand for these collaborations, the study seeks to fill the gap in understanding their market success and long-term value. It aims to provide comprehensive insights into the impact and performance of these products, offering valuable lessons for the continued expansion of the global fashion market.

Literature Review

Co-branded limited edition fashion products leverage scarcity and exclusivity to drive consumer demand and increase brand value, acting as powerful symbols of status and uniqueness (Aaker, 1991; Cialdini, 2001). Their strategic deployment enhances perceived value and purchase intent through associated prestige (Balachander & Stock, 2009). However, the appeal hinges on the nuanced balance between product suitability and scarcity signals (Gierl & Huettl, 2010).

High-profile collaborations, such as Chanel x H&M and Nike x Stüssy, have proven to not only meet consumer desires for distinctive products but also command premium resale values up to 600% above retail (Ahmed, 2018), showcasing the economic potential of these strategic partnerships. Iconic collaborations like Louis Vuitton x Supreme exemplify market excitement, with the active secondary market capitalizing on increasing rarity over time. Consumer behavior is shaped by perceived quality, brand reputation, and emotional connections (Kim & Kim, 2020).

Collaborations between high-end and mainstream brands extend luxury appeal while reinforcing exclusivity . The trend aligns with consumer preferences for unique, personalized fashion experiences and more sustainable choices. The anticipated growth of the luxury second-hand market to €77 billion by 2025 (TheIndustry. fashion, 2023) highlights a significant shift, indicating an essential area for further research into the long-term value and market demand of limited edition collaborations.

Research Method

This research aims to delve into the valuation dynamics of co-branded limited edition fashion products in the secondary market by analyzing sales data from StockX and search volume metrics from SEMRush, with a particular focus on Supreme's collaborations with luxury and streetwear brands such as Louis Vuitton, The North Face, Comme des Garçons, PLAYBOY, Lacoste, and Levi's. Utilizing the StockX platform, key data points including the number of sales, initial retail prices, average resale prices post-

launch, and the price increase index for each co-branded product are collected. The SEMRush analysis tool is employed to monitor the search volume of these co-branded products and their partnering brands to assess consumer interest and market impact. Search volume data is collected quarterly over two years following product releases to capture long-term trends. The selection of the aforementioned brands for study is motivated by their representation of a range of market positions in collaboration with Supreme, from luxury to traditional streetwear, facilitating an understanding of how different types of collaborations impact market valuation. The research timeframe is set to two years post-product release to fully comprehend market response and value fluctuations of these co-branded products. The "price increase index" is calculated as the percentage growth of the product's resale price relative to its initial retail price, quantifying the market's valuation of the co-branded products. The "average resale price" refers to the mean selling price of the products in the secondary market, serving as a measure of market performance and consumer willingness to pay. Supreme, as a preeminent streetwear brand, often garners significant market attention and recognition for its co-branded products with other labels. By conducting an in-depth study of this exemplary case, the research aims to comprehensively unveil the value evolution patterns of limited-edition co-branded products in the secondary market, providing valuable insights into the pricing mechanisms of the entire streetwear fashion industry.

Although the case study approach allows for a profound examination of the Supreme case, the generalizability of the findings may be limited to some extent. Future research could consider expanding the sample scope to include co-branded products from more brands, facilitating more comprehensive and generalizable discoveries.

Results & Discussion

Through StockX data, it was observed that "The North Face (Mountain Parka)" achieved the highest sales volume, contrasting with the lowest sales of "Playboy (Pocket Tee)." Among these, "Louis Vuitton (Box Logo Hooded Sweatshirt)" commanded the highest average resale price, witnessing a surge of 424.73%, whereas "Levi's (Nylon Trucker Jacket)" experienced a decline in the secondary market, with an index of - 10.48%. "Comme des Garçons (Box Logo Hooded Sweatshirt)" occupied a middle ground, with moderate sales volume but a price increase surpassing that of The North Face.

Overall, the average resale frequency of Supreme's co-branded products was about 16 times, with a significant variance in average sale price, further illustrating the diversity in consumer valuation and demand. Additionally, the secondary market price range from - 10.48% to 424.73% highlights the dramatic fluctuations in investment returns for resellers. Utilizing SEM Rush for frequency search volume revealed sustained consumer search interest in Louis Vuitton, indicating its consistent market position, whereas the collaboration with The North Face also maintained a steady trend. An initial surge yet subsequent drop in search volume for Playboy indicated gradually waning interest, while Lacoste's search volume demonstrated growth potential, especially after one year, suggesting its market influence, although delayed, was on the rise. Levi's collaboration presented a unique case with a notable decline, highlighting a potential decrease in consumer interest or market saturation.

To better understand these relationships, the study compared the search volume for co-branded limited edition sales products with the general search volume of each brand during the same period. It was found that nearly all brands maintained or showed an upward trend in search volume. Notably, Levi's brand search volume was on an upward trend, yet it showed a downward trend during the co-branded limited edition release. Given the study's focus on the long-term value of co-branding partnerships, it is evident that collaborations between luxury brands like Louis Vuitton and street wear giants such as Supreme can secure sustained market interest, indicating enduring appeal and investment potential. The continued market strength of collaborations with sportswear brands like The North Face and Supreme may reflect these brands' resonance within their specific consumer markets and their successful brand positioning strategies. The limited aftermarket appreciation potential for brands similar to Levi's might depend on their brand positioning.

Conclusion

The findings of this study elucidate the multifaceted motivations driving consumer purchases in the secondary market, where niche mainstream brands can surpass sales expectations due to unique design collaborations. The substantial price increases observed in luxury collaborations highlight the long- term investment value of high-end partnerships. However, trends for brands such as Levi's underscore the necessity of evaluating long-term investment value and the complexity of market demand.

This research also highlights that consumer interest in sportswear collaborations remains sustained over time. This ongoing appeal suggests that a combination of utility and prestige may yield more enduring investment value. Nevertheless, this study has certain limitations, including a reliance on StockX data and a focus on Supreme collaborations, which may introduce biases and potentially overlook broader insights in the luxury and streetwear sectors. In summary, products with established popularity are more likely to thrive in the secondary market following a co-branded release, while the unique attributes of a brand can significantly enhance the performance of co-branded items in the same market. This study aims to extend understanding of these dynamics, exploring the impact of brand allure and uniqueness on the long-term investment value and market demand of co-branded limited edition fashion items, thereby providing stakeholders with strategic insights into the secondary market's potential.

References

Aaker, D. A. (1991). *Managing brand equity*. Free Press.

Ahmed, O. (2018).The power of designer collaborations. *Vogue UK*. Retrieved from
https://www.vogue.co.uk/article/the-power-of-designer-collaborations

Balachander, S., & Stock, A. (2009). Limited edition products: When and when not to offer them. *Marketing Science,* 28(2), 336–355.

Cialdini, R. B. (2001). *Influence: Science and practice (4th ed.).* Allyn & Bacon.

Gierl, H., & Huettl, V. (2010). Are scarce products always more attractive? The interaction of different types of scarcity signals with products' suitability for conspicuous consumption. *International Journal of Research in Marketing*, 27(3), 225–235.

Kim, W., & Kim, B. (2020). Consumption motivation of limited edition product in reselling open market. *Journal of Open Innovation: Technology, Market, and Complexity,* 6(4), 133. https://doi.org/10.3390/joitmc6040133

TheIndustry.fashion. (2023). Why luxury brands are embracing the resale revolution. Retrieved from https://www.theindustry.fashion/

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THE EFFECT OF SUSTAINABLE FASHION STORYTELLING ON BRAND TRUST AND PURCHASE INTENTION
-THE MODERATING EFFECT OF CONSUMPTION VALUE ON SUSTAINABILITY-

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Introduction

As the impact of the fashion industry on the environment becomes more serious, interest in sustainable fashion is increasing as a solution. In this trend, sustainability has long been used in marketing as a keyword in the fashion industry. However, consumers' attitudes toward sustainable fashion brands have not always led to purchasing behavior(McNeill & Moore, 2015). Previous research underscores the pivotal role of sustainable brand storytelling in bridging the gap between consumer attitudes and purchasing behaviors by fostering trust in sustainable brands (Huang & Guo, 2021). Building on this foundation, this study delves into the comparative effectiveness of brand-oriented versus product-oriented storytelling in enhancing this trust. The research further explores how consumption value related to sustainability moderate these effects, positioning it both as independent and moderating factors. This approach aims to examine the mechanisms by which storytelling in sustainable fashion can increase brand trust, ultimately aligning consumer attitudes more closely with their purchasing behaviors.

Literature Review

Trust has a great influence on the purchase of sustainable products (Amyx et al., 1994). Huang and Guo (2021) emphasized the importance of brand trust and confirmed that brand trust has a positive effect on perceived brand authenticity. Storytelling is an important marketing tool that may influence this trust. Storytelling marketing makes brands more attractive and authentic, which has a positive effect on consumers' consumption behavior. In previous studies, various storytelling elements (brand value, history, vision, product attribute information, product development process, etc.) were presented, and in this study, two elements were classified: brand-centered storytelling elements and product-centered storytelling elements, which are commonly covered in many studies. In this study, storytelling marketing was also considered to be more effective for people with high consumption value for sustainability. This is because when consumers choose an eco-friendly product, they consider not only the physical characteristics or socio-economic aspects of the product, but also how it is connected to the value or goal they pursue (Heo & Ahn, 2009). It is also believed that the level of sustainable fashion brand trust can vary as the degree of acceptance of sustainable fashion brand storytelling varies depending on the level of consumption value for sustainable fashion. Based on these expectations, research hypotheses were posited as follows: H1: Sustainable fashion brand storytelling will have a significant influence on sustainable fashion brand trust and purchase intention. (Storytelling Main Effect), H2: The consumption value of sustainability will have a significant influence on fashion brand trust and purchase intention (Sustainable Consumption Value Main Effect), H3: Consumption Value for Sustainability will moderate the effect of sustainable fashion brand storytelling on sustainable fashion brand trust and purchase intention (Interaction Effect). Storytelling marketing makes brands more attractive and authentic, which has a positive effect on consumers' consumption behavior.

Research Method

An online survey of adult male and female consumers aged between 20 and 59 was conducted, and a total of 192 responses were collected. Respondents were randomly assigned to one of three groups: brand-oriented storytelling (Experimental group 1), product-oriented storytelling (Experimental group 2), or

general product description control group without a storytelling element (Control), each exposed to different information on a fictitious brand, *Mulgogi*. Based on the information provided in the stimuli, respondents were asked to answer questions measuring consumption value, fashion brand trust, intention to purchase the sustainable brand's product, and demographic characteristics for sustainability. For the analysis of the collected data, multiple regression analysis, one-way analysis of variance, and simple regression analysis were conducted using SPSS.

Results & Discussion

First, for the effect of sustainable fashion brand storytelling, two dummy variables were generated: Exp1 (experimental group exposed to brand- oriented storytelling coded as 1), and Exp2 (experimental group exposed to product-oriented storytelling coded as 1). A multiple regression analysis was conducted with the consumption value of sustainability(CV), sustainable fashion brand storytelling dummy variables (Exp1 and Exp2), and interaction terms (Exp1*CV and Exp2*CV) as in dependent variables, and brand trust (Trust) as the dependent variable. The model was significant with the F=53.53 (p<.001). The sustainable fashion brand storytelling main effect (Exp1) as well as the interaction effect with consumer value were significant only for brand-oriented group (Exp1*CV). For product-oriented group, neither main effect (Exp2) nor the interaction effect with consumer value (Exp2*CV) was significant. Second regression model included Exp1, Exp2, CV, Exp1*CV, Exp2*CV, and Trust as independent variable, and Purchase Intention (PI) as the dependent variable. This model was significant with the F=59.19 (p<.001). According to this model, only Trust had a significant effect on PI, indicating that the effects of storytelling and consumer value are mediated by brand trust.

Conclusion

In conclusion, confirmed that storytelling (especially brand-oriented) was effective in increasing brand trust, and brand-oriented storytelling was more effective than product-oriented storytelling in increasing brand trust. In particular, it was effective for people with low consumption value. In addition, as brand trust completely mediates the effects of storytelling and consumer value, it plays an important role in predicting purchase intention. The implications of this study are as follows. First, this study has a practical implication in that it confirmed the importance of brand trust in the marketing strategy of sustainable fashion brands. Although previous studies have found that storytelling can increase trust (Akgun et al., 2015; Hartmann et al., 2016), there has been no research on storytelling strategies targeted for sustainable fashion brands. It is meaningful in that it provides evidence to the usefulness of storytelling marketing as a means of enhancing consumer trust in the sustainability of fashion brands. Additionally, the findings of this study suggest that the impact of brand storytelling varies based on the specific storytelling elements incorporated with in the narratives, indicating the necessity for more detailed exploration.

References

Amyx, D.A., DeJong, P.F., Lin, X., Chakraborty, G., Wiener, J.L. (1994). Influencers of Purchase Intentions for Ecologically Safe Products: An Exploratory Study, *In Marketing Theory and Applications: The Proceedings of the 1994 American Marketing Association's Winter Educator's Conference*. 341–347.

Akgun, A. E., Keskin, H., Ayar, H., & Erdoğan, E. (2015). The influence of storytelling approach in travel writings on readers' empathy and travel. intentions. *Procedia Soc. Behav. Sci. 207*, 577–586.

McNeill, L., & Moore, R. (2015). Sustainable fashion consumption and the fast fashion conundrum: fashionable consumers and attitudes to sustainability in clothing choice. *International journal of consumer studies, 39*(3), 212-222.

Heo, W., Ahn, J. (2009). Effects of consumption value for eco-friendly products of silver consumers on satisfaction, trust, and loyalty, *Korean Geriatrics, 29*(1).

Huang, C., Guo, R. (2021). The effect of a green brand story on perceived brand authenticity and brand trust: the role of narrative rhetoric. *Journal of Brand Management, 28*, 60-76.

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LTNS (LOW TIME NO STEP): LIGHTWEIGHT TECH FOR CLOTHING RECOMMENDATION MODEL BASED ON YOLOv8 MODEL

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Introduction

In recent times, the fashion market has witnessed a proliferation of digital marketing and artificial intelligence (AI), wherein AI-based clothing coordination recommendation systems have gained significance in online retail. These systems offer personalized clothing suggestions tailored to individual preferences and styles. However, in today's fast-paced society, individuals often lack sufficient time to dedicate to finding fashion items that suit them personally, leading to unconscious duplicate purchases and inefficient consumption patterns. (Choi. J. Y, 2023) In this paper, we propose utilizing the YOLO model to classify and compare users' existing wardrobe items. To streamline AI models and enhance efficiency, we reduce the dataset's class complexity and conduct research to measure similarity within a short timeframe. By addressing the challenges of redundant purchases and promoting sustainable consumer behavior, our study aims to contribute to the optimization of AI-driven clothing recommendation systems.

Literature Review

For this study, we employed the YOLOv8 Classification model, sourced from 'Ultralytics,' among various YOLO models available. This model distinguishes object types by leveraging a Convolutional Neural Network (CNN) architecture to extract image features and classify object classes. Unlike conventional artificial intelligence models, YOLO models typically undergo one-step learning, enabling quick analysis of images with small input data. (Lee. G. H, 2019) (Yoon. J. H, 2021)Due to this characteristic and the model's ability to yield high-accuracy results swiftly, we deemed it suitable for our study's objectives and thus selected it for implementation.

Research Method

To initiate this study, as delineated in Figure 1, we established a "Wannabe Style" class and stored the coordination image representing the model presumed to be desired by the user. Additionally, we created a total of C Variety Style classes, each containing random images, to construct the dataset for image classification and comparison. As illustrated in Figure 2, we configured the size of the in-class image dataset utilized for learning to be 480, aiming to enhance training speed through increased memory utilization and reduced disk input/output. By enabling the cache parameter to True, we extended the epoch range from 1 to a maximum of 30 during training. In total, six models were trained. To manage the user's owned clothing items, we generated and stored lists named T for tops, B for bottoms, and TxB for combinations of tops and bottoms. These lists were utilized to assess similarity using the six trained models. We conducted calculations to determine the similarity of color and type for clothing items, considering a threshold of 0.4 or higher to identify items as similar, thereby guiding the progression of the study.
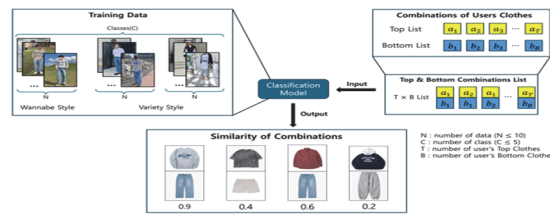
Figure 1. Concept Diagram

Figure 2. Dataset

Results & Discussion

The average learning time for each of the six models ranged between 6 and 8 seconds. To evaluate similarity, an experiment was conducted involving random images representing All Similar, Top Similar, Bottom Similar, and All Different clothing combinations, visually alike. The results indicated an average similarity comparison time per image ranging from 0.6 to 0.7 seconds. As illustrated in Table 1, an increase in the number of epochs correlated with an enhancement in the similarity of the "Wannabe Style" class. Notably, in the model trained for 25 epochs, a similarity exceeding 0.4 was observed in three images (All Similar, Top Similar, Bottom Similar).

Table 1. Result Table

Epochs : 1 (0.009 hours)

	All Similar	Top Similar	Bottom Similar	All Different
Wannabe Style	0.18	0.20	0.19	0.23
Spotry	0.20	0.20	0.24	0.16
Suit	0.17	0.19	0.21	0.18
Padded_coat	0.30	0.23	0.18	0.29
Basic	0.15	0.18	0.18	0.14

Epochs : 20 (0.187 hours)

	All Similar	Top Similar	Bottom Similar	All Different
Wannabe Style	0.43	0.37	0.35	0.16
Spotry	0.10	0.11	0.14	0.22
Suit	0.09	0.10	0.15	0.18
Padded_coat	0.14	0.14	0.13	0.24
Basic	0.25	0.29	0.23	0.21

Epochs : 5 (0.044 hours)

	All Similar	Top Similar	Bottom Similar	All Different
Wannabe Style	0.27	0.22	0.21	0.22
Spotry	0.15	0.20	0.21	0.17
Suit	0.16	0.16	0.21	0.19
Padded_coat	0.23	0.20	0.17	0.24
Basic	0.18	0.21	0.20	0.18

Epochs : 25 (0.228 hours)

	All Similar	Top Similar	Bottom Similar	All Different
Wannabe Style	0.59	0.55	0.53	0.17
Spotry	0.06	0.07	0.08	0.25
Suit	0.05	0.07	0.10	0.16
Padded_coat	0.09	0.10	0.10	0.25
Basic	0.20	0.22	0.19	0.17

Epochs : 10 (0.093 hours)

	All Similar	Top Similar	Bottom Similar	All Different
Wannabe Style	0.28	0.22	0.20	0.19
Spotry	0.15	0.17	0.19	0.18
Suit	0.13	0.13	0.19	0.18
Padded_coat	0.21	0.19	0.16	0.23
Basic	0.23	0.29	0.26	0.22

Epochs : 30 (0.274 hours)

	All Similar	Top Similar	Bottom Similar	All Different
Wannabe Style	0.72	0.55	0.67	0.16
Spotry	0.03	0.04	0.04	0.29
Suit	0.02	0.04	0.05	0.10
Padded_coat	0.04	0.08	0.04	0.24
Basic	0.20	0.29	0.20	0.20

Conclusion

In this paper, we adopt a unique approach by employing a learning model divided into a smaller number of epochs. For experimentation, we curated classes with random images focusing solely on top and bottom clothing items and their colors, generating the desired user model's coordination. However, it's worth noting that the study's images predominantly featured male clothing with limited variations. To improve accuracy, future experiments will diversify gender representation and clothing items, aiming to refine similarity measurements. This endeavor anticipates advancing the fashion market through a more comprehensive clothing recommendation system tailored to user preferences.

References

Choi. J. Y. : Deep Learning-based Fashion Image Analysis for Fashion Recommendation System, Master's thesis, Graduate School, Handong Global University, 2023/08.

Lee. G. H. : Development of Collaborative Deep Learning System for Fashion Recommendation, Master's thesis, Graduate School, Konkuk University, 2019/02.

Yoon. J. H : Service Quality and Satisfaction of Fashion Product Recommendation Systems, Master's thesis, Graduate School, Hanyang University, 2021/08.

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TEXT MINING-BASED GPT APPROACHES FOR ANALYZING FASHION TRENDS

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Introduction

Researchers who are new to research must examine large amounts of research data by analyzing previous past studies. Categorizing them manually is time-consuming and inefficient. To address these issues, many researchers are turning to text mining techniques to extract keywords to identify research trends, as it is the easiest way to leverage unstructured text data.(Won, Kang, Lee, 2023) However, it is difficult to analyze whether the keywords extracted from the results preprocessed with text mining techniques are relevant to the domain data. To address these issues, this study extracts keywords from yearly apparel data and feeds them into GPT to generate sentences. It goes beyond simply analyzing trends by keywords and proposes an innovative system that allows you to look at the generated sentences and compare fashion trends across years.

Literature Review

Fashion trends are accelerating over time. Text mining techniques are utilized to understand these rapid changes. Refining and analyzing vast amounts of unstructured data helps to identify trends in fashion. (Jang & Kim, 2023) For example, big data analytics tools such as 'Textom' are being utilized to perform morphological analysis and delete unnecessary text to refine the data.(Kim & Byun, 2020) In addition, various keywords have been extracted through keyword analysis of social media posts targeting Generation Z over the past five years, and among them, studies are being conducted to analyze fashion trends by selecting major keywords based on the frequency of co-occurrence.(Sung, 2020) However, keywords alone can sometimes be difficult to identify overall trends in the data, and the relevance of the extracted data to a specific domain can be difficult to find. To complement this, research is also underway to use natural language generation models such as GPT to generate more detailed sentences using extracted keywords as input.(Ha, Moon, Choi, 2020)

Research Method

In this study, we apply text mining techniques to fashion trend data and analyze it. Extract important keywords through text mining and feed them into GPT fine-tuning models to generate sentences. We propose a system to identify and compare fashion trends from year to year. In this process, text mining extracts meaningful information from unstructured data, while the GPT fine-tuning model generates sentences based on keywords. These methods open up new avenues of research and provide insights into analyzing fashion trends.
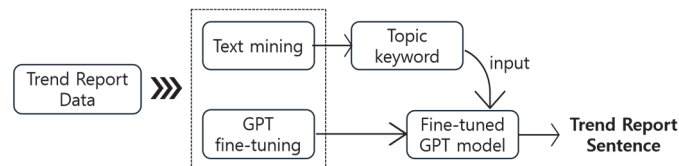
Results & Discussion

From this study, we found that the sentences generated by the GPT fine-tuning model based on keywords extracted through text mining reflect the fashion trends of each year well. The keywords extracted by year using text mining techniques are as follows. In 2020, the keyword up-cycling was extracted, and in 2021 and 2022, the same for Low-rise.

The above results are the result of extracting keywords from the S/S seasonal trend report data using text mining techniques. For fine-tuning, we set Max_length to 100, sentence degrees of freedom to 0.8, Epochs to 1, Sequences to 1, Batch_size to 8, and Blocks_size to 1024. These results show that by combining text mining and GPT fine-tuning, fashion trends are more easily identified than if they were simply identified by keywords.

years	Topic Keywords	Trend report sentences
2020	Up-cycling	The S/S 2020 season saw the rise of denim in a variety of styles, and with the upcycling of second-hand items and the rise of eco-friendly denim brands, there's been an increased focus on the environment.
2021	Low-rise	A keyword for S/S 2021, 'low rise' is the styling of pants worn slightly lower, with designs ranging from sensual to classic minimalist, depending on the mood.
2022	Low-rise	The low-rise fashion trend is making a comeback as the new season's hipster formula. Cropped tops, distressed jeans, and wide-legged pants are all the rage, with modern twists on 2000s styles, and bold styles that accentuate the waistline for a sensual vibe.

Conclusion

The study is expected to play an important role in the development of the fashion industry and a better understanding of consumers' fashion preferences. Furthermore, it will help various fashion brands and companies to quickly identify market trends and make strategic decisions. In an era characterized by the rapid evolution of fashion trends, this system holds promise as a valuable tool, offering timely insights to navigate the dynamic landscape of the fashion industry.

References

Kim, G. (2020). Study on the Korean fashion industry. *The Journal of Fashion*, 15(3), 120-135.

Yujeong Won, Chanhee Kang, Yuri Lee (2023). Analysis of Consumer Value Structure in Vintage Clothing Consumption: Based on Text Mining and Means-End Chain Analysis. Journal of the Korean Society of Clothing and Textiles, 729~742.

NamKyung Jang, Min-Jeong Kim (2020). Material as a Key Element of Fashion in 2010~2019: Text Mining Analysis. The Korean Fashion and Textile Research Journal, 551-560.

Ki-Hyun Kim, Hae-Won Byun (2020). The Analysis of Fashion Trend Cycle using Big Data. The Journal of the Convergence, 113-123.

Kwang-Sook Sung (2020). Social media big data analysis of Z-generation fashion. Journal of the Korea Fashion & Costume Design Association, 49-62.

Jeong_Hoon Ha, Mikyeong Moon, Bong-Jun Choi (2020). Research on text mining-based prompt design techniques for improving generative AI language model performance. Journal of the Institute of Signal Processing and Systems, 1-8.

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THE EFFECTS OF PERCEIVED VALUE OF UPCYCLED FASHION PRODUCT ON SATISFACTION AND WILLINGNESS TO PAY PREMIUM -FOCUSING ON THE MODERATING ROLE OF NORMATIVE SUSCEPTIBILITY-

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Introduction

The fashion industry has been a significant contributor to environmental pollution, discarding an estimated $400 billion worth of clothing annually (Dissanayake et al., 2018). This situation underscores the need for sustainable fashion practices capable of efficiently utilizing the large quantities of textile waste generated. Upcycling, a sustainable production method that transforms discarded materials into higher quality and more valuable products, has emerged as a viable solution. Also, the market for upcycled fashion products has shown a remarkable growth trajectory, increasing from KRW 2.5 billion in 2014 to KRW 4 billion in 2020, with expectations for continued expansion. Consequently, a detailed consumer perspective analysis on the purchasing factors for upcycled fashion products has become imperative. Therefore, this study was conducted based on the Perceived Value Framework proposed by Sweeney and Soutar(2001).

Literature Review

Perceived value refers "The consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given"(Zeithamal, 1988). This study adopted Amin and Tarun(2021)'s perceive value framework which includes function, social, emotional value. Economic value was excluded because in upcycled fashion product context, the price of an upcycled product is high, so it is considered as a barrier when consumers make a purchase decision(Kim et al., 2021). Plus, this study added environmental value by referring to Kim and Kim(2018)'s study since environmental value is a core value in upcycled fashion product context. Meanwhile, social acceptance is an important predictor in green buying behavior and MZ generation's buying behavior. So this study tried to verify the importance of social-related variable like normative susceptibility as a moderating role in upcycled fashion product consumption context. Normative susceptibility means the conformity to the norms and expectation of others under all circumstances(Bearden et al., 1989). Thus, the specific research objectives were as follows: Firstly, to segment the values perceived by consumers in upcycled fashion products into functional, social, emotional, and environmental values, and to verify if these values significantly affect consumer satisfaction. Secondly, the study aimed to explore the impact of satisfaction on the willingness to pay a premium price. Lastly, it sought to examine whether the relationship between functional, social, emotional, and environmental values and satisfaction varies depending on the degree of normative susceptibility.

Research Method

This study conducted an online survey targeting adult men and women of the Millennials and Generation Z age groups who are aware of the upcycling fashion brand FREITAG. Survey respondents were provided with a brief explanation of upcycling and FREITAG, and were asked to answer the survey after being provided with a virtual shopping context. As a result, a total of 432 valid responses were collected. Afterwards, frequency analysis of measured variables, descriptive statistical analysis, and explanatory factor analysis were conducted through SPSS 26.0, and confirmatory factor analysis, structural equation modeling, and multi-group comparison were conducted through AMOS 24.0.

Results & Discussion

The findings reveal that while perceived functional, emotional, and environmental values positively impact satisfaction, social value does not significantly influence it. Further examination of the moderating effect of

normative susceptibility revealed distinct outcomes. Individuals with low normative susceptibility experienced increased satisfaction in proportion to their perception of the functional value in upcycled fashion products. However, those with high normative susceptibility did not exhibit similar satisfaction levels, even when recognizing functional value. Additionally, while the low susceptibility group did not achieve satisfaction from the social value of upcycled fashion products, the high susceptibility group experienced greater satisfaction in this regard. This indicates that consumers more sensitive to social relationships tend to prioritize the social benefit gained from a product over its intrinsic functional benefit. Finally, the research clarified the structural relationship between consumer satisfaction and the willingness to pay premium prices, establishing a valid correlation.

Conclusion

This research is significant for broadening the scope of upcycled fashion literature, which had been primarily focused on design, by analyzing the purchasing factors of upcycled fashion products from a consumer perspective. It reaffirms the importance of the social functions products provide in sustainable fashion literature and validates the moderating effect of normative susceptibility. Practitioners can gain insights from this study on which aspects of a product to emphasize in order to stimulate consumer purchase desires. These insights can then be used to develop appropriate marketing strategies.

References

Amin, S., & Tarun, M. T. (2021). Effect of consumption values on customers' green purchase intention: a mediating role of green trust. *Social Responsibility Journal*, *17*(8), 1320-1336.

Bearden, W. O., Netemeyer, R. G., & Teel, J. E. (1989). Measurement of consumer susceptibility to interpersonal influence. *Journal of consumer research*, *15*(4), 473-481.

Dissanayake, D. G. K., Weerasinghe, D. U., Wijesinghe, K. A. P., & Kalpage, K. M. D. M. P. (2018). Developing a compression moulded thermal insulation panel using postindustrial textile waste. *Waste Management, 79,* 356-361.

Kim, H. Y., & Kim, J. (2018). The effect od perceived value and risk on purchasing intention of up-cycling fashion product – Moderating role of ethical consumption attitude -. *The Research Journal of the Costume Culture, 26*(6), 899-918.

Kim, I., Jung, H. J., & Lee, Y. (2021). Consumers' value and risk perceptions of circular fashion: Comparison between secondhand, upcycled, and recycled clothing. *Sustainability*, *13*(3), 1208.

Sweeney, J. C., & Soutar, G. N. (2001). Consumer perceived value: The development of a multiple item scale. *Journal of retailing, 77*(2), 203-220.

Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence. *Journal of marketing*, *52*(3), 2-22.

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Proceedings

SHOPPING MOTIVATION OF SOLO CONSUMER FOR FASHION GOODS: SCALE DEVELOPMENT AND VALIDATION

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Introduction

With the improvement of people's living standards and the enhancement of fashion awareness, China's clothing industry has gradually developed into one of the largest clothing markets in the world (XYZResearch, 2023). Powerful demographic, social, and economic forces have led to shifts in people's preferences and behaviors. For example, the rise of the solo economy, the increase in the number of solo consumers. This phenomenon shows that more and more people choose to eat, entertain, and shop alone, and they are occupying an important position in the consumer market. In particular, due to the social isolation brought about by COVID-19 and the personalized shopping pattern of consumers after the implementation of the one-child policy, more consumers are expected to participate in solo consumption and shopping activities. Given the economic benefits of China's huge fashion consumer market, it is important to understand the behavior and motivations of consumers who buy fashion products alone. Additionally, existing research papers on fashion retail mainly focus on peer shopping, and there is still a certain gap in the research on the motivations of solo fashion consumers. In summary, to better understand the shopping motivations of this consumer group, this study developed and verified a shopping motivation scale for solo fashion consumers.

Literature Review

The concept of solo consumers was put forward by Goodwin and Lockshin (1992), who emphasized that what solo consumers experience is positive solitude. For example, people with stable social relationships will engage in intrinsically motivated behaviors alone, have no fear of spending alone, and enjoy the pleasure of solitude (Ratner & Hamilton, 2015). Previous studies from retail have shown that consumers have multiple levels of motivation when shopping (Wagner & Rudolph, 2010). The reasons that determine consumers' choice of solo fashion shopping may be related to their own personal preferences, personality and fashion awareness. Solo fashion consumers may have more specific needs than ordinary solo consumers. To further understand their specific motivations, the research questions are as follows:
1. What specific dimensions are implicated in the shopping motivations of solo consumers concerning fashion, and how can these dimensions be effectively articulated through items?
2. How can the reliability and validity of the shopping motivation scale for solo consumers of fashion goods be validated?

Research Method

The development process was based on the scale development procedure published by Churchill in 1979. The main contents include the generation, purification, and validation of the scale items. Firstly, after extensive literature investigation, 43 literatures related to the theme were sorted out and analyzed. Then 10 consumers with solo shopping experiences were in-depth interviewed, and the preliminary scale formed was reviewed by experts. The items and dimensions of the scale identified were made into questionnaires and conducted two questionnaire surveys successively (n=208, n=293). IBM SPSS Statistics 26.00 and Amos 26.00 were used to organize and analyze the collected data.

Results & Discussion

The solo fashion consumer shopping motivation scale mainly consists of five dimensions (freedom, self-exploration, emotional stimulation, unique activity, and shopping ambiance), totaling 21 items. They have specific consumption preferences. For example, they attach more importance to the enrichment and

satisfaction of internal needs and enjoy purchasing goods freely and without constraints. They pay attention to the impact of goods and the shopping environment itself. At the same time, they also value and seek opportunities for self-growth and personal space, demonstrating a tendency to explore self-worth.

Conclusion

This study defines and improves the definition of the solo fashion consumer and identifies a shopping motivation scale belonging to this group, which is helpful in expanding related research topics. Rigorous procedures and data analysis determined the feasibility and repeatability of the scale. Fashion retailers can also identify the specific motivations of solo consumers through this scale, build their unique consumer behavior database, and provide appropriate services and products. However, this scale should be applied with caution in other fields. The language of the scale, the survey field, and the age of the survey subjects may vary, and future research needs to take this into account.

References

Churchill, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research, 16*(1), 64.

Goodwin, C., & Lockshin, L. (1992). The solo consumer: Unique opportunity for the service marketer. *Journal of Services Marketing, 6*(3), 27–36.

Ratner, R. K., & Hamilton, R. W. (2015). Inhibited from bowling alone. *Journal of Consumer Research, 42*(2), 266-283.

Wagner, T., & Rudolph, T. (2010). Towards a hierarchical theory of shopping motivation. *Journal of Retailing and Consumer Services, 17*(5), 415–429.

XYZResearch. (2023, December 1). Analysis report on the status quo and future development opportunities of China's garment industry in 2023. Retrieved from https://baijiahao.baidu.com/s?id=17840435 6694935545&wfr=spider&for=pc

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WHEN FASHION INFLUENCERS STEP INTO THE STORE: AN APPLICATION OF THE STEREOTYPE CONTENT MODEL

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Introduction

Given the tremendous success of fashion influencer marketing in the social media context (Grand View Research, 2020), fashion influencer marketing has recently extended to offline stores, as seen with brands like Brandy Melville, entered the Chinese market and became an instant hit by employing a large number of social media fashion influencers as salespersons. Brands such as Chengdu Cosmos, 3MODE, W.Management, TOFOURH, IFIK, and others have adopted a similar strategy. Understanding the perceptions of warmth and competence, as well as the effects of fashion influencer salespersons, and the interaction with consumers' degrees of fashion interest becomes crucial in the adoption process of this new approach to fashion influencer marketing. This is especially relevant when applying fashion influencers as salespersons in offline retail stores. However, research investigating the perceptions of fashion influencer salespersons and whether they necessarily have a positive effect on brand attitudes remains limited. therefore, the purpose of this study is to explore whether fashion influencer go from social media to offline, whether being a fashion influencer salesperson is warmer and more competent than a regular salesperson, and is influenced by consumers' personal interest of fashion the extent to which the influence is moderated by the consumer's personal interest of fashion.

Literature Review

According to the SCM (Fiske et al., 2002), individuals form social perceptions based on stereotypes. Stereotypes are best captured by the two universal dimensions of social cognition, namely warmth and competence (Fiske et al., 2007). Following the Stereotype Content Model (Fiske et al., 2002), social perceptions are shaped by stereotypes. Consumers perceive fashion influencers as fashion taste leaders and Fashion influencers can also be considered online opinion leaders (Casaló et al.,2020). The literature has established that opinion leaders can influence others' behaviors due to their personal appeal or connection with their audience. Therefore, this study believe that compared to a regular salesperson, a fashion influencer salesperson is perceived to be more competent by consumers and form more positive effect on brand attitude, because he or she has a certain following and also acts as a fashion recommender. In terms of warmth, as mentioned above fashion influencers are opinion leaders and have thousands of followers, and have a certain authority in the fashion field, these leading them to be high-status in the fashion field. Besides that, the negative relationship between perceived group status and warmth ratings observed in some studies (Conway et al., 1996), where low-status groups were perceived to be warmer than high-status groups. Additionally, warmth holds greater significance in the assessment of emotions and behaviors. (Abele & Wojciszke, 2007), and the judgement of warmth precedes occurs prior the assessment of competence (Willis & Todorov, 2006), According to the stereotype content model, individuals tend to first assess the intentions of another person before evaluating their competence in achieving those intentions, additionally, judgments of morality/warmth is the key of the inclination to approach or avoidance, therefore, judgement of warmth are the fundamental dimension (Cuddy et al., 2009) .we expect the effect of fashion influencer salesperson through warmth and competence and this effect to vary depending on the individual characteristics of the customer. Therefore, we also explored the moderating effect of fashion interest. Based on results of Park & Burns (2005), fashion interest had significant positive effect on importance of being well dressed, as result, they may engage in comparisons with fashion influencer salesperson in the offline retail shop, leading to the emergence of negative emotions, such as envy and jealousy. This study therefore believes that the level of individuals' interest of fashion moderates the serial mediating effect of warmth and competence on brand attitude.

Research Method

To explore the effect of a fashion influencer salesperson, the present study employed a 2x2 between-subject experimental design to investigate the impact of a fashion influencer salesperson (versus an ordinary salesperson) on the brand attitude process. This process was serially mediated by the perceptions of warmth and competence of the salesperson, with moderation through the participant's level of fashion interest.

Respondents consisted exclusively of Chinese women, considered for their heightened susceptibility to the influence of fashion influencers. Data analysis consisted of demographic analysis, reliability assessment, and an independent t-test using SPSS 26.0. Furthermore, moderated mediation analysis conducted using PROCESS MACRO 4.1.

Results & Discussion

A total of 186 female participants who are collected through WENJUANWANG completed surveys.Their ages were most between 18 and 24 years (72.6%). The study performed a manipulation check and found a significant difference in salesperson types ($M_{ordinary}$=3.67, $M_{influencer}$=5.14, F=3.64, p $\leq$ .001). Thus, the manipulation was successful.

The independent t-test results revealed that lower degree of warmth in the fashion influencer salesperson condition than in the ordinary salesperson condition ($M_{influencer}$=4.89 vs. $M_{ordinary}$=5.25; t= -2.57, p < .05), and there was a significant difference of fashion influencer salesperson on competence ($M_{influencer}$=5.49 vs $M_{ordinary}$=5.21; t= 2.24, p < .05), on brand attitude ($M_{influencer}$=5.50 vs $M_{ordinary}$=5.12; t= 3.08, p < .01).

The study performed the PROCESS (Model 83, Hayes, 2018) with 5,000 bootstrap samples to examine the serially mediating role of warmth and competence and independent mediating effect of warmth and competence, additionally, the moderated effect of fashion interest. The results showed that fashion influencer salesperson compared to the ordinary salesperson direct resulted in a significant positive effect on attitude toward brand (b= .28, BootSE = .10, $BootCI_{95}$ = [.08, .48], and positive independent mediation indirect effect path was significant via competence (b= .25, BootSE = .06, $BootCI_{95}$ = [.15, .38]). The results support the overall model (R^2 = .06, F = 3.53, *p* < .05), and indicated that a significant moderated mediation effect on serial mediation ($b_{SEP}^{[1]}$=- .09, BootSE = .05, $BootCI_{95}$ = [-. 20, - .00]). Specifically, a spotlight analysis at one standard deviation on the mean of fashion interest revealed a significant moderated effect on serial mediation path toward the brand attitude (*b* =-.11, BootSE = .04, $BootCI_{95}$ =$_{SEP}^{[1]}$[- .20, - .03]), also above the mean of fashion interest condition similarly demonstrate the same significant effect (*b*=-.19, BootSE = .06, $BootCI_{95}$ = [-.33, - .08]), however below the mean of fashion interest condition had no significant moderated mediation effect on serial mediation(*b*=-.03, BootSE = .05, $BootCI_{95}$ = [-.14, -.08]),

The results indicated that, compared with an ordinary salesperson, a fashion influencer salesperson was perceived as having lower warmth but higher competence, leading to a more positive brand attitude. Additionally, a significant interaction between salesperson category and the degree of fashion interest was observed: as consumers varied in their levels of fashion interest, significant differences emerged in the warmth assessments of fashion influencer salespersons. Furthermore, moderated serial mediation effects were revealed, demonstrating that the level of fashion interest moderated the serial mediating effect of warmth and competence between salesperson category and attitude toward the brand. When consumers had a median and high level of fashion interest, the negative effect of serial mediation on brand attitude was significant.

Conclusion

In conclusion, this study aims to delve into the perceptions of fashion influencers, offering insights into the negative effects brought about by their influence. The findings uncovered a significant moderated serial mediation effect of fashion interest on brand attitude. This result holds crucial implications for

fashion company managers and brands seeking to enhance the effectiveness of their fashion influencer marketing strategies. By considering consumers' levels of fashion interest, marketers can tailor their fashion influencer marketing strategies to maximize the impact of negative perceptions of warmth and, in turn, improve consumers' attitudes toward the brand.

Collectively, this research demonstrated diverse consumer perceptions of fashion influencers in distinct environments, shedding light on stereotypes associated with fashion influencer salespersons. Additionally, it provides a foundation for understanding the positive relationship between warmth and competence.

References

Grand View Research. (2020). Fashion influencer marketing market size, share & trends analysis report by influencer type (megainfluencers, macroinfluencers, nanoinfluencers), by fashion type, by region, and segment forecasts, 2020-2027.
https://www.grandviewresearch.com/industryanalysis/fashion-influencer-marketinmarket#:~:text=Influencer%20marketing%20enables%20fashion%20brands,influencer%20marketing%20for%20fashion%20brands

Fiske, S. T. (2002). What we know now about bias and intergroup conflict, the problem of the century. Current Directions in Psychological Science, 11(4), 123-128.

Fiske, S. T., Cuddy, A. J., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. Trends in cognitive sciences, 11(2), 77-83.

Casaló, L. V., Flavián, C., & Ibáñez-Sánchez, S. (2020). Influencers on Instagram: Antecedents and consequences of opinion leadership. Journal of business research, 117, 510-519.

Conway, M., Pizzamiglio, M. T., & Mount, L. (1996). Status, communality, and agency: implications for stereotypes of gender and other groups. Journal of personality and social psychology, 71(1), 25.

Park, H. J., & Burns, L. D. (2005). Fashion orientation, credit card use, and compulsive buying. Journal of Consumer Marketing, 22(3), 135-141 doi: 10.1108/07363760510595959

Abele, A. E., & Wojciszke, B. (2007). Agency and communion from the perspective of self versus others. Journal of personality and social psychology, 93(5), 751. doi:10.1037/0022-3514.93.5.751

Willis, J., & Todorov, A. (2006). First impressions: Making up your mind after a 100-ms exposure to a face. Psychological science, 17(7), 592-598. doi: 10.1111/j.1467- 9280.2006.01750

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USING OPEN AI TO SEE FASHION COLLECTIONS BEFORE ANYONE ELSE DOES

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Introduction

Although AI is now publicly available in the form of open-source libraries, there have been high barriers to access for those without coding and programming knowledge. In 2023, AI company OpenAI's test-to-text AI model ChatGPT broke down these barriers and revolutionized the democratization of AI technology. The same company's test-to-image AI model DALL-E is also being used to generate new images. Meanwhile, fashion is an ever-evolving and influential medium of personal expression and cultural portrayal, shaped by historical events, social trends, media influence, and technological advances (Guo et al., 2023). The use of generative AI in the complex field of fashion has been actively discussed in terms of efficiency and convenience. In this study, we aim to verify the effectiveness of generative AI in predicting and visualizing fashion trends and propose its application.

Literature Review

Generative AI with Prompt Engineering
: Typical examples of generative AI are ChatGPT, which is based on text, and DALL-E, which is based on images. ChatGPT is an AI model that uses advanced deep learning techniques to analyze and generate text in natural language format. DALL-E is an image generation AI that uses a dataset consisting of text and image pairs. These generative AIs have inputs and outputs, and users input prompts to the generative AI and output results. To get high-quality results, users need to craft their prompts well, which is known as prompt engineering. Prompt engineering is useful because it increases user satisfaction with generative AI (Henrickson & Meroño-Peñuela, 2023).
Human and AI co-creation in creative Fashion Design Area
: AI technology is increasingly being utilized in the fashion industry to enhance many aspects of the design process. It provides tools and insights that streamline the design process for fashion designers and meet the needs of creative consumers. Collaborative efforts between humans and AI are anticipated to yield sustainable solutions within the fashion industry, addressing concerns like heightened productivity and decreased energy consumption in fashion items, as well as mitigating environmental challenges associated with inventory management and excessive production (Lee, 2022). The artist community has continued to show interest especially in the potential of generative AI, and as a result, the relationship between generative AI and fashion design has grown stronger over time. As part of this the use of generative AI as a tool to support creativity in the process of user ideation and iteration is an emerging issue that is gaining traction (Liu & Chilton, 2022).

Research Method

This study aims to create a 2024 Men's Fall/Winter collection using DALL-E based on the prediction of 2024 Men's Fall/Winter fashion trends using ChatGPT. First, to predict 2024 Men's Fall/Winter fashion trends based on text, we use ChatGPT-3.5, which is updated until January 2022, and ChatGPT-4, which is updated until April 2023. In addition, DALL-E 2 and DALL-E 3 will be used to create the Men's Fall/Winter 2024 collection to implement the collection design. To evaluate the prediction accuracy of the resulting output, we will use the ChatGPT answers to the 2023 Men's Fall/Winter fashion trend prediction in May 2023 and the data from Vogue, WWD, and firstVIEWkorea, which are representative fashion trend companies.
First, create various styles of text prompts (A) to predict 2024 Men's Fall/Winter fashion trends and enter them into ChatGPT to derive results (C). The results are compared with the results of the 2023 & 2024

Men's Fall/Winter fashion trend prediction to evaluate the accuracy of the prediction. Then, to create the 2024 Men's Fall/Winter fashion collection, various types of text prompts (B) are created and entered into DALL-E, and the results (D) are obtained. In this case, the text prompts (B) are created using the fashion design trends (C) predicted by ChatGPT that match the actual fashion design trends. Finally, the final results of DALL-E are compared with the photos of Milan and Paris Fashion week MEN'S Fall/Winter 2024.

Results & Discussion

After comparing the ChatGPT-3.5 prediction results (C) for men's Fall/Winter fashion trends in 2024 to the ChatGPT-3.5 answers for men's Fall/Winter fashion trends in 2023, 8 of the 12 keywords matched and 4 new keywords appeared in 2024. The 8 matching keywords are: sustainability, oversized silhouettes, vintage and retro revival, tailoring and classic style, comfort and functionality, bold colors and patterns, textured fabrics, and earthy tones. And 4 new keywords appeared in the 2024 prediction: Workwear influence, customization, gender-fluid fashion, techwear and functionality. In particular, the influence of workwear and gender-fluid fashion emerged as prominent trends for men's Fall/Winter 2024. Despite the prominence of gender-fluid fashion in men's fall 2023 fashion trends, ChatGPT in May 2023 did not predict this trend, but we did predict it in our fall 2024 men's fashion trend forecast. This is because ChatGPT's data has been updated from September 2021 to January 2022, which proves that generative AI can only answer within the dataset it is trained on, and in the case of generative AI, the dataset has a great influence on the output. In addition, the 2024 Men's Fall/Winter fashion collection image created by entering the prompt (B) into DALL-E 3 showed a high degree of completeness that felt similar to the actual collection photo. DALL-E 3 did a great job of capturing the details of not only the items in the prompt, but also the colors, patterns, and runway backdrop of the fashion show.

Conclusion

In this study, we summarized the features of ChatGPT as a fashion design trend prediction tool, evaluated the accuracy of the predictions, and created seasonal collections using DALL-E based on the fashion design trends predicted by ChatGPT and compared them with the actual collections. ChatGPT requires repeated questions about trend predictions to answer, and the amount and content of ChatGPT's answers varies each time. As it sometimes provides redundant answers and conflicts with itself due to a lack of consistency in its responses, this is something that needs improvement. However, we found that both ChatGPT and DALL-E can understand and produce high-quality results if typos in the prompts are not a major issue. And it is also creative because the results vary depending on the type of prompt. Although ChatGPT's trend prediction results are not 100% accurate, it helps users predict fashion trends in a simple way by answering based on large datasets and real-time search data. And DALL-E allows users to quickly visualize their ideas by easily creating images on the web without installing programs. These findings show that in the future, even non-experts may be able to predict fashion trends and see their favorite fashion collections before anyone else, using artificial intelligence technology that is open to the public.

References

Guo, Z., Zhu, Z., Li, Y., Cao, S., Chen, H., & Wang, G. (2023). AI Assisted Fashion Design: A Review. IEEE Access.

Liu, V., & Chilton, L. B. (2022, April). Design guidelines for prompt engineering text-to-image generative models. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (pp. 1-23).

Polak, M. P., & Morgan, D. (2023). Extracting Accurate Materials Data from Research Papers with Conversational Language Models and Prompt Engineering--Example of ChatGPT. arXiv preprint arXiv:2303.05352.

Henrickson, L., & Meroño-Peñuela, A. (2023). Prompting meaning: a hermeneutic approach to optimising prompt engineering with ChatGPT. AI & SOCIETY, 1-16.

Lee, Y. K. (2022). How complex systems get engaged in fashion design creation: Using artificial intelligence. Thinking Skills and Creativity, 46, 101137.

Ryu, C. H., & Lee, Y. K. (2023, November 8-11). Using OpenAI to Forecast Fashion Trends and Design
    Development [Poster presentation]. ITAA-KSCT Joint Symposium, Maryland, USA.

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Poster Session 1.
Clothing Science & Technology

DEVLOPING COMPRESSION PANTS: ANALYSIS OF CLOTHING PRESSURE VARIATIONS VASED ON DYNAMIC MOVEMENTS OF THE KNEE

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Introduction

Clothing pressure refers to the pressure that exists between the human body and clothing. Since clothing pressure is associated with dynamic movement, sports compression pants are often being worn across various purposes and functions, such as leisure fashion, elite sports uniforms, and casual sportswear, distinguishing their uses and functionalities. Accordingly, it is important to objectively present clothing pressure during dynamic movement. In the apparel design academic field, air-pack sensors have been utilized as a direct measurement for assessing clothing pressure, yet there are limitations due to various issues. Any vigorous motion can pose a risk of causing damage to the susceptible air-pack sensor, and there are also cost constraints. Nevertheless, in the realm of apparel science, there is a limited representation of research focused on measuring clothing pressure during dynamic movements using flexible pressure sensors. Especially, given the close association between the clothing comfort and the injuries related to the knee joint area, measurements such as pressure are occasionally taken for the development of compression pants and similar garments. So, there is a need for research on measuring clothing pressure around the knee area during dynamic movements using flexible pressure sensors, which is easy to use and cost-effective, for development of compression pants (Luo, etc., 2016). Thus, the purpose of this study is to develop a clothing pressure measurement device using flexible pressure sensors, measure and analyze clothing pressure in the knee area during dynamic movements, and propose patterns for the development of compression pants.

Research Method

In order to measure clothing pressure during movement around the knee, this study used flexible pressure sensors and Arduino system. This study utilized flexible sensors, as seen in many previous research works. Because the measurement of clothing pressure needs to be conducted during dynamic movement, Bluetooth device, which is "Flora Wearable Bluefruit LE Module", was used for wireless communication. Additionally, three FSR 402 sensors were utilized to simultaneously measure clothing pressure around the knee, and these were designed in patch form, allowing for easy and removable attachment. The circuit diagram is shown in figure1.

For this study, calibration was conducted for the pressure sensor FSR 402, employing both exponential and polynomial regression methods (Jin&Lee, 2022). The measurement device with three sensors was attached to the inside of the pants, which were created through pre-study (Lee, etc., 2017), around the knee area for this study (Figure 2). Sensor A was

Fig 1. Circuit diagram   Fig 2. Location of 3 sensors

designed to be positioned on the inside of the knee, Sensor B on the center of the knee, and Sensor C on the outside of the knee. Since the style structure and fabric ingredients needed to be decided, market research was conducted. It revealed that sports compression pants have a diverse range of style structures and various fiber blending ratios, even within the same brand (such as "lululemon") available in the market. Since it was shown that polyurethane (PU) fiber was mostly used between 13% to 20% in the fabric blends for the compression pants, the sample compression pants for in this study were made 18% polyurethane. Also, pattern was used without any style structure.

To assess clothing pressure during dynamic movements, four distinct actions were chosen for investigation: running, squatting, kneeling of Yoga, and cycling pedal rotations (pedaling) (Figure.3).

Movement			
running	squatting	kneeling	pedaling
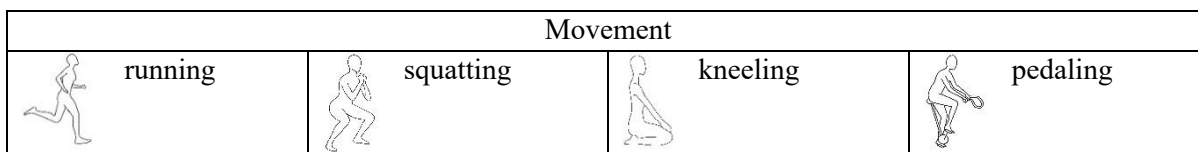
Fig 3. Type of movements

Five female participants, all in their twenties and of standard sizes, donned experimental garments equipped with measurement devices, executing each prescribed movement. Their exercise movements were performed for 30 seconds each, and pressure changes were measured.

Result and Discussion

The pressure measurement results revealed strong pressure from sensor C in the running motion, with a mean value of 3.86 kPa. Additionally, all sensors exhibited strong pressure during both kneeling and squatting postures, registering mean values ranging from 3.99 to 5.55 kPa. In pedaling, sensor A demonstrated intense pressure, recording a mean value of 6.38 kPa. Although dynamic movements were performed over a 30-second interval, the varying frequencies of each action required standardization due to differences in the number of repetitions for each movement. In addition, in activities such as running, momentary increases in pressure occurred. To flatten these values, the integration of all pressure values over the 30 seconds was calculated. Subsequently, for comparative analysis of pressure values received in each area, both min-max normalization and standardization were applied.

As shown in the graph (Figure 4), during running movement, sensor A registered significantly lower pressure compared to other activities. Also, both kneeling and squatting exhibited significant pressure across sensors A, B, and C. In addition, in the pedaling motion, the highest pressure was observed at sensor location A in contrast to sensors B and C. This implies that, in the running motion, less pressure was experienced on the inside of the knee. Meanwhile there was an increased

Fig.4. Min-max normalization and Standardization

pressure on the inside of the knee during pedaling. On the other hand, both the kneeling and squatting movements involved pressure across all knee areas. Distinct pressure values are evident even within the same anatomical region during the execution of diverse dynamic movements. This highlights the potential impact of clothing patterns dictated by varying exercise objectives. Based on the results of this study, patterns for running pants can incorporate stretching fabric on the outside and center of the knee, while for cycling pants, utilizing stretchable fabric on the inner side of the knee is suggested. Pants designed for yoga and squats can also be suggested to feature patterns that facilitate pressure release across the entirety of the knee region. Additionally, when selecting materials for clothing, considering the tension of stiffness as a variable enables the application of optimal pressure in the garment.
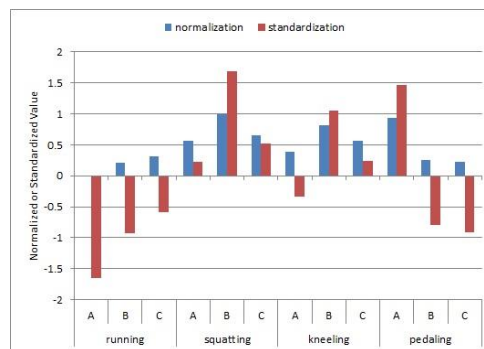
Conclusion

This study measured the pressure on the knee surface during various movements to ultimately recommend patterns associated with comfort when creating compression pants for different movements. In contrast to other research that measures clothing pressure at specific points, this study employed a comprehensive measurement approach by utilizing wireless and flexible sensors to measure pressure across the entire

knee surface. Furthermore, this study demonstrates that different movements yield varying pressures on the same knee area, highlighting observed changes in pressure during dynamic states.

Acknowledgment

References

Jin, H & Lee, H. (2022). The development of a wearable prototype to measure clothing pressure through sensor calibration procedure. *Journal of the Korean Society of Clothing and Textiles.46*(5), 827-835

Luo, S., Wang, J., Shi, H. & Yao, X. (2016). A novel approach to characterize dynamic pressure on lower limb wearing compression cycling shorts. *The Journal of the Textile Institute*, *107*(8).

Lee, H., Kim, K., & Lee, Y. (2017). The effect of the pressure level of sports compression pants on dexterity and movement related cortical potentials. *Science & Sports*, *32*(5), e183-e190.

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DEVELOPMENT OF FUNCTIONAL SUMMER INNERWEAR FOR FEMALE SOLDIERS AND ITS EFFECTIVENESS

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Introduction

Today's female soldiers constantly undergo various training exercises to complete their missions and demonstrate their military capabilities, during which some experience major and minor musculoskeletal injuries and thermal stress. The difficulties are even more significant when high-intensity training is performed for a long time in high temperatures and humid summer environments (Yi & Kim, 2016), and appropriate solutions are needed. Against this backdrop, this study aims to develop functional innerwear that uses differentiated materials and provides compression pressures appropriate for each human body part to stabilize the wrist and ankle joints, support the core muscles, and increase thermal comfort for female soldiers during summer training, and validate its effectiveness.

Literature Review

In recent years, the proportion of women in the military has increased, and their roles have expanded. Accordingly, there has been a growing interest in female military uniforms and equipment, recognizing the need for improvement (Lee & Lee, 2023). However, military uniforms and equipment research has focused primarily on male soldiers. However, female soldiers have a different physical structure than their male counterparts, resulting in significant body shape and size differences. There are also physiological differences in perspiration, skeletal stability, and muscle activity (Molloy et al., 2020). Therefore, the development of multi-functional garments for female soldiers is crucial. Especially, innerwear worn on the innermost side of a multi-layer garment system (e.g., innerwear-combat uniform-chemical, biological, and radiological [CBR] protective garment) must be designed to be ergonomic and comfortable while primarily having exceptional functionality.

Research Method

We developed functional innerwear in the form of a leotard-style top with a built-in bra cap and a legging-style bottom based on the average size of women in their 20s and 30s (height: 162.1±5.2 cm, chest circumference: 89.04±6.8 cm, waist circumference: 74.6±8.2 cm, and hip circumference: 95.2±2.5 cm) according to the 8th Size Korea (Size Korea, 2021). The materials used for the functional innerwear were materials for increased thermal comfort (85% NY, 15% PU) and materials for joint stability and core muscle support (94% PET, 6% PU). We analyzed ten active-duty female soldiers and compared the effectiveness of their functional innerwear before and after wearing it in a hot environment (30±1°C, 60±1%RH, 0.2m/sec). The evaluation items (on a 5-point Likert scale) were the subjective sensation of wrist and ankle joint stability, core muscle support, hotness, wetness, and preference during a walking exercise (7 km/h, 15 minutes) with wearing a 10 kg military backpack. Furthermore, to observe the microclimate change in the garment, which is an essential factor in a hot environment, we measured the change in temperature and humidity in the garment at the chest and back.

Results & Discussion

The garment pressure for each body part of the developed functional innerwear was upper arm, forearm, wrist, spine (backline), thigh, calf, knee, and ankle, respectively, 0.5 kPa, 0.7 kPa, 1.5 kPa, 0.7kPa, 0.6 kPa, 0.5 kPa, 1.3 kPa, and 2.0 kPa. When exercising in a hot environment while wearing the developed

functional innerwear, the temperature inside the garment at the chest and back increased by 2.7°C and 3.1°C, respectively. When it was not worn, the temperature increased by 6.9°C and 7.6°C, respectively. This indicates that functional innerwear is effective in reducing heat stress. Furthermore, the wetness in the garment at the chest and back increased by 15.1%RH and 17.0%RH, respectively, when innerwear was worn and by 22.3%RH and 28.9%RH, respectively, when it was not worn, showing that it was also effective in reducing wetness. In the subjective sensation evaluation, the study participants also felt less hot (2.0 points) and less wet (2.5 points) when wearing functional innerwear than when not wearing it (4.0 and 4.5 points, respectively), indicating that functional innerwear was effective in reducing thermal stress. Furthermore, the participants reported that wearing functional innerwear was very helpful in maintaining their posture while performing walking exercises and carrying military gear. Specifically, they responded that functional innerwear kept their wrist (4.2 points) and ankle joints (4.3 points) stable and provided good support for the abdomen (4.0 points) and waist (4.5 points). Finally, it was found that wearing functional innerwear while exercising was highly preferred (4.5 points).

Conclusion

Summer innerwear with functional material and differentiated compression pressures for each body part will likely support the wrist and ankle joints to prevent injury, help maintain posture, and effectively reduce thermal stress. However, even functional material with cooling, sweat-absorbing, and quick-drying properties is likely to have a limited ability to reduce thermal stress during prolonged high-intensity exercise in a hot environment. Therefore, future studies should investigate additional optimization measures, such as cooling and drying systems.

Acknowledgements

References

Lee, O., & Lee, Y. (2023). Evaluation of the Fit and Motion Suitability for Korean Female Combat Uniforms. *Journal of the Korean Society of Garment and Textiles*, *47*(4), 696-710.

Molloy, J. M., Pendergrass, T. L., Lee, I. E., Chervak, M. C., Hauret, K. G., & Rhon, D. I. (2020). Musculoskeletal injuries and United States Army readiness part I: overview of injuries and their strategic impact. *Military medicine*, *185*(9-10), e1461-e1471.

Yi, J. M., & Kim, G. S. (2016). Factors influencing musculoskeletal symptoms in military personnel during basic combat training. *J Korean Nurs*, *46*(4), 523-533.

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QUANTIFYING AESTHETIC CHARACTERISTICS OF GARMENT STRUCTURE USING EYE-TRACKING TECHNIQUE

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Introduction

Aesthetic design principles are integral to successful design strategies, encompassing elements such as balance, contrast, and unity. When consumers purchase clothing products online, they unconsciously align their expectations with their own bodies, greatly influenced by visual aspects like color, pattern, and shape (Mo et al., 2021). However, factors beyond product appearance, such as price, size, and influencer endorsements, pose challenges in measuring aesthetic quality using indicators like sales volume and views. In the fields of industrial and product design, efforts have been made to define each principle as an aesthetic indicator and develop mapping models based on user preferences through quantitative data collection using eye-tracking technology (Hu et al., 2022). Among the visual elements in clothing design, shape is closely linked to the garment's structure and the quantity of raw materials required. Nonetheless, research on quantifying the aesthetic quality of clothing products, where various visual elements intricately intertwine, is still in its early stages, and there is a lack of studies evaluating the aesthetic quality of individual clothing product shapes. To address this gap, this study sampled various design combinations representing different elements of a garment's shape and examined whether aesthetic quality could be assessed using eye-tracking technology. This endeavor aims to provide a quantitative feedback mechanism for clothing designers to enhance the appearance of their products.

Literature Review

Exploring aesthetic evaluation poses a challenge as human aesthetic sense is often difficult to articulate and closely tied to our interpretation of content (Zeng et al., 2019). Zeng et al. (2019) utilized classification, mean score regression, and score distribution prediction to train an aesthetic evaluation model, achieving excellent performance. Khalighy et al. (2015) defined aesthetic quality components such as contrast, purity, proportion, appropriateness, and novelty to quantify the aesthetic appeal of product designs, formulating these components based on data measurable with an eye-tracker. To gather subjective preferences, researchers presented well-known chair designs as stimuli in eye-tracking experiments, revealing a close correspondence between calculated aesthetic quality and subjective response quality. Similarly, Liu et al. (2020) employed eye-tracking experiments to quantify the aesthetic quality of streetlight design, using the same aesthetic formula. Despite surpassing the limitations of previous psychological measurements reliant on semantic evaluations, the researchers noted some challenges in converting appropriateness and novelty indicators. Hu et al. (2022) developed a model for evaluating the aesthetics of camera front designs, incorporating balance, ratio, contrast, and harmony. They constructed a mapping model using results from an online survey through a fuzzy inference model, followed by creating an optimal design using a genetic algorithm. Harrar et al. (2018) conducted a comparative analysis of studies quantitatively analyzing the beauty of human faces, concluding that establishing quantitative beauty is challenging, even with measurements like symmetry and the golden ratio. Particularly, when evaluating images containing human bodies, the initial analytical visual processing of body stimuli was found to play a crucial role in subsequent aesthetic evaluations (Calvo-Merino et al., 2010). In essence, when assessing the aesthetics of garment designs, the evaluation process may differ from that of product designs in other areas, reflecting the influence of human implications. However, there remains a gap in research conducting quantitative aesthetic evaluations in the field of clothing and fashion design.

Research Method

A long-sleeved shirt for women, featuring a typical design but customizable in various ways, was chosen as the stimulus. Twenty-four shirt designs were created, taking into account factors such as the collar, sleeve style, placket, bodice silhouette, and seam lines that contribute to the overall shirt shape. Images capturing front views, created by drape-simulated patterns of the shirt designs on the basic female avatar in Clo3D and processing only the clothes to be visible, were utilized as the stimuli (Figure 1).

Figure 1. Examples of front views of garment structures

Participants were asked to assess the appearance of shirts displayed on the screen, rating them on a scale of 1 to 10. The question consisted of a single query: "Please verbally respond to subjective design scores with (bad) 1, 2, ..., 9, 10 (good)". No specific evaluation criteria were provided, and there was no set time limit between each presentation. The study utilized a fixed eye tracker, GP3HD (Gazepoint/Vancouver, Canada), operating at a resolution of 150Hz. For each participant, data were collected on the number of fixations, the duration of each fixation, the total fixation period, and the coordinates of all fixations. Subsequently, eye tracking data were analyzed to derive aesthetic indicators using Equation 1, as outlined in the methodologies of previous studies by Liu et al. (2020) and Khalighy et al. (2015).

$$aesthetics = Ae^{NB} - e^{NBA} + 1 \tag{1}$$

The variables A (appropriateness) and N (novelty) contribute to attractiveness, while B (beauty) represents universal beauty. Attractiveness, in this context, refers to beauty that evolves with time and function. It is assessed by comparing the eye fixation area of the image rated highest by each participant with the rest of the image. B denotes enduring beauty, which includes elements such as contrast, pureness, and proportion. This form of beauty can be evaluated using factors such as the number of fixations, the standard deviation of the fixation period, and the total fixation period. For each shirt design, these elements were recorded as CSV files using the software provided by the eye tracker. Python code was then developed for formalization and data analysis. The eye-fixation area was represented as an oval shape using the Ellipse function from the Matplotlib library and the PCA (Principal Component Analysis) packages from sklearn. Beauty, aesthetics, and subjective scores were visualized on graphs using sklearn's MinMaxScaler to ensure they were on the same scale. Due to the limited number of participants and significant individual differences in results, certain participants' cases were specifically analyzed in the Results and Discussion section.

Results & Discussion

Figure 2 shows an example of a design score graph for three participants' evaluations of shirt designs. The horizontal axis depicts 25 shirt designs, while the vertical axis represents both the calculated aesthetic score (red circle) and the subjective design score (blue square).
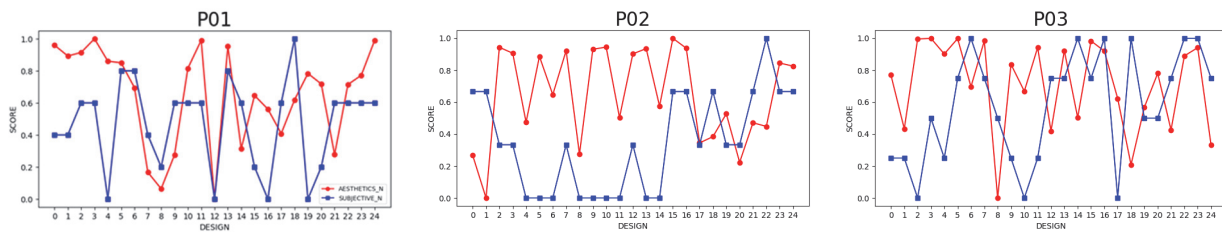
Figure 2. Shirt design scores for each participant

Figure 2 shows that there is no direct correlation between aesthetics scores and subjective design scores, but there are striking similarities in the trend. For example, participant P01 showed that the tendencies of aesthetics and subjective scores were closely matched. Conversely, participant P03 showed a contradictory relationship between the two scores. Further interviews revealed that this dissonance could be attributed to factors other than design preferences (considering fit, ease of wearing, etc.). Participant P02's response shows a change in perception throughout the stimulus series. This participant responded that they assigned the same score throughout the first half of the stimulus series because each design looked similar to each other. As the degree of design transformation increased in the second half of the stimulus series (Figure 1), it can be seen that the participant's perception gradually converged, leading to higher consistency between aesthetics and subjective scores. Despite the range of designs presented, none of the 25 shirt designs were universally preferred or disliked, emphasizing the subjectivity inherent in aesthetic preference.

Conclusion

This study investigated the feasibility of using eye-tracking technology to evaluate the aesthetic quality of clothing design. The experimental results revealed a complex interaction between the aesthetic score derived from eye-tracking data and the subjectively perceived design score. Subjective design evaluation can be influenced by factors beyond visual attraction, thus complicating aesthetic evaluation. Research on quantifying the aesthetic quality related to clothing shape is still in its early stages, indicating the need for further investigation to gather data essential for comprehensively interpreting and analyzing aesthetic preferences in clothing. This endeavor aims to assist clothing designers in decision-making by providing a systematic evaluation system that surpasses the limitations of existing psychological measurements.

Acknowledgement

References
Calvo-Merino, B., Urgesi, C., Orgs, G., Aglioti, S. M., & Haggard, P. (2010). Extrastriate body area underlies aesthetic evaluation of body stimuli. *Experimental brain research*, 204, 447-456.

Harrar, H., Myers, S., & Ghanem, A. M. (2018). Art or science? An evidence-based approach to human facial beauty a quantitative analysis towards an informed clinical aesthetic practice. *Aesthetic Plastic Surgery*, 42, 137-146.

Hu, H., Liu, Y., Lu, W. F., & Guo, X. (2022). A quantitative aesthetic measurement method for product appearance design. *Advanced Engineering Informatics*, 53, 101644.

Khalighy, S., Green, G., Scheepers, C., & Whittet, C. (2015). Quantifying the qualities of aesthetics in product design using eye-tracking technology. *International Journal of Industrial Ergonomics*, 49, 31-43.

Liu, P., Wang, K., Yang, K., Chen, H., Zhao, A., Xue, Y., & Zhou, L. (2020). An aesthetic measurement approach for evaluating product appearance design. *Mathematical Problems in Engineering*, 2020, 1-15.

Mo, X., Sun, E., & Yang, X. (2021). Consumer visual attention and behaviour of online clothing. International Journal of Clothing Science and Technology, 33(3), 305-320.

Zeng, H., Cao, Z., Zhang, L., & Bovik, A. C. (2019). A unified probabilistic formulation of image aesthetic assessment. *IEEE Transactions on Image Processing*, 29, 1548-1561.

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DEVELOPMENT OF BULLETPROOF PLATE DESIGN SYSTEM FOR FEMALE

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Introduction

The human body shape varies depending on gender, race, and lifestyle, making it essential to understand the structure and form of the body in order to develop well-fitting and comfortable garment products. Women are known to have smaller skeletal structure and that almost all body dimensions are smaller than men (Edwards et al., 2014). In modern society, as women increasingly enter traditionally male-dominated fields such as the military, police, and security, it's crucial to recognize that most protective equipment is designed based on male body proportions. Personal protective equipment based on the female body has generally not been developed. Consequently, women have to make do with ill-fitting protective gear, which not only compromises comfort but also affects their athletic performance negatively (Mahbub et al., 2014; Coltman et al., 2020). This study aims to analyze the differences in torso morphology between women and men using 3D body data and develop a system to design bulletproof plates specifically tailored for women.

Literature Review

In Coltman et al. (2020), over 60% of women reported experiencing pain, discomfort, and behavioral constraints due to wearing ill-fitting larger protective equipment. Among these, bulletproof plate are inserts placed in plate carriers worn by individuals such as soldiers and police officers to protect the chest. The size and shape of the bulletproof plate significantly impact the wearer's overall athletic ability and body protection, making custom design crucial (Kang & Kim, 2019). There was a prior study to develop a bulletproof plate using human data (Kang & Kim, 2019), but since women have different chest curves and a different waist-to-chest width ratio than men, a problems arose when producing plates. There has been prior research on bulletproof plates that take into account the female body, but they have a form that makes it difficult to use them in existing plate carriers. Additionally, there's a lack of significant deviation from the design of men's bulletproof plates, indicating insufficient research fully considering the female body (Mahbub et al., 2014).

Research Method

Three hundred males and females in their 20s and 30s were selected as subjects from the 3D data of the 6th Size Korea. Measurements of 14 landmarks and 13 body dimensions were taken from 300 3D body data samples to analyze the differences in upper body shape according to gender. To develop bulletproof plates for women, a total of 150 sets of three-dimensional female upper body data were analyzed and utilized in plate development. The body data were grouped into an arbitrary number of groups through two stages: the first stage involved grouping based on three body dimensions (waist width, chest breadth, and side waist length) using the theory of standard normal distribution, and the second stage involved grouping based on two bust angles (upper and lower). Furthermore, considering the upper body shape of women, the coverage area of the body armor plate was defined using four body dimensions (chest breadth, waist breadth, side waist length, and length from the armpit to the front neck point) and five parameters.

Results & Discussion

Among the 9 analysis items used to analyze gender differences in upper body morphology, differences by gender were observed in 8 items. Significant differences by gender were noted in all items related to the ratio differences in circumference, breadth, and depth between the chest (bust) and waist. Additionally,

disparities in the shape of the upper body were observed in bust angle and cross-section. This emphasizes the necessity for developing bulletproof plates tailored to women, as it's evident that considering chest morphology is crucial in plate design for women. A system for producing bulletproof plates for women was developed using upper body analysis results and 3D modeling. Users can determine the number of groups, considering factors such as data quantity and efficiency in plate manufacturing. The length and width of the bulletproof plate varied according to the three measurement items in each group, and differences in plate curvature were observed based on bust angle. The shape of the generated bulletproof plate could be partially modified to the desired shape according to the user's needs using free-form deformation. Additionally, functionality to smooth faces and edges was developed to refine the shape of the bulletproof plate. The final completed bulletproof plate was saved as printable data using 3D printing, and its shape was confirmed.

Conclusion

In this study, a system was developed to design a bulletproof plate that can effectively protect the female body by analyzing the shape of the upper body. The aim was to reduce the discomfort experienced by women in the field of security and defense due to equipment. It is expected that the method developed in this study can be used to develop various customized garments based on ergonomics, such as soft robots and sports clothing, as well as protective equipment.

Acknowledgement

References

Coltman, C. E., Steele, J. R., Spratford, W. A., & Molloy, R. H. (2020). Are female soldiers satisfied with the fit and function of body armour?. *Applied Ergonomics*, *89*, 103197. https://doi.org/10.1016/j.apergo.2020.103197

Edwards, M., Furnell, A., Coleman, J., & Davis, S. (2014). A preliminary anthropometry standard for Australian Army equipment evaluation. Land Division, *Defence Science and Technology Organisation*. https://apps.dtic.mil/sti/citations/ADA610792

Kang, Y. H., & Kim, S. (2019). Development of bulletproof pad design system using 3D body scan data. *International Journal of Clothing Science and Technology*, *31*(6), 802-812. https://doi.org/10.1108/IJCST-03-2019-0025

Mahbub, R., Wang, L., & Arnold, L. (2014). Design of knitted three-dimensional seamless female body armour vests. *International Journal of Fashion Design, Technology and Education*, *7*(3), 198-207. https://doi.org/10.1080/17543266.2014.956152

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SUPERVISED MACHINE LEARNING FOR BODY SHAPE CLASSIFICATION

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Introduction

Recognizing body shape is crucial for practitioners and researchers in many aspects. It allows them to acquire a comprehensive understanding of the human body form. Based on that, the apparel industry can establish a pivotal foundation to formulate strategies in achieving superior garment fit and predicting accurate sizes. The body shape classification is also an important factor enabling mass customization. This study explores supervised machine learning techniques for automated prediction of female body shapes and evaluates their effectiveness.

Literature Review

As an alternative solution to standard clothing sizes, body shapes have attracted significant attention since the 1990s. Figure Identification Technique (FFIT©) is an example for extensive research discussing methodologies in a traditional domain. Taking stepwise processes, it created a mathematical logic to calculate the differences and ratios between specific body measurements and describe body shapes, where visual inspections and manual verifications are fairly involved (Lee et al., 2007). It ended up suggesting 8-9 body shapes for 6,300 female body scans obtained for SizeUSA project, which included 5 primary shapes of hourglass, oval, triangle, inverted triangle, and rectangle (Simmons et al., 2004). The characteristics of each body shape heavily relied on vertical distributions of girth measurements from shoulder to bust, waist, abdomen, and hip.

Recent researchers have highlighted the effectiveness of machine learning techniques in characterizing various anthropometric attributes from large datasets and accelerating complex calculations (Kim et al., 2018). During machine learning processes, input data and corresponding outputs are mapped, and the nuanced elements of body shape are captured from the input-output pairs. The integration of machine learning techniques holds the potential to automate body shape classification of large populations into discrete silhouette groups.

Research Method

Predictive models were developed employing three machine learning algorithms using RStudio: Multinomial Logistic Regression (MLR), Random Forest (RF), and Support Vector Machine (SVM). The training and validation were conducted with 80% of an existing dataset, SizeUSA. The performance of each machine learning model was evaluated using the remaining 20% data with an aim to identify the most effective model (Gholamy et al., 2018). The chosen predictive model was applied to assess the body shapes of a new anthropometric dataset acquired from 211 females. The research subjects were 165 cm tall and weighed 68.17 kg in the age of 32.21 (±13.1) on average. Since a sorting rationale is typically unknown in a machine learning model, the resulting classification was analyzed through analysis of variance (ANOVA). Tukey's Honest Significant Difference tests were followed up to describe anthropometric characteristics of the resulting body shape classifications.

Results & Discussion

Based on the prediction accuracy and Kappa (κ) statistics (**Table 1**), the MLR model was selected for further investigations. The MLR model found rectangular, triangular, and inverted triangular body shapes within the new dataset, while 3 subjects remained unclassified (**Table 2**). A few body shapes (hourglass, top-hourglass, bottom-hourglass and oval) did not appear in the new dataset since low percentages (0 to 8%) of population in these body shapes were included in the training dataset. Sharing the similar nature of dimensional characteristics, spoon shapes seemed to be merged into triangular shapes, where narrow top and wider bottom were outlined.

Table 1. Performance of proposed predictive models

	Prediction accuracy (%)	Kappa (κ) statistics
Multinomial Logistic Regression (MLR)	80.1	0.71
Random Forest (RF)	72.7	0.58
Support Vector Machine (SVM)	71.8	0.57

Table 2. Anthropometric characteristics of each body shape

	N	Bust Girth	Waist Girth	High-hip Girth	Hip Girth
Rectangle	120	1.04 [a]	1.00	1.03 [a]	1.09 [b]
Triangle	66	0.97 [b]	1.00	1.02 [a,b]	1.12 [a]
Inverted Triangle	23	1.06 [a]	1.00	1.01 [b]	1.02 [c]

Based on the training results, the key predictors determining body shapes have varied depending on the shape. Beyond the universal measurements considered in the FFIT© formula, which were bust, waist, high-hip, and hip girths, the model highlighted several additional body dimensions, such as crotch length, thigh girth, waist height, and waist back length, significantly contributing to the classification of body shapes. It is not explicit to visualize how these additional body dimensions have contributed to the body shapes, but these supplementary considerations may have advanced the prediction accuracy of the model.

The results of the analysis of variance (ANOVA) indicated significant differences among the body shapes after considering multiple body measurements simultaneously. Across a range of measurements, noticeable distinctions emerged that delineated the unique relationships among body measurements in each body shape. **Table 2** presents the ratios between girth measurements: bust ($F_{(3, 207)}=[27.33]$, $p<0.0001$), high-hip ($F_{(3, 207)}=[4.91]$, $p=0.0026$), and hip girths ($F_{(3, 207)}=[26.40]$, $p<0.0001$) over waist girth. Triangle shapes were characterized by the smallest girth ratio of 0.97 at the bust level, as well as the highest ratio of 1.12 at the hip level. The distinction between rectangular and inverted triangular groups was less obvious, but the inverted triangular group showed the tendency that girth ratios got smaller toward the lower body, while the rectangular group did not. Crotch lengths were the only vertical measurement that showed significance for each body shape. The inverted triangular group exhibited significantly longer crotch lengths ($F_{(3, 207)}=[6.26]$, $p=0.0004$) than other body shapes.

Conclusion

The research findings highlight the efficacy of developing a novel predictive model and discerning body shapes from an extensive dataset through a machine learning approach. Taking approximately 20 minutes to process 211 data points after the appropriate input data was coded, the proposed model suggested a streamlined and time-effective methodology for body shape classification compared to the existing approaches. Since machine learning techniques take non-anthropometrical attributes into considerations which are inexplicitly related to the body shape, it would be intriguing to see how the classification accuracy advances with massive data pools become available from diverse sources.

References

Gholamy, A., Kreinovich, V., & Kosheleva, O. (2018). *Why 70/30 or 80/20 relation between training and testing sets: A pedagogical explanation*. Departmental Technical Reports. https://scholarworks.utep.edu/cs_techrep/1209.

Kim, Y. M., Son, Y., Kim, W., Jin, B., & Yun, M. H. (2018). Classification of children's sitting postures using machine learning algorithms. *Applied Sciences, 8*(8), 1280.

Lee, J. Y., Istook, C. L., Ja Nam, Y., & Mi Park, S. (2007). Comparison of body shape between USA and Korean women. *International Journal of Clothing Science and Technology*, *19*(5), 374-391.

Simmons, K., Istook, C. L., & Devarajan, P. (2004). Female figure identification technique (FFIT) for apparel Part I: Describing female shapes. *Journal of Textile and Apparel, Technology and Management*, *4*(1), 1-16.

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ANALYSIS OF UPPER BODY TYPES OF MEN AGED 19-27 FOR THE DEVELOPMENT OF ARMY UNIFORM

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Introduction

South Korea's defense industry focuses on developing advanced weapons such as tanks, fighter jets, submarines, and satellites. The field of clothing and equipment, which is directly related to soldiers' basic lifestyle and combat capabilities, has been somewhat undervalued in terms of priority. At a time when the number of troops is decreasing rapidly every year, each soldier is a critical asset, and the development of specialized clothing to ensure their safety and prevent injuries is also essential in the defense industry. Notably, determining clothing sizes suitable for the changing body shapes of the MZ generation, aged between 19 and 27 years, is an essential study that must be conducted first.

Literature Review

Army uniforms are divided into various items, such as underwear, combat clothing, winter inner and outerwear, and military boots (Jeong & Nam, 2016). They not only protect the combatant's body but also enhance combat capabilities. Identifying the systematic basic principles related to the establishment of standards for military clothing with excellent functionality and comfort, as well as securing relevant technology, can open a window of opportunity to increase quality competitiveness and develop South Korea into a promising export country for clothing and equipment in the ever-growing global defense industry. Optimal clothing enhances the combat efficiency of individual combatants and the national defense power (Lee & Hong, 2016) and increases combatants' satisfaction with military life. Therefore, this study analyzes the upper body types of men aged between 19 and 27 years to establish baseline data that can be used to develop clothing for male army soldiers.

Research Method

The subjects of this study were 516 men aged 19–27 years and wearing a size 8 in Korea in 2020. Thirty items were analyzed: nine circumference items (neck circumference, waist circumference [omphalion], waist circumference [natural indentation], abdominal extension circumference, chest circumference, bust circumference, armpit circumference, upper arm circumference, elbow circumference); five depth items (waist depth [omphalion], waist depth [natural indentation], armscye depth, chest depth, bust depth); five breadth items (waist breadth [omphalion], waist breadth [natural indentation], bust breadth, chest breadth, biacromial breadth); 10 length items (nape biacromial length, biacromial length, shoulder length, posterior shoulder length, waist back length [natural indentation], vertical trunk length, waist front length, underarm length, arm length, upper arm length); and one weight item. We used factor analysis to analyze the factors of male upper body types and principal component analysis to extract the factors. We utilized Varimax for factor rotation. Moreover, we conducted a K-means cluster analysis based on the factor analysis results using the SPSS 26.0 program.

Results & Discussion

The age distribution of the subjects was as follows: 1.8% for age 19, 5.4% for age 20, 6.4% for age 21, 14.7% for age 22, 18.4% for age 23, 20.7% for age 24, 13.2% for age 25, 9.9% for age 26, and 9.5% for age 27. As a result of factor analysis, we classified five factors, and the explanatory power of the total variance was 85.97%. We named Factor 1 the "waist/abdomen" factor, which accounted for 31.55% of the total variation. We called Factor 2 the "chest/armpit" factor, which accounted for 20.63% of the total variation. Factor 3 was the "shoulder" factor, accounting for 15.04% of the total variation. Factor 4 was named the "torso" factor, accounting for 9.47% of the total variation. Finally, we called Factor 5 the "arm"

factor, which accounted for 9.28% of the total variation. Cluster analysis showed that the difference among the five factors is best reflected when we categorize the upper body shape of men aged 19–27 into three clusters using the factor scores extracted through factor analysis. In short, out of 516 men aged 19–27 years, Type 1 consisted of 46 men, all of whom were large; Type 2 consisted of 247 men, all of whom were small in size; and Type 3 consisted of 223 men, all of whom were medium in size.

Conclusion

Based on the factor analysis of the upper body types of men aged 19–27, we classified five factors, and based on the cluster analysis, we organized three upper body types. For men aged 19–27 years, the dominant upper body types are medium (43.2%) and small (47.8%); the large body type (8.9%) accounts for a small proportion. The three types revealed different requirements in terms of the size for essential items for upper body clothing: neck circumference (large body type: 41.0cm; medium body type: 37.8cm; small body type: 35.8cm), chest circumference (large body type: 111.1cm; medium body type: 102.7cm; small body type: 95.6cm), waist circumference (large body type: 101.8cm; medium body type: 85.9cm; small body type: 75.5cm), arm length (large body type: 60.9cm; medium body type: 59.3cm; and small body type: 57.6cm). When producing upper-body army uniforms for each size, reducing the production quantity for the large size would be economically advantageous according to the ratio of body types.

References

Jeong, M., & Nam, Y. J. (2016). A study on the current state of Korean military winter uniform tops. *Journal of the Korean Society of Costume*, *66*(5), 66–81.

Lee, M., & Hong, S. (2016). A study on the reliability of the drying rate test about military clothes. *Journal of Korean Society for Quality Management*, *44*(3), 487–508.

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DESIGN AND DEVELOPMENT OF AN IOT SYSTEM
FOR THE DETECTION OF SEAM PUCKER

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Introduction

Seam pucker is a major defect in garment manufacturing. Seam pucker occurs when fabric wrinkles along the seam line during sewing. If seam pucker is detected during quality control, the entire seam must be removed and re-sewn to ensure the highest level of quality. This process is very time-consuming. Quality control for defect detection relies on subjective visual evaluation by workers. Therefore, studies have been conducted over the past several decades to objectively evaluate seam pucker. The main method was to analyze the contrast of the image using an image sensor to determine the degree of wrinkles (Inui and Shibuya, 1992; Pan et al., 2017). However, a high-performance processor must be installed to process image data, which increases production costs and makes it difficult to apply to current garment manufacturing. It is also difficult to detect on dark fabrics because it uses contrast. Therefore, in this study, an IoT system that can detect seam pucker using low-cost IR sensors was designed.

Research Method

The conceptual design of the IoT system for detecting seam pucker is shown in Fig. 1(a). Two IR sensors are installed at the front and back, centered on the sewing needle. The fabric length is measured before sewing by analyzing the data collected from the IR sensor installed in the front, and the fabric length is measured after sewing by analyzing the data collected from the IR sensor installed in the back. The seam pucker is detected by comparing the length of the fabric before and after sewing. The sensor module was implemented and installed on the sewing machine as shown in Fig. 1(b).
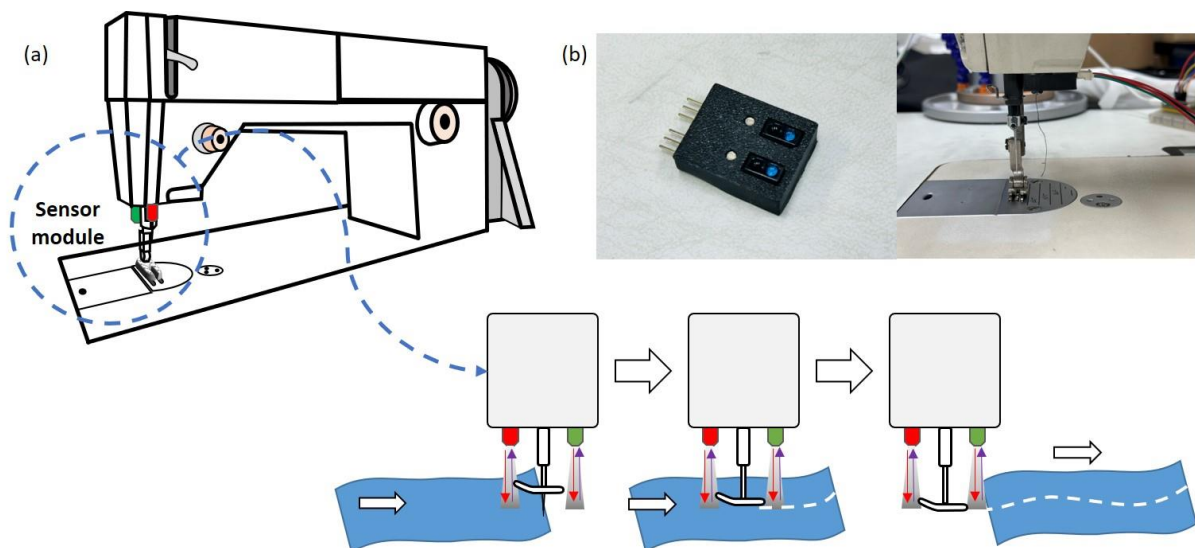
Fig. 1 The IoT system for detecting seam pucker: (a) the conceptual design, (b) implementation

The data collected by the sensors is shown in Fig. 2, and an algorithm has been implemented to calculate the fabric length. In Fig. 2(a), zone ① is in a state where the fabric is not detected by the sensor, and the sensor value at this time is set to 100 %. Zone ② is the fabric preparation state before sewing starts, and the point ④ that first intersects with the sensor value is the time when the fabric is first detected (Fig. 2(b)). Zone ③ is the section being sewn and the fabric is fully detected by the sensor. At this time, the sensor value is set to 0 %. The point ⑤ that intersects the value calculated by subtracting the percentage of the sensor value in zone ② from 100 % is the time the fabric was last detected. Therefore, the fabric length can be calculated by subtracting ⑤ - ④, and the seam pucker can be detected by comparing the fabric length. To verify the implemented seam pucker detection system, ten black fabric samples of 38 cm × 4 cm were prepared. Five samples were sewn to prevent seam pucker, and the remaining samples were sewn to detect seam pucker.
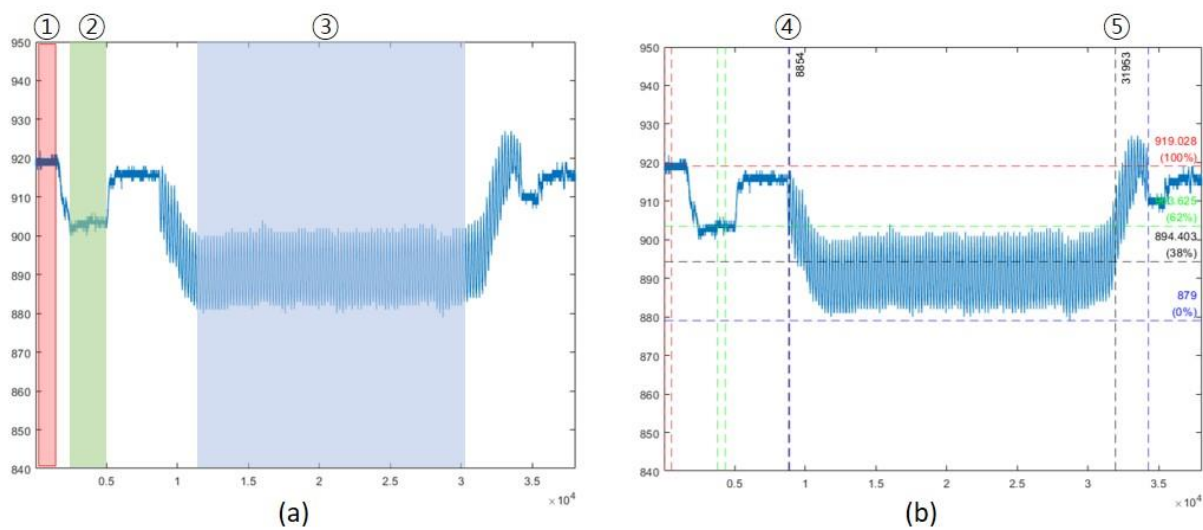
Fig. 2 IR sensor collection data and analysis: (a) fabric detection, (b) start and end of fabric

Results & Discussion

The difference in fabric length before and after sewing of ten samples is shown in Table 1. The algorithm was calculated from the time difference before and after sewing collected from the two sensors. It was confirmed that seam pucker can be detected by the designed IoT system, since the time difference calculated by the algorithm is large between non-seam pucker samples and seam pucker samples. The ground truth and predicted values tend to be similar in the case of non-seam pucker samples, while there are samples with significant differences in the case of seam pucker samples. It appears that an error occurred during the process of forcing seam pucker.

Table 1 The difference in fabric length before and after sewing

No.	Non-seam pucker		Seam pucker	
	Algorithm (ms)	Ground truth (mm)	Algorithm (ms)	Ground truth (mm)
1	0.7	1	20.0	28
2	1.9	2	39.7	41
3	0.8	1	23.1	37
4	0.2	0	20.7	33
5	0	0	41.6	43

Conclusion

In this study, an IoT system was designed to detect seam pucker using two inexpensive IR sensors. And an algorithm was implemented to analyze data collected from sensors to detect seam puckers. The implemented detection system was verified through a conducted experiment. The experiment confirmed that the implemented system can reliably detect seam pucker even on dark fabrics. In this study, sewing was performed at a consistent speed. However, it is important to note that in a real work environment, the speed of sewing varies. Therefore, a real-time seam pucker detection system independent of sewing speed will be implemented in further research.

References

Inui, S., & Shibuya, A. (1992). Objective evaluation of Seam Pucker: using automated contactless measurement technology. *International Journal of Clothing Science and Technology*, 4(5), 24-33.

Pan, R., Gao, W., Li, W., & Xu, B. (2017). Image analysis for seam-puckering evaluation. *Textile Research Journal*, 87(20), 2513-2523.

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A STUDY ON DEVELOPMENT OF MEN'S SUIT JACKET PATTERN WITH THE BODY TYPE FOCUS ON THEIR LATE 30S
-FOCUSING ON VIRTUAL FITTING SIMULATION-

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Introduction

In order to offer ready-to-wear customization services, store personnel take body measurements of consumers in accordance with made-to-measure (MTM) production, which entails customization through a mass production system and is being adopted by ready-to-wear menswear brands. In order to produce MTM jackets, men's suit manufacturers select an existing pattern featuring the size that most closely resembles the customized consumer and automatically produce it using MTM CAD (Choi et al., 2016). However, it presents a challenge to improve the fit of suit jackets with existing patterns that are limited to the standard size of ready-to-wear garments. As a result, the classification of consumers' body types falls under the purview of the pattern development department of a brand's MTM production system; however, there are no established dimensional specifications for each body type (Choi et al., 2016). The target age range for men's suit brands in Korea is late 30s to late 40s (Choi et al., 2016), but the late 30s mark a significant transition body shape from youth to middle-aged, necessitating the development of patterns that conform to the proportions of each body type (Shin et al., 2019). Especially for people in their 30s who are changing into various body types, unlike people in their 20s (Lee et al., 2015), it is necessary to analyze the body measurements and body shapes of the exact target group in order to create fit patterns that are suitable for evolving body shapes and reflect menswear trends and the needs of male consumers (Kim, 2018). Consequently, the objective of this research is to provide body-type-specific jacket patterns and size recommendations that can be utilized to personalize suit jackets for males in their late 30s through the utilization of a virtual fitting simulation.

Research Method

For this study, a total of 256 men aged 35 to 39 years old were analyzed from the 8th Korean Human Body Measurement Survey (Korean Agency for Technology and Standards, 2020). The analyzed items included five items of height, thirteen items of length, nine items of circumference, three items of width, four items of thickness, and 36 items of height and weight among the human body measurements required for jacket pattern design. The types were classified using the SPSS WIN 28.0 program. The method of drafting the type-specific research pattern is derived from prior investigations concerning the design of men's suit jacket patterns(Shin & Suh, 2019), which yielded a regression result for pattern design that incorporated the dimensions of the human body. Jacket length: height/2.5, back length: [height/5+8.5(constant)], vibration depth: [height/7-1.5(constant)], back piece: [C/9+9.5(constant)] +1 (allowance), front: [C/9+8.5 (constant)] +1 (allowance), underarm: C/8, front waist: 1, front opening: 2, front neck width: C/20+3.7. For pattern analysis, the pattern was drafted using the PAD system (ver.5.0), a pattern CAD program, and measured on the program, and each dimension was divided into front and back for comparative analysis. The dimensional difference between patterns was compared through polymerization. Additionally, eight apparel experts evaluated a total of 52 evaluation items during virtual fitting using the CLO3D program (ver. 7.3) to compare the differences in fit between jackets with each type of dimension and jackets with average dimensions. Repeated Measures ANOVA was performed to analyze the results.

Results & Discussion

In designing a jacket pattern for a late 30s male, five factors were identified for composing the necessary body measurements. These factors were used to categorize upper body circumference and volume, upper

body height, upper body back length, shoulder width, and upper body front length based on factor scores, resulting in four distinct types. On the basis of his anthropometric measurements, a male in his late 30s was classified into four distinct types when a jacket pattern was being developed for him. The characteristics of each type are: Type 1 (I) is short and thin, with narrow shoulders, a short front, and a long back; Type 2 (Y) is broad-shouldered and thin in the upper body; Type 3 (B) is tall with an average upper body size; and Type 4 (D) is short with a bulky upper body and a protruding stomach. When analyzing the dimensions and polymerization of each type of pattern, the 'I' pattern was the smallest in all categories, while the 'Y' pattern was the largest in the jacket length, back length, chest line height, and upper sleeve circumference categories. Although the distinction was not statistically significant, the 'B' pattern demonstrated the greatest magnitude in sleeve height. Conversely, the 'D' pattern produced the largest magnitudes in back, underarm, front, back neck, and front neck width, and the smallest for sleeve height and upper sleeve circumference. The virtual fitting appearance evaluation showed that the jacket drafted with the type-specific dimensions was superior to the jacket drafted with the average dimensions. Notably, the distinctions were as follows: front jacket length, V-zone depth, lapel length, and sleeve mount height and position. As a result, it was evident that ready-to-wear garments can be adjusted to fit individual body types through pattern modification. It was also noted that the most critical factors in body type classification during pattern design are height and chest circumference.

Conclusion

The objective of this research endeavor was to furnish foundational information that could be utilized in the creation of tailored suit jacket designs for men in their late 30s. The findings revealed that 'front jacket length', 'V-zone depth', 'lapel length', and 'height and position of sleeve mount' are variables that could enhance the fit when fitting ready-to-wear garments to individual body types. It is expected that the pattern dimensions presented in this research can be used to classify consumers' body types and set dimensional benchmarks for each body type required by ready-to-wear personalized brands.

References

Kim, E. K. (2018). Changes in upper body sizes and body types of men in their 30s for bodice pattern design. *Journal of the Korean Fashion & Costume Design Association*, 20(2), 73-87.

Korean Agency for Technology and Standards. (2021). [The 8th anthropometric survey report (2020-21)]. *Size Korea.* Retrieved August 10, 2022, from https://sizekorea.kr/human-info/meas-report?measDegree=8.

Lee, J. E. & Do, W. H (2015). Lower Body Type Classification of Korean Men in Their 30's for the Development of Slim-Fit Pants Pattern. *Fashion & Textile Research Journal*, 17(2), 227-236.

Shin, K. H. & Suh, C. Y. (2019). A Study on Development of Men's Formal Jacket Pattern by 3D Human Body Scan Data -A Focus on Men's in their Late 30s. *Journal of the Korean Society of Clothing and Textiles*, 43(3), 440-458.

Choi, J. Y. & Song, H. K. (2016). Investigation of Production Condition of Ready-Made and MTM Men`s Suits - Focusing on Brands of Department Store - *Fashion & Textile Research Journal*, 18(6), 746-754.

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DEVELOPMENT OF ADAPTIVE CLOTHING DESIGN FOR POSTURE CORRECTION FOR SENIORS

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Introduction

Due to the rapid increase in the elderly population worldwide, health problems among the elderly have also become a social issue. It was reported that 20% of adults aged 65 and above spent at least eight hours per day sitting, while 33% sat for a duration of six to eight hours (Centers for Disease Control and Prevention, 2016). Extended periods of sitting, bereft of adequate intervals for active movement, contribute to the deconditioning of trunk and lumbar spine structures (Sempere-Rubio, 2023). There is a need to develop posture correction clothing that can correct posture and reduce musculoskeletal pain in seniors who lead a sedentary lifestyle. In this study, we designed corrective clothing that can be easily worn using soft and stretchy fabrics that are comfortable to wear. By doing so, we aimed to help reduce shoulder, spine, and various chronic body pains faced by seniors in today's increasingly sedentary society.

Literature Review

Previous studies have also been conducted on lumbar support clothing to effectively address low back pain (Lyu & LaBat, 2021; Zou et al.,2023). It was found that the average muscle activity of the lumbar erector spinae muscle decreased through the wearing of the exoskeleton (Zou et al., 2023). There are also examples of posture-correcting garments that use soft fabrics to improve comfort (Lyu & LaBat, 2021). However, these garments were a type of bodysuit that covers the upper back to the mid-thigh and are worn over underwear, which is inconvenient to wear consistently in daily life. Therefore, this study developed a garment based on soft fabric that can be worn over clothes to help correct posture.

Research Method

To enhance posture and body alignment, this adaptive posture-correcting clothing integrated materials like elastic bands, buckles, and neoprene, inspired by the anatomical study of the human posterior torso, which revealed columnar and bandlike shapes in the vertebral column and muscles (Lyu & LaBat, 2021). The design of this corrective clothing is that each band hangs from the shoulder and the one at the waist is wrapped around. The clothing featured a unique design, resembling the number eleven at the front band and forming an 'X' shape at the back. It included buckles on the chest webbing strap for secure fastening and connection of the band. To provide additional waist support, three 7cm plastic rods are integrated into the back waist area. Furthermore, the band is constructed from neoprene material, equipped with hooks and loops to facilitate the attachment of an elastic band. The design incorporated textile bands crafted from soft, stretchable fabrics, essential for aligning the spine and shoulders. To effectively support the spinal column, the clothing featured shoulder bands that are 2 to 3 inches wide, which measure approximately 43 mm (1.69 inches) in width. Furthermore, the clothing offered a range of sizes from small to extra-large, accommodating diverse body shapes. This inclusivity is enhanced using stretchable fabric, making it ideal for seniors of varying body sizes.

Results & Discussion

In this study, we created posture-correcting clothing that is both comfortable and effective. Here are the key findings. First, the clothing, made of neoprene and plastic rods, supports the lower back. This helps keep the spine straight. Second, the elastic band gently pulls the shoulders back. This reminds the wearer to keep their chest open and gently move the shoulders back, helping to align the spine and chest. This is a great help for those who sit a lot and have posture problems. This clothing not only provides physical support but also helps train the muscles for better posture over time. Therefore, the ergonomic design of

this clothing subtly shifts the shoulders and maintains spine alignment, helping to promote a natural, healthy posture for the elderly.

Conclusion

This study developed a soft, posture-correcting garment to assist the elderly in maintaining correct posture. The design of this clothing gently realigns the shoulders and spine, contributing significantly to improving posture in seniors. It is easy to wear, comfortable nature encourages prolonged use, which is beneficial in addressing the tendency of the elderly to develop a stooped posture due to long postural habits. This design is key in reducing the shoulder and back discomfort commonly experienced by seniors. Future research will focus on more extensive usage in everyday settings to better mimic real-life conditions and include electromyography tests. These studies will provide precise data on the garment's effectiveness in muscle posture correction.

Acknowledgement

References

Centers for Disease Control and Prevention. (2016). *National health and nutrition examination survey 2015-2016*. https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/default.aspx?BeginYear=2015.

Lyu, S., & LaBat, K. L. (2021). Posture modification effects using soft materials structures. *International Journal of Industrial Ergonomics*, *84*, 103125.

Sempere-Rubio, N., Muñoz-Gómez, E., Inglés, M., Aguilar-Rodríguez, M., Mollà-Casanova, S., & Serra-Añó, P. (2023). Impact of physical activity levels on the ability to maintain static trunk posture in older adults. *Geriatric Nursing*, *52*, 24-30.

Zou, H., Choi, J., Kang, S. H., Kim, S., & Jin, S. (2023). Passive exoskeletons alter low back load transfer mechanism. *Journal of Biomechanics*, *147*, 111437.

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Proceedings

A CASE STUDY: APPLYING PBL FOR IMPROVEMENT OF TECHNICAL DESIGN & PRODUCTION IN 'FASHION STUDIO' COURSE

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Introduction

In both industrial and academic spheres, there is growing recognition of the need for education programs that can actively respond to the rapid environment of the clothing and fashion industry and cultivate new talents aligned with future trends. The core competencies required for future professionals, often summarized as the '4Cs' – Creativity, Communication, Critical thinking, Collaboration – are increasingly being addressed through Problem-Based Learning (PBL). PBL, widely acknowledged as an optimal educational approach in various fields, including clothing and fashion, enhances problem-solving abilities, fosters diverse and creative approaches, encourages self-directed learning in theoretical and practical aspects, and improves practical understanding and communication skills (Min et al.,2021). Despite these benefits, the application of PBL in clothing and fashion courses, particularly in technical design and production, remains limited, presenting a notable gap in contemporary educational practice (Kang, 2021).

In clothing and fashion design departments, courses related to the creation of graduation projects are crucial, encapsulating all the major competencies of a student. These courses require a thorough understanding and proposal of fit development, composition, and specifications aligned with the design intent for the creation of innovative fashion designs. Experiencing the production process, which includes design comprehension through fit analysis and adjustment, pattern correction considering material characteristics, and sewing specifications suitable for style and material, represents an invaluable educational opportunity to teach the vital aspects of technical design in an academic setting. Previously, the classes were taught as two regular classes with two professors team-teaching the same subject. To effectively apply PBL, the design classes were separated and reorganized into Fashion Studio I and III and the production classes into Fashion Studio II and IV courses. In this study, we conducted a case study specifically on the technical design & production components of the Fashion Studio II and IV.

The purpose of this study is to explore the possibility of curriculum improvement by applying the PBL learning method to the Fashion Studio course of the fashion design department and to examine the educational effects. Additionally, this research aims to enhance students' major competencies and foster 4C abilities by incorporating PBL into the graduation project.

Research Method

This study consisted of two phases: First, we designed a 'Fashion Studio' curriculum that applied the PBL learning method; second, we analyzed questionnaires and self-reflection journals to assess teaching effectiveness.

  Research Content 1: We presented the lesson design and examples of 'Fashion Studio II/IV' course applying the PBL learning method.
  Research Content 2: Questionnaires and reflection journals were analyzed to verify the educational effectiveness of the PBL learning method.

The subjects of this study were a total of 22 students enrolled in the 'Fashion Studio II' course in the first semester and the 'Fashion Studio IV' course in the second semester of 2023. The learners consisted of 4th grade students who took compulsory clothing design and fabrication-related courses such as pattern design and draping, and also included students who took elective courses such as clothing making and tailoring. None of them had any prior experience with PBL learning methods.

Table 1. Overview of 'Fashion Studio II/IV' based on PBL

Step	PBL	Week	Instruction	Additional description
1	Introduction	1	Orientation	Design set

2	Problem suggestion & problem selection	2	Design analysis	Color, material, and details
3	Definition establishment related to variables Information research & solution explorations	3	Creative pattern design	Market survey
		4	Design fitting	Flat sketch
		5	Design modification	
		6	Master pattern	Pattern list
		7	Design the sewing process	Sample manufacturing instruction
		8	Sewing preparation	Fabric & subsidiary materials
		9	Production	Sewing
		10-13	Works according to the sewing process	
4	Final presentation & reflection journal	14	Final presentation	Production portfolio
		15	Peer review	

Results & Discussion

In this study, participants were asked to evaluate their overall satisfaction with the PBL experience using a 5-point scale. The satisfaction scores for class preparation, conduct, and lectures conducted under the PBL methodology were 4.52 in the first implementation and 4.62 in the second. These findings suggest that learner satisfaction can improve as PBL progresses, thereby recommending the structuring of PBL learning in multiple rounds. The learning effect on major competencies were quantitatively evaluated as follows: "I understand the process of organizing a graduation fashion show(4.86)."; "I can create an outfit that fits the design of the graduation fashion show(4.73)."; "I can create accessories to match the design of the graduation fashion show(4.82)."; "I have improved my fashion design skills(4.86).". The quantitative evaluation for collaboration was surveyed as: "I can communicate and collaborate with members(4.86)." After analyzing the content of the reflection journals, it was found that the learners' satisfaction with the class was very positive, and the results of their efforts and time to solve their own problems were thought to be the driving force for the students to improve not only their professional competencies but also their competencies in the areas of creativity, communication, judgment, and collaboration related to the 4Cs.

Conclusion

The purpose of this study was to prove the educational effect by applying the PBL to on a technical design & production course. The research methods are model development research to guide to utilizing PBL. As a result of this study, the students' satisfaction with the subject applying PBL was evaluated quite positively. In general, it has been shown to have a very effective effect on improving the learner's problem-solving capability, cooperative learning capability, and self-directed learning capability. The result is consistent with the educational goal of the PBL for improving the learner's problem-solving capability. This is a testament to their ability to exert greater influence when the competencies that each learner develops are combined. Upon comparing the lecture evaluation scores between the original class type and the PBL class type, it was found that the scores which PBL was applied were higher than those for the original classes. However, this result is not solely due to the influence of the PBL method but rather to the complex impact of various elements that integrate design and production within the educational process.

References

Kang, Y. (2021). A case study of problem-based learning (PBL) in <Draping> classes. *The Research Journal of the Costume Culture*, *29*(3), 346-360.

Min, H., Nam, M., Seo, Y., & Um, M. (2021). *Guide to innovative teaching*. Pukyong National University.

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DEVELOPMENT OF MUSCLE-STRENGTH ASSISTIVE GLOVES FOR INDUSTRIAL WORKERS

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Introduction

The importance of protecting workers' rights is becoming more recognized, leading to a greater focus on improving workplace conditions. This includes a push for the development of protective gear to ensure worker safety. Wearable gloves are also being produced to assist the strength of the hand to prevent potential injuries caused by lack of strength. Previous research showed that wearable robotic gloves are not very comfortable to wear because they often have a stiff, exoskeleton design. Wearable gloves that don't fit well or move with the wearer can be uncomfortable and risky. It is important to carefully place and support the moving parts of these gloves to make them both strong and comfortable to wear (Park et al., 2020). Therefore, this study intends to design methods for fixing actuators in industrial wearable gloves while considering the wearer's movement and therefore improve the wearability of industrial wearable gloves.

Literature Review

For the wire to accurately transmit force to the finger joint in wearable gloves, the wearable system must be worn accurately on the body (Kim et al., 2020). In the case of industrial wearable robots, light weight, comfortable, and efficient actuator support are important for consistent use (Kho, 2022). Rigid structure based wearable robots are uncomfortable and the structure may limit the wearer's movements (Park & Park, 2019). Thus, it is important to minimize rigid components to ensure the user's comfort and wearability and to provide a wide radius of action. In designing a wearable robot, the strap pressing and holding the wearable platform in place is needed but it is important for the strap to not interfere with the wearer's movement by providing an appropriate amount of pressure (Eom & Lee, 2020). It is important to securely attach the actuator to the wearer for effective force transfer and too much ongoing pressure can lead to muscle damage (Nam, 2022).

Research Method

The process of developing the glove-type wearable robot platform included the development of the initial design, making and testing of the prototype, and the multi-step modification process to improve function and wearability. To develop and access a wrist fastening design that both effectively transfers force and is comfortable for the wearer, previous studies as well as wrist protection gear and medical devices were referred to (Kim et al., 2020).

Results & Discussion

Four types of actuator attachment methods were designed and assessed to select a suitable method for the wearable glove-type device. The first method for attaching the motor was using a rivet. This involved securing the 3D-printed part to the wrist fabric with a brass screw-type rivet, measuring 10 mm in head diameter, 4 mm in column diameter, and 5 mm in height. The second method used a hooks and loops system, where the 3D-printed component was fastened to the wrist using an elastic strap and hooks and loops fasteners. The third method focused on the 3D-printed component that was extended to wrap around the palm-side thumb and was secured with hooks and loops fasteners. Finally, the fourth method involved wrapping elastic straps in an X-shape over the back of the hand and securing them at the wrist with hooks and loops. In designing an industrial wearable robot, it is important to use as few hard parts as possible to allow for a wider range of motion and therefore enhance the comfortability of the wearer. The X-shaped fastening method was excluded because of the concern that the strap may apply excessive pressure to the

wrist. Methods using metal rivets or elastic straps to hold the 3D printing may not be enough to hold the actuator in place so the combination of the rivet type and the hooks and loop type design was selected.

Conclusion

This study aimed to develop an actuator attachment method for an industrial wearable device by evaluating various designs by literature study and selecting a suitable design. From four types of actuator-embedding methods, two were excluded for wearability reasons and a final design that combined the rivet type and the hook and loops type was selected. In further studies, the process of setting standards for assessing function and wearability and evaluating and improving the designs according to these criteria would be conducted. This research can be helpful for developers trying to embed the actuators into gloves for industrial workers.

Acknowledgement

References

Eom, R. I., & Lee, Y. (2020). Comfort evaluation by wearing a gait-assistive rehabilitation robot. *Journal of the Korean Society of Clothing and Textiles, 44*(6), 1107-1119.

Kho, S. C. (2022). *A case study on the development of wearable robotics: Focused on target market and product form factor*. [Master's thesis, Hongik University].

Kim, G. S., Weon, J. H., Kim, M. H., Koh, E. K., & Jung, D. Y. (2020). Effect of weight-bearing wrist movement with carpal-stabilizing taping on pain and range of motion in subjects with dorsal wrist pain: a randomized controlled trial. *Journal of Hand Therapy, 33*(1), 25-33.

Nam, Y. J. (2022). *Quantification of comfort for the development of lower-limb binding parts of a wearable robot*. [Master's thesis, Yonsei University].

Park, J., Hwang, I., & Lee, W. (2020). Wearable robotic glove design using surface-mounted actuators. *Frontiers in Bioengineering and Biotechnology, 8*, 548947.

Park, S. J., & Park, C. H. (2019). Suit-type wearable robot powered by shape-memory-alloy-based fabric muscle. *Scientific Reports, 9*(1), 9157.

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KOREAN NATIONWIDE CROSS-SECTIONAL STUDY OF THE RISK FACTORS FOR SARCOPENIA OBESITY

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Introduction

Sarcopenic obesity is a condition where an individual presents both sarcopenia and obesity. Sarcopenia entails the gradual decline of muscle mass, strength, and function in the elderly (Lorenzo M Donini et al., 2022). Obesity involves the accumulation of excess body fat, posing health risks like diabetes, hyperlipidemia, hypertension, and cardiovascular disease (L. M. Donini et al., 2020). The purpose of research is that sarcopenia obseity associated risk factors exist in women aged 65 to 74 years. We hypothesized that this age group would have specific risk factors that would differ from those observed in older individuals.

Literature Review

Ahtough the increasing elderly population and potential adverse outcomes, healthcare professionals and primary care providers encounter challenges in diagnosing sarcopenic obesity due to limited knowledge and diagnostic tools. General practitioners typically have less than 10 minutes per patient visit, necessitating the need for them to assess the likelihood of sarcopenic obesity before considering a referral for further diagnosis and treatment. Additionally, a lack of awareness among clinicians about sarcopenic obesity raises the risk of overlooking the diagnosis (Reijnierse et al., 2017). Recognizing the characteristics of key risk factors for early detection and prevention is vital for effectively addressing this issue (Mehiret, Molla, & Tesfaw, 2022).

Research Method

The Korea National Health and Nutrition Examination Survey (KNHANES) is conducted annually by the Ministry of Health and Welfare and Korea Institute for Health and Social Affairs. This study examined somatometric risk factors including age; height; weight; body mass index; waist circumference. The data analysis was performed utilizing SPSS software (version 22.0; SPSS Inc., Chicago, IL, USA). To ensure the representation of the entire elderly population in Korea, weighted values were incorporated into each sample through a three-step procedure: (1) determining the base weight, (2) accommodating for non-responses, and (3) post-stratification adjustment to align with the complete preceding census population.

Results & Discussion

The clinical risk factors included short height, and high weight, body mass index, waist circumference, skeletal muscle mass index($P < 0.05$). First, despite the inclusion of a substantial sample size of 2,814 participants with representative statistical weights, the use of a cross-sectional design may have restricted the ability to establish causal relationships for the identified risk factors. Thus, further research is imperative to comprehensively elucidate the intricate relationship between these predictors and the development of sarcopenia obesity.

Conclusion

Specific clinical risk factors for sarcopenic obesity were found among community-dwelling older women. Recognizing identified risk factors will provide healthcare professionals with an enhanced ability to identify and detect potential cases of sarcopenia among men. Nevertheless, further research is imperative to deepen our understanding of the relationship between these risk factors and sarcopenia, and to bolster the overall robustness of these findings.

References

Donini, L.M.; Busetto, L.; Bischoff, S.C.; Cederholm, T.; Ballesteros-Pomar, M.D.; Batsis, J.A.; Bauer, J.M.; Boirie, Y.; Cruz-Jentoft, A.J.; Dicker, D. Definition and diagnostic criteria for sarcopenic obesity: ESPEN and EASO consensus statement. Obesity Facts 2022, 15, 321-335.

Donini, L.M.; Busetto, L.; Bauer, J.M.; Bischoff, S.; Boirie, Y.; Cederholm, T.; Cruz-Jentoft, A.J.; Dicker, D.; Fruhbeck, G.; Giustina, A.; et al. Critical appraisal of definitions and diagnostic criteria for sarcopenic obesity based on a systematic review. Clin. Nutr. 2020, 39, 2368-2388, doi:10.1016/j.clnu.2019.11.024.

Roubenoff, R. Sarcopenic obesity: the confluence of two epidemics. Obes. Res. 2004, 12, 887-888, doi:10.1038/oby.2004.107.

Zhang, X.M.; Xie, X.H.; Dou, Q.L.; Liu, C.Y.; Zhang, W.W.; Yang, Y.Z.; Deng, R.L.; Cheng, A.S.K. Association of sarcopenic obesity with the risk of all-cause mortality among adults over a broad range of different settings: a updated meta-analysis. BMC Geriatr. 2019, 19, 1-14, doi:ARTN 183 10.1186/s12877-019-1195-y.

Kulik, C.T.; Ryan, S.; Harper, S.; George, G.J.A.o.M.J. Aging populations and management. 2014, 57, 929-935.

Nam, G.E.; Kim, Y.H.; Han, K.; Jung, J.H.; Rhee, E.J.; Lee, W.Y.; Obesity Fact Sheet of the Korean Society for the Study of, O. Obesity Fact Sheet in Korea, 2020: Prevalence of Obesity by Obesity Class from 2009 to 2018. J Obes Metab Syndr 2021, 30, 141-148, doi:10.7570/jomes21056.

Reijnierse, E.M.; de van der Schueren, M.A.E.; Trappenburg, M.C.; Doves, M.; Meskers, C.G.M.; Maier, A.B. Lack of knowledge and availability of diagnostic equipment could hinder the diagnosis of sarcopenia and its management. PLoS One 2017, 12, e0185837, doi:10.1371/journal.pone.0185837.

Mehiret, G.; Molla, A.; Tesfaw, A. Knowledge on risk factors and practice of early detection methods of breast cancer among graduating students of Debre Tabor University, Northcentral Ethiopia. BMC Womens Health 2022, 22, 183, doi:10.1186/s12905-022-01768-0.

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Proceedings

A COMPARATIVE STUDY ON BODY MEASUREMENTS BY AGE GROUP IN KOREA

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Introduction

Sarcopenia refers to a muscle disease that is accompanied by a gradual decrease in muscle strength, muscle mass, and muscle function with aging. This phenomenon affects healthy aging, so it is important to prevent or detect sarcopenia early by observing individual muscle mass and fat changes through age-related body shape analysis. This study aimed to analyze physical measurements by age to examine the characteristics of body shape changes with aging and to use it as basic data necessary for predicting sarcopenia.

Literature Review

Preliminary research has suggested that body circumference measurements can be used as an indirect indicator of muscle mass reduction. Kim et al (2020) stated that there is a significant positive correlation between the muscle mass of elderly people's arms and legs and their waist and hip circumferences. Endo et al (2021) proposed the arm and calf circumferences as major indicators for predicting muscle loss. Sato et al (2022) suggested the neck circumference, while Mienche (2019) reported that the diagnostic accuracy for muscle loss was excellent when calf and mid-thigh circumferences were combined with the SARC-F questionnaire.

Research Method

After receiving approval from the Bioethics Committee (7002016-A-2023-015), measurements were taken from September 2022 to January 2024 for a total of 233 participants who agreed to participate in the study. The number of participants by age was 38 males and 58 females aged 20-49, 19 males and 58 females aged 50-64, and 14 males and 46 females aged 65 and over. Through direct measurement and 3D body scanning, we derived measurement items that could reflect the characteristics of sarcopenia. These items included 2 for height, 12 for circumference, 2 for width, 3 for thickness, 1 for length, and 1 for other, totaling 21 items. To identify differences by age group, we performed an ANOVA analysis using SPSS 27.0.

Results & Discussion

The results showed statistically significant differences in the calf circumference, thigh circumference, hip circumference, and upper arm circumference for males, and in the calf circumference, upper arm thickness, waist width, and waist thickness for females ($p<.05$). Compared to the young and middle-aged groups, the elderly showed a tendency for the circumference of the lower body parts such as the buttocks, thighs, knees, shins, and ankles to decrease, while the circumference of the upper body parts like the waist and abdomen increased. This is characteristic of elderly obesity, where the abdomen becomes disproportionately larger without an increase in other body parts. As age increases, the height, weight, and limbs decrease, but the abdominal-related items have larger values. This is similar to the findings of a previous study by Lee et al (2019), which reported similar results.

Conclusion

This study examined differences by gender and age based on whole body measurements, and the results showed a tendency for the circumference of the lower body to decrease and the upper body to increase as age increases. Future studies should analyze the distribution of sarcopenia by gender and age by applying various sarcopenia diagnostic indicators (BMI, ASM, ASMM), and understand the characteristics of sarcopenic body types in the elderly. It is thought that research should be conducted to determine how changes in specific body types or body measurements are associated with sarcopenia

References

Kim, M., Kim, H., Park, S., Cho, I., & Yu, W. (2020). A study on the analysis of physical function in adults with sarcopenia. Journal of The Korean Society of Integrative Medicine, 8(2), 199–209. https://doi.org/10.15268/KSIM.2020.8.2.199

Endo, K., Sato, T., Kakisaka, K., & Takikawa, Y. (2021). Calf and arm circumference as simple markers for screening sarcopenia in patients with chronic liver disease. Hepatol Res, 51, 176–189. https://doi.org/10.1111/hepr.13589.

Sato, R., Sawaya, Y., Ishizaka, M., Shiba, T., Hirose, T., & Urano T. (2022). Neck circumference may predict sarcopenia in Japanese older adults requiring long-term care. Geriatric Nursing, 47, 159-163. https://doi.org/10.1016/j.gerinurse.2022.07.005

Mienche, M., Setiati, S., Setyohadi, B., Kurniawan, J., Laksmi, P. W., Ariane, A., & Tirtarahardja, G. (2019). Diagnostic performance of calf circumference, thigh circumference, and sarc-f questionnaire to identify sarcopenia in elderly compared to asian working group for sarcopenia's diagnostic standard. Acta Med Indones, 51(2), 117-127.

Lee, J., Park, J., & Nam, Y. J. (2019). A study on body shape characteristics of elderly men and women-focusing on the application of various obese indices. Journal of the Korean Society of Clothing and Textiles, 43(2), 184-203. https://doi.org/10.5850/JKSCT.2019.43.2.184

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AGE-SPECIFIC FOOT MEASUREMENT COMPARISON ANALYSIS

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Introduction

The foot, as the only part of the body in direct contact with the ground, plays a crucial role in serving as the axis of the human body. Simultaneously, it bears the weight of the body, maintains balance, generates propulsive force necessary for walking, and absorbs shock (Shin, 2020). Similar to other parts of the body, the structure of the foot undergoes changes over time due to factors such as aging and deformities caused by footwear. Therefore, it is essential to accurately understand the shape and size of the foot according to age. Additionally, as muscle loss occurs with age and walking may become unstable, the design of insoles becomes crucial to accurately support the ground, especially in situations where stability is compromised.

Literature Review

Seong(1998) noted that elderly individuals tend to have longer foot length compared to the younger population. Additionally, characteristics such as increased foot width, foot circumference, instep circumference, and inner side length of the foot were observed with aging. It was also mentioned that the circumference measurements tend to be larger than foot length measurements. Park and Chae (2008) reported that as individuals age, toe width decreases, while the width below the fifth metatarsal head increases. They observed a reduction in ball circumference, instep circumference, and heel-to-instep circumference. Deformities were noted, including the convergence of the big toe and little toe toward the central axis of the foot. According to Park(2011), as age increases, circumference measurements tend to thicken, and ball width and heel width widen. The ankle shape also tends to develop thickness. Lee(2022) highlighted that in women in their 60s, foot length and foot width are smaller compared to those in their 20s. Inner ball width is broader, and the H-shaped foot bottom with a lower arch was identified as the predominant foot shape in women in their 60s.

Research Method

A study was conducted to examine the changes in the foot structure across different age groups, involving a total of 274 adult participants, including 81 individuals aged 20-39, 111 individuals aged 40-64, and 82 individuals aged 65 and above. Both males and females were included in the study. After obtaining approval from the Institutional Review Board(7002016-A-2023-015), measurements were conducted on participants who had consented to participate in the research. Measurements were taken using a 2D scanner, with each participant placing one foot at a time in a grounded position. The data collection was performed through indirect measurements. A total of 31 measurement items were established, including 9 length-related parameters, 14 width-related parameters, and 8 angle-related parameters, covering various aspects of the foot structure.

Results & Discussion

In the length-related measurements, the average foot length for young adult males was 25.204 cm, middle-aged males had an average foot length of 24.380cm, and elderly males had an average foot length of 23.242cm. For young adult females, the average foot length was 22.977cm, middle-aged females had an average foot length of 22.743cm, and elderly females had an average foot length of 23.333cm. Across all age groups, the heel-to-toe length generally appeared longer than the heel-to-ball length. In the width-related measurements, among the 14 parameters, young adult males exhibited the widest measurements in toe width, big toe width, little toe width, foot width, ball width, inner ball width, instep length level width, instep length level inner width, instep length level outer width, ankle length level width, and ankle length level inner width. For females, young adults showed the widest measurements in toe width, big toe width, little toe width, foot width, and ankle length level width, while elderly females had the widest measurements in ball

width, inner ball width, side foot width, heel width, instep length level width, instep length level inner width, instep length level outer width, and ankle length level outer width. Regarding angle-related measurements, elderly males had a significantly larger angle for the big toe angle at 12.786°, and elderly females had a big toe angle of 11.507°, which was notably larger compared to the average angle of 6-8° in other age groups. Additionally, the ball width angle for the elderly group was the smallest, indicating a steeper slope in ball width compared to other age groups.

Conclusion

The purpose of this study is to investigate the size and shape of the foot when grounded according to age, aiming to provide foundational data for addressing the decrease in muscle mass and increased instability in walking that often accompanies aging. Notably, the feet of the elderly tend to exhibit a distinctive characteristic, falling into the 'diamond' type where the big toe is oriented towards the center of the foot, which differs from the younger and middle-aged groups. As such, it is suggested that special insole designs may be necessary for the elderly population to address this unique characteristic and aid in mitigating the challenges associated with decreased muscle mass and instability in walking that come with aging.

Acknowledgement

References

Park, J. E. (2011). Classification or adult women's foot shape and their morphological characteristics by age-By using 3D foot data of size Korea-. Unpublished doctoral dissertation, Kyung Hee University, Seoul.

Park, S. J., & Chae, H. S. (2008). Analysis on foot measurements of elderly women for ergonomic shoes design. Journal of the Korean Society for Clothing Industry, 10(1), 83−91.

Seong, H. K. (1998). The classification of foot type and the analysis of foot shape for older adult women. Unpublished doctoral dissertation, Dongkuk University, Seoul.

Shin, Y J. (2020). Analysis of foot shape and size system of male high school students using 3d scan data. The Korean Society Clothing and Textiles, 44(1), 53-67.

Lee. (2022). Analysis of Foot Characteristics and Classification for the Development of Lasts for leather shoes for Women in their 60s. Journal of Korea Design Forum, 75, 7-16.

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OPTIMAL SIZING STRATEGIES FOR ENHANCED FIT AND PRODUCTION/MANAGEMENT EFFICIENCY IN MEDICAL EXAMINATION CLOTHING

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Introduction

Medical examinations play a crucial role in disease prevention and early detection, providing additional benefits such as reducing complications in chronic diseases, lowering costs, and decreasing mortality rates. As our society ages, medical examinations are expected to become an integral component of our social system. However, current participation rates face challenges due to factors such as uncomfortable procedures, potential complications, difficult preparations, and negative past healthcare experiences (Teo et al., 2016). Specifically, ill-fitting patient gowns or examination clothing have been identified as factors that contribute to reinforcing negative medical experiences and emotions (Detsky & Krumholz, 2014). As a result, this study aims to develop an optimized sizing system for medical examination clothing tailored to the dimensions of Korean participants, using mathematical optimization techniques such as the loss function.

Given the design of medical examination clothing to wrap the body in a loose silhouette without accentuating body contours, it is important to note that existing sizing systems for such garments are universally developed as unisex. Therefore, in this study, we have integrated the dimensions of both male and female bodies to optimize and establish a unisex sizing system. This approach ensures that the examination clothing, designed to drape the body without emphasizing its curves, accommodates a wide range of body shapes and sizes, promoting comfort and a positive experience for all participants.

Literature Review

Previous research on improving healthcare clothing has mainly focused on general hospital gowns or patient gowns, seeking enhancements primarily from a design perspective (Gordon & Guttmann, 2013; Black & Torlei, 2013; Hwang et al., 2022). However, this design-centric approach has proven limited in offering effective solutions as it does not directly address the size and fit of medical examination clothing. The existing literature lacks comprehensive studies on the size and fit of patient gowns or examination clothing. While Cheon & Seo (1998) introduced a new sizing system for pediatric patient gowns, and Jankovska (2015) attempted an anthropometric approach for improved fit, research in this field remains insufficient. Importantly, there is a notable absence of initiatives to develop a sizing system for medical examination clothing based on adult body measurements specifically tailored for the Korean population.

Research Method

The sizing system for medical examination clothing in this study was developed utilizing the loss function presented by Park & Kim (1992) (Equation ①) and the optimization program based on the Data-driven approach developed by Hong & Choi (2023).

$$L(x) = \begin{cases} C_1(u-x)^2, \ if \ x \leq u \\ C_2(x-u)^2, \ if \ x > u \end{cases} \text{.................} ①$$

To optimize the sizing system for medical examination clothing in this study, anthropometric data from 5,082 adults aged 20 to 60, collected through the 8th Size Korea, were employed. The optimization process involved applying the loss coefficient ratio value of 9.36, derived from the survey by Hong et al. (2023), and was conducted separately for cases with 1, 2, 3, 4, 5, and 6 sizes. The final number of sizes was determined by considering overall efficiency in terms of total loss, production, and management for each

number of sizes. Subsequently, the accommodation rate of the developed optimal sizing system was derived through cross-analysis using SPSS 26.0.

Results & Discussion

The key dimensions for the developed medical examination clothing sizing system in this study were established as height and chest circumference, based on international clothing size standards (ISO 8559-2:2017, ISO 8559-3:2018), Korean standards (KS K 0050, KS K 0051), and various commercially available medical examination clothing sizing systems. Following a comparison and analysis of total loss values for sizes ranging from 1 to 6, we opted for the final count of 4 sizes due to their relatively small total losses and efficiency from both production and distribution perspectives. The dimensions optimized for the 4 sizes were converted to centimeters for practical convenience and rounded to the nearest decimal place. In consideration of healthcare professionals' preferences, size designations were chosen to resemble daily clothing sizes: 2XS-XS, S-M, L-XL, and 2XL-3XL. Consequently, the final key dimensions for 2XS-XS were determined as height 161cm, chest circumference 89cm, for S-M as height 167cm, chest circumference 97cm, for L-XL as height 175cm, chest circumference 103cm, and for 2XL-3XL as height 182cm, chest circumference 112cm.

The establishment of optimal size boundary intervals was guided by the body measurement classification chart outlined in the standards for adult men's clothing sizes (KS K 0050) and adult women's clothing sizes (KS K 0051) in South Korea. Specifically, for adult men's clothing sizes (KS K 0050), the chest circumference range from L to XL sizes was set at 15cm, and this was integrated into the medical examination clothing optimal sizing system for L-XL and 2XL-3XL sizes. Conversely, concerning adult women's clothing sizes (KS K 0051), the chest circumference range from S to M sizes was determined as 17cm, and this was applied to the medical examination clothing optimal sizing system for 2XS-XS and S-M sizes. The height range was chosen as 12cm or 13cm for men (KS K 0050) and 10cm for women (KS K 0051), with 13cm being selected for implementation.

To assess the efficacy of the optimal sizing system developed in this study, the accommodation rate of the sizing system was determined using SPSS 26.0. The total accommodation rate was found to be 81.9%, with the accommodation rate of 2XS-XS size being the highest at 32.1%. The accommodation rates for S-M, L-XL, and 2XL-3XL sizes were 21.3%, 20.7%, and 8.2%, respectively. Additionally, within the 32.1% accommodation rate of 2XS-XS size, 31.1% was occupied by females, suggesting that this size is predicted to target relatively smaller-bodied females. In contrast, for L-XL size, the accommodation rate was 20.7%, with 20.0% attributed to males, indicating that this size is predicted to target males. The 8.2% accommodation rate of 2XL-3XL size was entirely occupied by males, suggesting that this size is designed for male examinees. Additionally, the 21.3% accommodation rate for S-M size demonstrated an almost equal distribution between males (9.7%) and females (11.6%), making it suitable for both relatively larger females and smaller males.

Conclusion

In this study, we formulated a medical examination clothing sizing system tailored to the body dimensions of Korean individuals. The newly devised sizing system is anticipated to optimize examinees' satisfaction through the application of the loss function technique, concurrently improving the production and management efficiency of medical examination clothing by constraining the number of sizes.

References

Teo, C. H., Ng, C. J., Booth, A., & White, A. (2016). Barriers and facilitators to health screening in men: a systematic review. *Social Science & Medicine*, *165*, 168-176.

Detsky, A. S., & Krumholz, H. M. (2014). Reducing the trauma of hospitalization. *Jama*, *311*(21), 2169-2170.

Gordon, L., & Guttmann, S. (2013). A user-centered approach to the redesign of the patient hospital gown. *Fashion Practice*, *5*(1), 137-151.

Black, S., & Torlei, K. (2013). Designing a new type of hospital gown: A user-centered design approach case study. *Fashion Practice*, *5*(1), 153-160.

Hwang, C., McCoy, L., & Shaw, M. R. (2022). Redesigning maternity hospital gowns. *Fashion practice*, *14*(1), 79-98.

Cheon, J. S., & Seo, D. (1998). A study on sizing system for child hospital gown. *Journal of the Ergonomics Society of Korea*, *17*(3), 81-90.

Jankovska, D. (2015). *Identifying fit issues for the one-size-fits-all hospital patient gown: An anthropometric approach* (Doctoral dissertation, Colorado State University).

Park, Y. T., & Kim, S. D. (1992). On the Determination of Optimal Sizes. *Journal of the Human Engineering Society of Korea, 11*(1), 39-47.

Hong, Y., & Choi, H. E. (2023). Development of Optimal Sizing System for Tactical Gloves Applying Empirical Loss Coefficient Ratio. *Scientific Reports, 13*, 11529.

Hong, Y., Kim, Y., & Choi, H. E. (2023). Analysis on the Current Size for the Optimization of Medical Examination Clothing Sizing System. *Poster presented at the Annual Conference of The Society of Fashion & Textile Industry, Seoul, Korea.*

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EVALUATION OF BENDING STRENGTH OF 3D PRINTING MATERIALS FOR LUMBAR SUPPORT BRACES

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Introduction

Despite the widespread use of 3D printing in the development of medical devices and protective gear, research on lumbar support braces using 3D printing is still limited. Technology using 3D printing is effective for the production of custom-fit lumbar support braces. Materials for 3D printing, such as filaments, are being actively developed with flexible properties, which are crucial for enhancing the ergonomic suitability of protective gear. The bending strength characteristics of 3D printed products are affected by their structure and printing materials. Lattice structures are based on nature's fundamental building blocks, and the internal structures of honeycombs or bones also belong to biological lattices (Varotsis, 2022). Therefore, this study aims to examine the bending strength characteristics of various lattice structures, 3D printing types, and printing materials for the production of lumbar support braces.

Literature Review

In the fashion industry, research on protective apparel using 3D printers and 3D scan data is actively underway. Kim (2015) introduced 3D printing in the development of protective garments for policewomen. Park & Kim developed a lumbar support garment for obese women using 3D printing. In the medical field as well, research is being conducted utilizing 3D technology for the development of protective gear and assistive devices. Koo & Lee (2017) modeled a wrist brace using 3D human body data, while Lee & Lee (2017) developed a 3D printed segmental hard shell knee protector with TPU materials for children. Various studies utilizing 3D technology are being conducted in both the fashion and medical fields.

Research Method

Prior to developing lumbar support braces integrating lattice structures, lattice samples were produced in the current study. Three types of lattice structures were utilized: X-shell, Honeycomb, and Gyroid. To examine the bending strength differences based on the number of lattice structures inserted, samples were created in two patterns: Pattern 1 with one lattice structure inserted per 1.27cm width, and Pattern 2 with two lattice structures inserted per 1.27cm. All sample sizes were standardized as 12.7×1.27×0.64(cm) and 12.7×1.27×0.8(cm), with two thicknesses of rectangular solids. A total of 12 samples were modeled with three structural variables, two pattern variables, and two thickness variables (3X2X2). Sample modeling was designed using Fusion 360 (Autodesk Inc., USA) software. The modeled samples were 3D printed using three printing types and material combinations: FDM method with TPU material, SLS method with TPU material, and Polyjet method with rubber-like material. A total of 36 samples were 3D printed.

Bending strength experiments were performed on the printed samples. The force (load) required to bend the samples was measured using the Push-Pull Gage (AIGU, China). For bending strength measurement, rubber cables fixed half and quarter lengths of the samples, and the force required to bend each sample was measured at 30° and 60°. Bending strength was measured three times for each sample, and the average of the three measurements was calculated as the result.

Results & Discussion

When examining the lattice structure variables, the Honeycomb structure exhibited the highest bending strength load, followed by the X-shape and Gyroid structures, respectively. Regarding the printing type and material, samples printed using the FDM method with TPU material generally showed higher bending strength loads, while those made with the Polyjet method using rubber-like material exhibited lower bending strength. Furthermore, when comparing samples made with FDM and SLS methods using TPU material,

the samples produced with the FDM method required more force to bend, despite both being made of TPU material.

In terms of the pattern variable, it was found that Pattern 2, which had 2 lattice structures inserted within the same width compared to Pattern 1 with 1 lattice structure inserted, exhibited higher bending strength. X-shape and Gyroid structure samples made with rubber-like material exhibited bending strength loads at a notably low level, which was below 5kgf, and the bending elasticity was also low. However, adjusting the hardness settings during the printing process of rubber-like samples could improve the bending strength.

Conclusion

The aim of this study was to determine suitable 3D printing methods and materials for the production of lumbar support braces. Upon examining the results of the bending strength experiments, we suggest that TPU material, along with FDM and SLS printing methods, exhibits appropriate bending strength and elasticity recovery, making them suitable for lumbar support brace production. However, for the production of lumbar support braces, it is necessary to understand the characteristics of the samples beyond just bending strength, such as tensile strength, weight, breathability, and others. Therefore, conducting further evaluations of the samples through follow-up research and applying the structure and materials to the lumbar support braces will be necessary.

References

Kim, J. H. (2015). *The development of protective clothing pattern for riot police woman using 3D printingb* [Unpublished master's thesis]. Konkuk University.

Koo, D. S., & Lee, J. R. (2017). The development of a wrist brace using 3D scanner and 3D printer. *Fashion & Textile Research Journal, 19*(3), 312-319.

Lee, H. & Lee, Y. (2017). Segmental hard shell design of knee protector for children using 3D printing. *Journal of Fashion Business, 21*(4), 116-126.

Park, S., & Kim, D. E. (2023). The application of 3D printing technology for developing a lumbar support garment for obese women. Textile Research Journal, 93(7-8), 1712-1733.

Varotsis A. B. (2022, April 28). *Guide to Lattice Structures in Additive Manufacturing*. nTopology, Retrieved December 18, 2023, from https://ntopology.com/blog/guide-to-lattice-structures-in-additive-manufacturing/.

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DEVELOPMENT OF PATIENT CLOTHING FOR WOMEN IN NURSING HOSPITAL BASED ON ZERO-WASTE CUTTING TECHNIQUE

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Introduction

This study aimed to develop patient clothing specifically tailored for elderly female bedridden patients. Following an assessment of existing patient clothing, both in nursing hospitals and commercially available, a satisfaction and preference survey was conducted among patients and caregivers. Additionally, user-centered clothing design factors aimed at enhancing user satisfaction were identified, and a pattern drafting method was established. As of 2023, Korea's elderly population aged 65 or older stands at approximately 9.49 million, constituting 18.4% of the total population. By 2030, this figure is projected to rise to approximately 12.9 million, or around 25.5%, and by 2050, it is expected to surpass 40% (19 million) as the population ages rapidly (Statistics Korea, 2021). Elderly patients, especially those who are bedridden, have limited mobility due to their condition. Therefore, it is crucial that patient clothing functions properly in all situations to avoid weakening the patient's psychological state and delaying recovery. Hence, providing appropriate clothing is essential to aid in treatment activities.It is imperative to incorporate design elements tailored to the primary treatment needs of bedridden patients. From a clothing design and production perspective, the aim is to develop a cutting technique that minimizes fabric wastage, a significant consideration in terms of environmental, social, and governance (ESG) factors. Additionally, efforts were made to utilize pattern modifications within design constraints, utilizing zero waste marking with CAD software to generate baseline data for minimizing fabric wastage.

Literature Review

Previous research on patient clothing has analyzed the conditions of various patient groups, including spine surgery patients (Jeong-eun Park, 2011), traffic accident patients (Jeong-hyun Kim, 2002), orthopedic patients (Seon-hwa Lee, 2012), and dementia patients (Hye-won Park et al., 2007), examining their specific characteristics. Research on developing patient clothing designs that cater to these needs has been steadily advancing. However, many studies have primarily focused on modifying opening and fastening methods, rather than devising comprehensive pattern design methods. These modifications mainly consider the ease of donning and doffing clothes or handling, without addressing issues such as skin conditions caused by wearing diapers or pressure ulcers. Therefore, there is a need for research to develop patient clothing patterns suitable for bedridden patients who face mobility challenges. Among various approaches to zero-waste fashion, this study specifically focuses on the zero-waste pattern cutting method, aiming to eliminate fabric waste entirely. It incorporates insights from previous studies on this topic (Jeong-hye Kim, 2022; Hee-kyung Yang, 2022; Gangnam, 2020; Lee Yu-seon et al., 2020; Kim In-kyung et al., 2016; Guk Hye-seung, 2014). The objective is to achieve zero waste during the cutting process by optimizing the pattern composition (Hyeonju Kim, 2021). This approach aligns with sustainable fashion principles, intending to minimize resource wastage from the design stage (Kuk Hye-seung, 2014). Typically, around 15% of fabric is discarded as waste in fashion production processes (Rissanen, 2013). Hence, it is essential to devise strategies to minimize this waste. Notably, there appears to be a lack of research specifically focusing on zero-waste cutting patterns related to patient clothing design.

Research Method

The Yeungnam University Bioethics Committee (IRB) approved 69 out of 70 copies for caregivers (7002016-A-2023-106) after recruiting one large geriatric nursing hospital and one geriatric specialty hospital with a capacity of approximately 200 patients. For the 90 copies intended for patients, 86 copies were collected and analyzed using a 5-point Likert scale. Frequency analysis and descriptive statistics

were conducted using IBM SPSS Statistics 27. A fabric requirements survey was conducted on 20 caregivers and 20 patients by comparing existing patient clothing fabrics with commercially available fabrics. Three similar types of fabrics (Fabric 1: CVC blended fabric, Fabric 2: Washed fabric, Fabric 3: Pigment-processed fabric) were provided for subjective sensory evaluation using a 5-point Likert scale, and IBM SPSS Statistics One-way analysis of variance was performed. Referring to the women's clothing size standard for older women (KS K 0055, 2019), top and bottom designations and body measurements corresponding to size M (90) were derived. The values of chest circumference ranging from 86 to 94 cm and hip circumference ranging from 87 to 93 cm were applied. For zero-waste cutting-based patient clothing pattern design, the YUKA CAD program was utilized to design the pattern and the marker function was used to check the fabric loss rate. Three cases were considered: using the existing patient clothing pattern, the developed patient clothing M size pattern, and the developed patient clothing S/M/L patterns. S and L sizes were produced by grading ±5cm based on the loss rate of the M size. User satisfaction was evaluated on a total of 65 individuals, including 25 bedridden patients and 40 caregivers, using a 5-point Likert scale for a total of 27 items related to appearance (6), treatment (6), wearability (6), and material (8). Expert appearance evaluation was also conducted on a 5-point Likert scale for a total of 20 items, including tops (9) and bottoms (11), by 20 clothing-related professionals. Descriptive statistics and t-tests were performed using SPSS 27.0 to compare existing and developed patient clothes and analyze satisfaction differences.

Results & Discussion

A total of 857 pieces of information on commercially available patient gowns were collected from data obtained from eight brand homepages searched on major portal sites. These gowns were classified according to shape. Among them, the characteristics of 84 partially open patient gowns, which were deemed suitable for this study, were analyzed to identify elements of patient gown design. Fabric selection for the bedside patient uniform was based on previous research and a market survey. Two types of 16-count fabric and one type of 20-count fabric, similar to existing patient uniforms, were selected. Subsequently, the fabric with the highest satisfaction level for both patients and caregivers was chosen from the three options. Furthermore, the suitability of the analysis results was confirmed by the KATRI Testing Research Institute, which compared the physical properties of the fabric used in existing patient clothing with that of the developed patient clothing. The size of elderly women's bedside clothes was determined based on size M, analyzed from the dimensions of users' existing patient clothes. Referring to the size standard for elderly women's clothing (KS K 0055, 2019), it was determined that the tops should have a chest circumference of 86 to 94 cm, while the bottoms should have a hip circumference of 87 to 93 cm. Upon designing a patient clothing pattern based on zero waste cutting, it was found that the fabric efficiency of the existing patient clothing was 77.42%, with a loss rate of 22.58%. Conversely, the M size of the developed patient clothing exhibited a fabric efficiency of 90.48%, with a loss rate of 9.52%. When considering all sizes (S, M, and L) of the developed patient clothing, the fabric efficiency was 91.72%, with a loss rate of 8.28%. These results indicated that the fabric efficiency of the developed patient uniform pattern significantly surpassed that of the existing patient uniform. The suitability evaluation for patient clothes designed to meet specific requirements resulted in an average rating of 4.00 points or higher in items such as sleeve length, pants length, intravenous line management, urinary tract treatment, urine and feces disposal, bedsore management, pants waist fastening, and hip bulge. The developed patient uniform was thus evaluated to have excellent wearability. In appearance evaluation, the expert group provided positive feedback, noting that the uniform provided adequate space for wearing a diaper, appeared convenient for changing, and seemed easy to administer intravenous injections.

Conclusion

In this study, the development of patient clothing tailored for elderly female bedridden patients was pursued. Requirements for existing patient clothing were derived through user demand surveys, informing the creation of clothing patterns that addressed users' needs. Furthermore, a zero-waste cutting pattern design method was investigated, aiming to achieve a fabric loss rate of 15% in patient clothing production.

Previous studies (Gangnam, 2020; Kuk Seung-hye, 2014; Rissanen, 2013) were referenced in this endeavor. Patient garments for bedridden individuals were manufactured, and suitability evaluations were conducted among users, along with appearance evaluations by experts. The objective was to propose patient clothing solutions for elderly female bedridden patients that offered improved wearability, manageability, and a functional, aesthetic design. This study sought to contribute to the development of innovative patient clothing that prioritizes user convenience and environmental friendliness for elderly female bedridden patients. It was demonstrated that the patient clothing developed through this research exhibited a lower fabric loss rate and enhanced wearer convenience compared to existing products.

References

Rissanen, T. (2013). Zero-waste fashion design: A study at the intersection of cloth, fashion design and pattern cutting [Doctoral dissertation, University of Technology]. Open Publications of UTS Scholars. http://hdl.handle.net/10453/23384

Gangnam. (2020). Shirt design study using zero-waist pattern cutting method [M.D. thesis]. Graduate School of General Studies, Incheon National University.

Gong Hye-jeong. (2007). A study on the development of severe wound (臥床) patient clothing [M.D. thesis]. Ewha Womans University.

Kook Hye-seung. (2014). Sustainable zero-waist fashion design research [Ph.D. thesis]. Graduate school of Ewha Womans University.

Kim Jung-hyun. (2002). Design of patient clothing for long-term hospitalized patients without mobility: focusing on injured patients in traffic accidents [M.D. thesis]. Ewha Womans University.

Kim Hyun-joo. (2021). Development of a zero-waist pattern cutting education model: utilizing 3D virtual design programs [Ph.D. thesis]. Graduate School of General Studies, Seoul Women's University.

Park Jung-eun. (2011). Development of patient clothing for spinal surgery patients [M.D. thesis]. Ewha Womans University.

Hyewon Park, Injo Park. (2007). Development of hospital suit design for dementia patients. Journal of the Korean fashion business society, 11 (1), 75-85.

Kim In-kyung, Cha Yumi, Lee Jin-ah. (2016). Development of circular zero-waist fashion design. Archives of Design Research, 29 (2), 215-229.

Kim Jung-hye. (2022). Consumer Participation in Fashion Design Study with Tessellation as a practical measure to minimize fashion waste [Ph.D. thesis]. Ewha Womans University.

Yang Hee-kyung. (2022). Development of zero-waist fashion design using equal division patterns [Master's thesis]. Chungnam National University.

Sun Hwa Lee. (2012). Research on the development of hospital medical staff and patient suit design [Ph.D. thesis]. Chung-Ang University.

Lee Yoo-sun, Choi Yoon-mi. (2020). A study of zero-waisted fashion design using Chilgyo nori and folding. Journal of the Korean Society of Fashion Design, 20 (1), 93-108.

Statistics Korea. (2021). Future population estimates [Data set].

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A STUDY ON THE USE OF THE REPLICA METHOD FOR PATTERNMAKING EDUCATION IN THE CLOTHING DOMAIN FOR ADOLESCENTS

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Introduction

It is important to deliver clothing education to middle and high school students, who are typically very interested in fashion. Except for fashion-related departments in specialized high schools, clothing education for adolescents is somewhat limited to theoretical education or small item production activities using very basic sewing techniques. Consequently, students who later advance into fashion and apparel majors in higher education find it difficult to learn practical patternmaking skills related to clothing configuration. It is critical to understand the human body thoroughly to learn patternmaking for clothing configuration. However, students struggle with patternmaking classes mostly because their understanding of the human body remains limited to the level of body measurements. Meanwhile, the replica method is a three-dimensional anthropometric method that allows us to observe the body surface. Flat patterns obtained through this method allow us to easily see natural curves along the surface of the body. As pattern drawing based on the replica method does not rely on calculations using human body dimensions, pattern drawing education using the replica method can be used for practical classes in educational settings for adolescents. By comparing the replica method and draping method, which can be used to acquire patterns from the human body in three dimensions, this study reviews the use of the replica method for patternmaking education for adolescents.

Literature Review

While clothing education for adolescents is crucial as it is useful in real life and strongly favored, there are many challenges in educational settings due to the lack of time to practice and the difficulty of teaching diverse majors (Park, 2016). More specifically, both students and teachers feel pressure regarding education in clothing configuration. Recently, universities have focused on providing education in 3D virtual clothing technology, and education in clothing configuration is increasingly recognized as an essential educational course in clothing science. In this context, a teaching and learning method that can help adolescents to understand clothing configuration in the clothing section of the academic subject of home economics could provide huge educational benefits to adolescents who want to pursue a career in fashion. Meanwhile, there are difficulties in learning clothing configuration using the drafting and draping methods. Utilizing the replica method, which can be used to develop patterns similar to the draping method using a human body model, would allow students to better understand clothing configuration. However, it is difficult to find review studies on educational approaches using this method.

Research Method

A female mannequin was used as the human body model for this study, and a skirt was selected as the most basic item to learn in clothing configuration. Using line tape, we marked the front center line, back center line, side lines, waist line, hip line, and mid-hip line on the mannequin. Then, patterns were acquired via the draping method using cotton cloth, and via the replica method using paper tape. The waist dart location to obtain patterns was where the waist line and hip line were divided into thirds. The above process was carried out by four individuals majoring in clothing science and one individual who majored in clothing science and also worked as a technology and home economics teacher at a middle school, and we analyzed the advantages and disadvantages of the methods. Finally, we reviewed whether the replica method is acceptable for patternmaking education targeting adolescents.

Results & Discussion

After patterns were developed using the draping method and replica method, the following results from the

comparison of the methods were obtained: The draping method started with pinning the mannequin to the location marked by line tape. After learning the skill of pinning, I was able to proceed with the task. The replica method started with drawing lines on the surface of paper tape, which wrapped around the mannequin, to compartmentalize the surface of the mannequin. It could be done with just a pen. With the draping method, it was necessary to obtain patterns on the front and back separately, while patterns on the front and back could be obtained together with the replica method. Skirt patterns developed using the two methods differed in shape. While patterns could be obtained using the draping method with the desired extra margins on the waist line and hip line, there was a problem where patterns with unplanned extra margins were obtained depending on the operator's skills. From the replica method, we were able to obtain patterns with the form of the mannequin surface maintained without extra margins. It was found, however, that it would be difficult to use the replica method for the alignment process of joining multiple pattern pieces, especially for those who are not experienced in drawing patterns. Upon exploring the use of the replica method for patternmaking education for adolescents in the clothing domain, we found the following results: The class that used the replica method did not require students to use tools used by professionals. It was also found that visual data provided by the teacher about the replica method process was enough for students to easily follow and proceed. The process made it easy to acquire and develop patterns flat on the surface of the mannequin, and students could intuitively comprehend the curved waist line, hip side lines, and dart shape. Furthermore, it was possible to develop patterns with the replica method more quickly than with the draping method. The biggest advantage was that even beginners could use the same mannequin to obtain the same patterns. However, if they had no experience in pattern drawing, it would be somewhat challenging to finalize patterns. In this regard, teachers should provide a theoretical explanation of patternmaking before proceeding with practices if the replica method is used for teaching. Overall, the replica method was deemed acceptable for educating adolescents in clothing configuration.

Conclusion

Upon reviewing the use of the replica method for patternmaking education for adolescents, this study demonstrated that this method can be used to provide education that is easily accessible to adolescents in the field of clothing configuration. It would be vital to check satisfaction with the replica method among students after applying the method to actual classes in schools for adolescents. The results of this study are expected to serve as a useful learning reference for clothing education targeting adolescents, and to lead to adolescent career education that can contribute to the fashion industry.

References

Park, A.-M. (2016). Investigation of Preference and Demand for Teaching-Learning of Clothing Chapter of Middle School's Technology and Home Economics: Centrally around Seoul and Jeju Province. *Master's Thesis in the Graduate School of Education at Chosun University.*

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THE BODY SHAPE CHARACTERISTICS OF MALE ADOLESCENT EARLY STUDENTS AND DEVELOPMENT OF VIRTUAL MODELS

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Introduction

The COVID-19 pandemic's enduring impact has spurred an acceleration in digital transformation, notably increasing online consumption patterns compared to pre-pandemic times. In particular, teenage consumers, who are digital natives familiar with digital content from a young age, have recently emerged as a major demographic in consumption (Cho & Kang, 2023). According to a survey on 'Clothing Consumption' targeting teenagers, 91% of teenagers reported that they primarily purchase clothes online (Yang, 2021). However, adolescents often grapple with a lack of comprehension regarding product details (Lim et al, 2023), hindering their ability to ascertain the suitability of clothing items. This predicament frequently leads to dissatisfaction with purchased items and subsequent returns or exchanges. Notably, early male adolescents aged 12 to 14, undergoing rapid and uneven growth during puberty and exhibiting pronounced individual variations (Kim, 2004), are anticipated to experience heightened dissatisfaction with fit when procuring clothing online. Consequently, recent attention has turned towards leveraging virtual models and virtual fitting as potential solutions to these challenges (Kang, 2017). Therefore, this study endeavors to delineate the body shape characteristics of male early adolescents aged 12 to 14, categorize their body types, and furnish foundational data for the development of virtual models tailored to this demographic. The ultimate goal is to mitigate return rates stemming from ill-fitting garments in online shopping malls.

Research Method

Research Subjects: For the investigation of male adolescent body types, males aged 12 to 17 were chosen as the research subjects from the direct measurement data of the 6th Size Korea anthropometric survey. After excluding missing data, the study analyzed anthropometric data for 1,492 male early adolescents and 954 male late adolescents to compare and analyze body shape-specific characteristics.

Analysis Items: Directly measured data essential for understanding male early adolescent body shapes were utilized, with analysis items selected based on previous research (Shin, 2019). The analysis encompassed ten height measurements, fifteen length measurements, twenty circumference measurements, six width measurements, six thickness measurements, and two additional parameters (body weight and BMI), totaling 59 items.

Data Analysis: The data analysis was conducted using SPSS Statistics ver. 28.0. Descriptive statistics and independent samples t-tests were performed to compare the morphological characteristics of early and late adolescents. Factor analysis was conducted to extract the components of early adolescent male body types. Reliability was assessed using Cronbach's α to investigate the internal consistency among items. Cluster analysis was performed with the factors obtained from factor analysis as variables to typify the various forms of body types into several characteristic types, and ANOVA and Duncan tests were conducted to examine the differences in body types and type structure by classified factors.

Development of 3D Virtual Models: To visually compare and analyze the physical characteristics of early adolescent males by type, 3D virtual models were created using the average body measurement values for each type through the Custom Avatar feature of CLO enterprise 7.0. The silhouettes of the virtual models generated automatically by entering height and chest circumference in the avatar editing window were compared with those of the virtual models created for each type.

Results & Discussion

Factor Analysis for Understanding Body Characteristics: Comparing the physical development characteristics of early adolescents with late adolescents, it was found that the height increased by 157mm in the 12-14 age group and by 26mm in the 15-17 age group. Weight increased by 13.4kg in the 12-14 age group and by 4.7kg in the 15-17 age group. Growth rates in chest circumference, waist circumference, and hip circumference were higher in the 12-14 age group compared to the 15-17 age group. Factor analysis to extract the constituent factors of male early adolescent body shapes revealed four factors: Factor 1 related to body volume and horizontal size, Factor 2 related to height and length, Factor 3 related to shoulders, and Factor 4 related to back length, explaining 82.51% of the total variance.

Classification of Body Types and Their Characteristics: Cluster analysis was conducted using the variables obtained from factor analysis to classify and understand the characteristics of male early adolescent body types. As a result, three types of body shapes were identified. Type 1 accounted for 35.3% of the total, characterized by the tallest height and length but the smallest body volume and horizontal size. Type 2, representing 37.4% of the total, showed the smallest body volume and horizontal size but average height and length. Type 3, comprising 27.3% of the total, exhibited average height and length but the largest body volume and horizontal size.

Design and Dimension Comparison of 3D Virtual Models by Type: Designing virtual models by type and comparing them with existing virtual models in the CLO virtual fitting program revealed specific differences. Type 1 had a lower crotch height compared to the designed virtual model. Type 2 showed a lower crotch height and shorter arm length in the existing virtual model, along with smaller upper arm circumference. Type 3 exhibited shorter arm length and smaller upper arm circumference in the existing virtual model.

Conclusion

In conclusion, this study aimed to understand the changes in the body shape of adolescent boys and discuss the necessity of designing virtual models and producing clothing based on these changes. Through the comprehensive analysis of the research findings, it was observed that the size and shape of the adolescent body are influenced by various factors during growth, highlighting the importance of distinguishing body types. Particularly, the design of virtual models based on body types allowed for a visual understanding of each body's characteristics, serving as fundamental data for enhancing online clothing shopping experiences and developing customized products. These results are expected to contribute to providing tailored products for the adolescent market and innovating online shopping experiences by integrating the clothing industry with digital technology.

References

Cho, H. & Kang, W. (2023). The Effects of Consumers' Overall Transaction Competence and Digital Transaction Competence on Adolescents' Consumption Satisfaction, Korea Consumer Agency, 54(2), 63-89. http://dx.doi.org/10.15723/jcps.54.2.202308.63

Kim, D. & Kim, I. (2004). A Study on Sizing System and Growth-allowance Measure for Middle-school Girl's School Uniform According to Their Body Types. Journal of the Korean Society of Clothing and Textiles, 28(11), 1524-1535.

Kang, Y. (2017). An Analysis of Young Girls' Somatotype and the Design for Virtual Fitting Model. Journal of the Korean Society of Clothing and Textiles, 41(6), 1109-1123.
https://doi.org/10.5850/JKSCT.2017.41.6.1109

Lim, E., Park, J., & Oh, S. (2023). Research on Measurement of Levels of Teenager Consumer Competencies. Korea Consumer Agency.
https://www.kca.go.kr/home/sub.do?menukey=6101&mode=view&no=1003528665

Shin, J. (2019). Classification of junior high school boys' body types. Journal of the Korea Fashion & Costume Design Association. 21(3), 13-24. https://doi.org/10.30751/kfcda.21.3.13

Yang, M. (2021, January 19). 청소년 2명 중 1명, 라이브 커머스서 의류 구매 [One out of every two teenagers purchases clothing through live commerce]. Sports Seoul, Retrieved February 13, 2024, from https://www.sportsseoul.com/news/read/1003822

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DEVELOPMENT OF SMART SPORTS SAFETY CLOTHING FOR ADOLESCENTS AND SMART SAFETY WORK CLOTHING FOR ADULTS

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Introduction

The purpose of developing safety clothing is to prevent or reduce safety accidents in road traffic and sports activities so that outdoor activities can be done more safely, especially at night or in bad weather. Therefore, after designing and making sports safety clothing for youth based on international standards (ISO20471, 2013) using high-visibility fluorescent fabric and retroreflective film, introducing of optical fiber and by combining advanced electric·electronic technology and providing smart functions, we developed safety clothing with improved visibility even from a distance by using luminous changes. In addition, people who work exposed to the roadside, such as street cleaners and road maintenance workers, where traffic accidents frequently occur during sunset work, are always exposed to the risk of traffic accidents. Accordingly, this researcher made an outer layer with light green fluorescent fabric and retroreflective film, and made in an inner layer with a black quilted fabric, so that drivers can recognize human body from a distance even without an ambient light source at night. The retroreflective materials were attached on the outer layer to create a top and bottom pair of winter safety work clothes. The research is including to develop and install a smart photonic device and a solar energy harvesting device to ensure that roadside workers wear safety clothing that improves long-distance visibility, especially on the road at night. Thereby the purpose of the research is to reduce a casualty from preventing traffic accidents and protecting people's lives, especially at night/sunset and in bad weather.

Literature Review

Since the international standards for safety clothing (ISO 20471, 2013) have been stipulated, research on the physical properties of light green fluorescent fabric and retroreflective materials was conducted using materials that comply with these standards (Park, 2019), and safety clothing for children, for adolescents, and for adults were made. Accordingly, suitability has been evaluated through wearing experiments (Park et al., 2020). In addition, in previous research, smart safety clothing was developed by applying LEDs (Park & Kim, 2020) and optical fibers (Park et al., 2021). We also developed a smart photonic safety clothing for children by applying optical fibers and by attaching the solar panels (Park et al., 2023). These increased long-distance visibility at night. In this study, we developed optical fiber-emitting high-visibility safety clothing for adolescent's sportswear and smart photonic safety work clothing for adults in the winter to improve visibility at night and at long distances by introducing optical fiber and solar cells.

Research Method

The adult winter work-wear materials are made of light green fluorescent fabric on the top and bottom, the outer layer is 94% polyester + 6% polyurethane, and the lining is quilting fabric, that is, 100% black polyester + lining cotton (high-quality low-denier cotton, and does not bunch up after washing).

An optical fiber was inserted into a transparent tube on the retroreflective film on the safety winter clothing, integrated with piping, and a smart function was given to emit blue light in three types of blinks. The optical fiber manufacturing method was implemented using the latest method to enable side emission by forming grooves in the covering layer of the optical fiber. In other words, the process consists of manufacturing optical fiber piping → lighting work to apply light to the optical fiber → luminous control module, and the control unit includes a power unit, switch, micom, and charging port. A harvesting device is installed here to harvest solar energy. In order to sustain the emission of optical fiber, energy harvesting system is needed a supply system that harvests solar energy by connecting solar cell panels. In order to

sustain the emission of optical fiber, energy harvester has been developed to enable stable operation for long periods of time while being environmentally friendly. I prepared that the voltage of the solar cell module was 5.5V, the current was 180mA, and the panel was small (about 120 x 75 mm) and very light, so it was attached so as not to be a load. This solar cell panel was attached to the top of the back of the safety work-wear to harvest solar energy and convert it into electrical energy.

Results & Discussion

The optical fiber-applied light-emitting safety clothing was designed with three blinking methods to enable blue lighting and blinking speeds of 1 second interval, 0.5 second interval, and continuous light emitting with a single touch of the on/off switch. The light emission control module designed a light emission pattern program and was driven by attaching and connecting a USB to enable use of an auxiliary battery. Continuous light emission was achieved by attaching solar cells for energy harvesting to the upper part of the back of the made safety clothing. It can be seen that electrical energy was being generated as the voltage and outside temperature rise during the time when sunlight is shining from the solar cell. In other words, on a clear day, the voltage of the storage device rose from 2.84V to 3.52V from 8:30 a.m. to 1 hour after solar power was first received, and it took about 4 hours and 30 minutes to reach 4.28V to be fully charged, a relatively slow rate of increase. After this research, energy harvesting methods will be attempted to supply energy through a hybrid energy harvesting method by introducing solar cells and technology that harvests energy obtained from human activities, thereby extending device operation time and enabling stable light emission. We are considering attaching the device in a built-in form so that it can be easily to ensure practicality.

Conclusion

The development of smart photonic safety work-wear for night use with optical fiber applied in this study can improve long-distance visibility in dark places. Energy that is discarded when not used is harvested through solar panels and converted into electrical energy to extend the emitting time of optical fibers, thereby increasing the visibility of the human body on the road, especially at night and from a distance. therefore, we can contribute to prevent traffic accidents as well as safety accidents and reducing other casualties.

References

International Organization for Standardization. (2013). ISO 20471: 2013 *High visibility clothing-Test methods and requirements.* Retrieved from https://www. iso.org/standard/42816.

Park, S. (2019). An evaluation of the suitability of fluorescent fabrics and retroreflective materials for road traffic warning clothing in compliance with international standards. *Fashion & Textiles, 6:34.* https://doi.org./10.1186/s40691-019-0190-4.

Park, S., & Kim, S. (2020). Designing and fabricating of the high-visibility smart safety clothing. *Science of Emotion & Sensibility, 23(*4). 105-116.

Park, S., Tempoya A., & Koshiba, T. (2020). Evaluation on wear sensation of safety clothing for current street cleaner. *Journal of the Korean Society of Clothing and Textiles, 44*(6), 1037-1052.

Park, S., Jeoung, J., & Moon, M. (2021). Development of prototype of the high-visibility smart safety vest applying optical fiber and energy harvesting. *Science of Emotion & Sensibility, 24*(2), 25-38.

Park, S., Ko, D., & Jang, S. (2023). Development and evaluation of children' smart photonic safety clothing. *Korea Society for Emotional and Sensibility, 26*(2), 129-140.

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DEMAND FOR HEALTHCARE SMART SHOES ACCORDING TO DIABETIC SYMPTOMS

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Introduction

Heatwaves and cold waves caused by climate change directly or indirectly cause health damage, and long-term exposure to such extreme temperature environments can cause heat and cold diseases due to poor body temperature control. As such, the environmental climate is affecting human health, and there is a growing demand for individual health monitoring for diabetic patients who have difficulty maintaining body temperature at the ends of the body due to external environmental temperatures. Although the foot only account for 7% of the entire body surface area, they function as an important thermal radiator to thermally regulate the human body (Shimazaki at al., 2016). Shoes are important for foot insulation under cold stress and act as a barrier to heat and moisture transfer between the skin and the external environment (Bushkill at al. 2002). However, in general, aesthetics and comfort are the main factors in shoes design, and the physiological characteristics of wearers are not commonly considered. Therefore, it is meaningful to understand the demand for healthcare smart shoes according to the degree of symptoms of diabetes that require maintaining foot temperature. The results of this study can serve as a database to analyze the primary user characteristics of healthcare smart shoes with foot temperature monitoring and heating functions.

Research Method

[Respondents] We conducted an online survey of 545 adults living in Seoul and Gyeonggi Province (August, 2023): 265 males (age: 43.9 ± 13.5 y, height 173.9 ± 5.6 cm; weight 73.0 ± 10.6 kg) and 280 females (age: 44.6 ± 13.7 y; height 160.3 ± 4.9 cm; weight 56.9 ± 9.4 kg). By age group, 103 respondents in their 20s (20–29 y, 18.9%), 112 in their 30s (30–39 y, 20.6%), and 106 in their 40s (40–49 y, 19.4%). 114 in their 50s (50–59 y, 20.9%) and 110 in their 60s (60–69 y, 20.2%) were distributed equally among all ages. Among them, 33.2% (n = 181) of all respondents said they had diabetes symptoms.

[Questionnaire] The questionnaire was self-developed with a final 21 questions based on items reported to have high internal consistency in existing survey studies. The main variables of this study were demographic characteristics (Q1-6), personal health (Q7-14), technical acceptance (Q15-20) and purchase decision for smart shoes (Q21). Recognition and demand questions for smart shoes were selected in a study of previous studies related to smart clothing, and questions related to the technology acceptance and purchase intention questions based on Davis' (1989) theory.

Results & Discussion

[Diabetic symptoms] To the question of 'Do you have diabetes?' (Q14), they answered 'yes' 33.2%', 'No' 66.8%. The rate was higher for males than for females (diabetic: male: 22.7%, female: 9.7%, t = 4.894, *P* < 0.001), and increased with age. In response to the question of foot coldness during outdoor activities in winter, 18.8% said 'very agree' and 37.6% 'agree', 52.7% of respondents without diabetes felt foot cold in winter (Q8). Also, in the case of summer (Q11), 34.6% felt their feet were hot during outdoor activities in summer. Meanwhile, 50.8% of the respondents who had diabetics answered 'very agree' or 'agree', they felt foot cold during outdoor activities in winter. In summer, response to 'very agree'(8.3%), 'agree'(47.0%), a total of 55.3% responded that they felt their feet were hot. Therefore, respondents with diabetes had a relatively higher rate of cold feet in winter and hot feet in summer during outdoor activities than those without diabetes. In can be inferred that when there are symptoms of diabetes, the range of change in foot temperature depending on the external environmental temperature is greater. Among the 545 respondents, 11.2% of those who responded that they had no symptoms of diabetes experienced foot frostbite (Q9) in winter without any sex-related difference. On the other hands, 19.9% of respondents who

responded that they had diabetes symptoms experienced frostbite during winter, and there was no difference between male and female. Concerning sweat rate form the feet during summer, 7.1% felt that they sweat a lot. However, 39.2% of respondents with diabetes symptoms responded that their feet sweat a lot in the summer. Although relatively few diabetics were found among the respondents, the more responded with severe diabetes symptoms, the more they perceived themselves as unhealthy ($r = -0.142$, $P < 0.01$), experienced foot frostbite during outdoor activities in winter ($r = 0.103$, $P < 0.05$), felt hot feet in summer ($r = 0.147$, $P < 0.001$), and tended to sweat a lot ($r = 0.170$, $P < 0.001$).

[Demands for smart shoes] To the question 'Would you be interested in purchasing the following elements if you had a healthcare smart shoes?' (Q15-20), there were no differences between groups according to the presence or absence of diabetes symptoms in design for aesthetics, ease of use, content, price, and aesthetic improvement of appearance. However, functionality was answered as more necessary in the group with diabetes symptoms ($t = 1.171$, $P < 0.05$). On the other hands, 47.5% of respondents without diabetes symptoms answered 'agree', 65.2% of respondents with diabetes symptoms answered 'agree' to the question 'Is temperature monitoring and heating function of feet in summer and winter necessary' (Q21). There was a demand for foot temperature monitoring and warming healthcare smart shoes regardless of the presence or absence of diabetes symptoms. Finally, respondents with diabetes symptoms, during the outdoor activities in winter, the even colder feet felt ($r = 0.095$, $P < 0.05$), especially the more you respond to the experience of frostbite ($r = 0.102$, $P < 0.05$), the higher the need for healthcare smart shoes.

Conclusion

Diabetes's typical symptoms of the 'diabetic foot ulcer' are known to be insensitive to the sense of the foot, making it difficult to manage and maintain the foot temperature in the extreme external environment. In the results of this study, in case of diabetes symptoms, it was easy to get frostbite because it was difficult to maintain the foot temperature when exposed to a low-temperature environment. In addition, foot care was required due to increased foot temperature and humidity due to sweat even in hot environments in summer. Therefore, it was confirmed that healthcare smart shoes with foot temperature monitoring and heating functions were necessary to prevent and treat foot-related diseases, which are representative symptoms of diabetes.

References

Boulton, A.J.M., Scarpello, J.H.B., Ward, J.D. (1982). Venous oxygenation in the diabetic neuropathic foot: Evidence for atteriovenous shuting?. *Diabetelogia*, 22, 6-8.

Devies C. (1979). Thermoregulation during exercise in relation to sex and age. *Eur J Appl Physiol* 42, 71-79.Shimazaki, Y., Matsutani, T., & Satsumoto, Y. (2016). Evaluation of thermal formation and air ventilation inside footwear during gait: The role of gait and fitting, *Appl. Ergon.*, 55, 234-240.

Shimazaki, Y., Matsutani, T., & Satsumoto, Y. (2016). Evaluation of thermal formation and air ventilation inside footwear during gait: The role of gait and fitting, *Appl. Ergon.*, 55, 234-240.

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A STUDY ON ANALYSIS OF ELECTRODE PAD AND WEARING EVALUATION OF COMMERCIALLY AVAILABLE EMS SMART CLOTHING

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Introduction

In the fitness industry, smart healthcare products are being researched that can provide electrical muscle stimulation (EMS) to muscles to perform low-intensity exercises in a short period of time (Kemmler et al., 2012). A widely used small EMS device consists of a hydrogel pad and device. Hydrogel pads are highly adhesive, keeping the pad in place on the skin surface, but they are not elastic, which can cause the pad to be detached with movement. In addition, it is difficult to use for long periods of time due to degradation by soiling and drying, and different textures from textiles may negatively affect wearing comfort (Yeun & Kim, 2021). Particularly, the devices need to be attached to the target muscles individually, causing disadvantages. Recently, EMS clothing developed to provide simultaneous electrical stimulation to the whole body include dry electrodes based on textile or silicone pads to improve the limitations of gel electrodes. In this study, comfort and usability evaluation results of EMS electrode pads were analyzed according to size, location, and material.

Literature Review

1. EMS. Electrical Muscle Stimulation

Electrical muscle stimulation (EMS) is a stimulation therapy that uses artificially high electrical currents to induce muscle contraction, typically utilizing low frequencies in the 7-100 Hz band. Repetitive electrical stimulation of skeletal muscles improves blood flow to muscle fibers, increases capillaries, increases strength of skeletal muscles, and improves the function of damaged nerves, thereby using EMS as a rehabilitation or training tool(Seyri & Maffiuletti, 2011; Kemmler et al., 2016). EMS training recently increased focus as an exercise program that enables physical strength improvement through low-intensity exercise in a short period of time. It is possible to maximize the exercise effect by adjusting the intensity according to the individual and muscle(Kemmler et al., 2013).

2. Electrode pad of EMS smart clothing

EMS smart clothing consists of electrode pads and wiring embedded in compression wear. An analysis of EMS smart clothing within the last five years shows that EMS electrode pads typically use silver-coated fabrics or conductive knitted fabrics, and it is generally recommended to wet the pads with water to increase electrical conductivity. Although a few products use sticky silicone pads, which can be used without water due to higher adhesion to the body, the stickiness can cause discomfort or skin rashes.

Research Method

1. Analysis of electrode pad embedded in EMS smart clothing

In this study, the properties of EMS electrode pads were analyzed for three types (M, W, and R) of the most recent EMS smart clothing commercial products with textile electrode. The thickness, weight, morphology, components, electrical properties, etc. of the EMS electrode pads were analyzed.

2. Wearing comfort evaluation
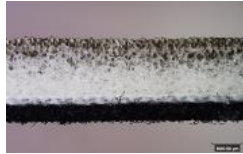
The wear evaluation was conducted by wearing the EMS smart clothing and evaluating its comfort and usability. Participants with musculoskeletal disorders and those with implanted devices such as pacemakers were excluded from the study (KITECH IRB: A-2023-003). The evaluation were conducted on 10 participants (height = 177.9 cm, weight = 79.7 kg) and all rated on a 5-point scale, with higher scores indicating higher satisfaction.

Results & Discussion

1. Analysis of EMS electrode pads

As a result of the morphology analysis, the electrodes of all three products are knitted with conductive yarn, and the surface of R is designed with a loop pile structure unlike M and W, which may affect the comfort evaluation of the electrode part when contact(Table 1). The electrodes of M and W are composed of foam with a conductive knitted fabric, and the M product is the thickest at 8.96 mm, which is expected to have high adhesion between the EMS electrode and the skin surface. Product W has a silicone-based rubber layer added to the surface of the electrode according to EDS analysis, so the adhesion between the electrode and the skin surface is expected to be higher than the other two products. Accordingly, it is expected to minimize shifting of the electrode position due to movement.

Table 1. 3D microscopy images of electrode pad of EMS commercial products

Sample code	× 35		
	Surface	Back	Cross-section
M			
W			
R			

2. Wear evaluation

The participants evaluated the comfort and usability of each product after wearing it and using the EMS mode for 20 minutes. As a result of the comfort evaluation, R was rated the highest for sweat absorption with an average score of 4.6, while W with the rubberized layer was rated the lowest with a score of 4.1. The texture of the electrode pads and their adhesion to the skin were rated highly for all three products. The location and size of the electrode pads were highly satisfactory for all three commercial products, with an average score of over 4.5. Usability evaluation for EMS training showed the R product to be the best.

Conclusion

This research aimed to analyze the impact of the material and size of EMS electrode pads on the comfort and usability of EMS commercial products. As a result of the wear evaluation according to EMS electrode pads, there was no statistically significant difference between the products, but for comfort, satisfaction was higher for products with EMS pad materials that can absorb sweat well. For usability, the thickness and size of the EMS pads affected satisfaction, and when the electrode pads were fully adhered to the skin surface, electrical stimulation was evaluated as effective. Further research on clothing pressure measurement and EMS usability evaluation through more subjects is expected to provide a basis for the design of EMS smart clothing.

References

Kemmler, W., Stengel, S. V., Schwarz, J., & Mayhew, J. L.(2012). Effect of whole-body electromyostimulation on energy expenditure during exercise. Journal of Strength & Conditioning Research, 26(1), 240-245.

Kemmler, W. & Stengel, S. V.(2013). Wholebody electromyostimulation as a means to impact muscle mass and abdominal body fat in lean, sedentary, older female adults: subanalysis of the TEST-Ⅲ trial. clinical interventions in aging, 8, 1353-1364.

Kemmler, W., Teschler, M., Weißenfels, A., Bebenek, M., Frohlich, M., Kohl, M., & von Stengel, S. (2016). Effects of whole-body electromyostimulation versus high-intensity resistance exercise on body composition and strength: a randomized controlled study. Evidence-Based Complementary and Alternative Medicine, 2016. http://dx.doi.org/10.1155/2016/9236809

Seyri, K. M., & Maffiuletti, N. A. (2011). Effect of electromyostimulation training on muscle strength and sports performance. Strength & Conditioning Journal, 33(1), 70-75.

Yeun, E., & Kim, J. (2021). A study on the high sensitivity electrical muscle stimulation (EMS) pad using E-Textile. Science of Emotion and Sensibility, 24(3). 81-90.

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EVALUATION OF 3D PRINTED WRIST BRACE BY MEASURING WRIST BENDING ANGLE AND CLOTHING PRESSURE

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Introduction

Carpal tunnel syndrome (CTS) is one of the most common neuropathies caused by compression of the median nerve at the wrist (De Angelis et al., 2006). It frequently appears on people who are involved in computer due to overuse of wrists. It is important to recognize and treat carpal tunnel syndrome at an early stage since it can lead to complications and musculoskeletal disorders (Seo et al., 2019). Therefore, wrist braces are often worn to prevent carpal tunnel syndrome or to relieve pain. Wearing a wrist brace can help prevent carpal tunnel syndrome because it minimizes the movement of the wrist and requires one to keep one's wrist in an unbent position. Therefore, there is a lot of research to develop different types of wrist braces. However, most of the research is on product development, and there is a lack of research on verifying the effectiveness of wrist braces. This study was aimed to verify the functionality and effectiveness of a 3D printed wrist brace by measuring the maximum angles of wrist bending and pressure of the wrist while wearing a 3D printed wrist brace developed in a previous study.

Literature Review

Recently, a variety of 3D printed wrist braces have been developed and evaluated. Both development of a wrist brace using a 3D scanner and 3D printer by Koo (2017) and analysis of the usefulness of a customized wrist brace made through 3D printing by Choi et al. (2018) validated the effectiveness of the wrist braces through subjective comfort evaluation. Additionally, Lee et al. (2020) evaluated the mechanical performance of 3D printed hand orthoses and assessed their validity through dimensional comparison, using a universal material testing machine to evaluate the yield load and stiffness of the 3D printed hand orthoses.

Research Method

Wrist bending angle measurements and clothing pressure measurements were conducted on 9 subjects with an average women hand size of 20s and 30s in Size Korea. Three variables were set for the wrist bending angle measurement: no wrist brace, a commercially available product (aluminum splint wrist brace), and a 3D printed wrist brace. The 3D printed wrist brace used at this time was developed directly from previous research to prevent and alleviate carpal tunnel syndrome. For the clothing pressure measurements, the pressure was measured while subjects were wearing the 3D printed wrist brace and a commercially available product (aluminum splint wrist brace). The experiment measured the maximum angle and clothing pressure in each subject's wrist flexion, extension, ulnar deviation, and radial deviation states. The clothing pressure measurement compared the pressure at the maximum angle of wrist bending (flexion, extension) by variable, and the measurement location (3 points on the wrist) is as shown in <Fig. 1>. Clothing pressure was measured three times for 1 minute at each measurement location and the average value was derived. The clothing pressure measurement equipment used was a Clothing Pressure Measurement System (MASTER UNIT AMI 3037-2, Technox, Inc., Korea) and an air pack sensor.
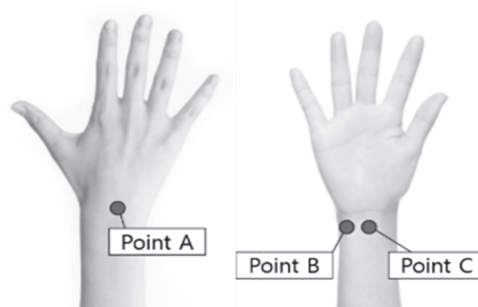
Fig.1. Clothing pressure measurement locations

Results & Discussion

The results of measuring the maximum angles of wrist bending were as follows: in the flexion without wearing a wrist brace, maximum angle was measured to be 86.7°, while wearing the aluminum splint wrist brace showed 55.0°, and wearing a 3D printed wrist brace showed 38.3°. In the extension state, without wearing a wrist brace, the maximum angle was measured to be 65.0°, while wearing the aluminum splint wrist brace showed 51.0°, and wearing a 3D printed wrist brace showed 43.3°. In the ulnar deviation without wearing a wrist brace, the maximum angle was measured to be 23.3°, while wearing the aluminum splint wrist brace showed 18.3°, and wearing a 3D printed wrist brace showed 8.3°. In the radial deviation without wearing a wrist brace, the maximum angle was measured to be 35.0°, while wearing the aluminum splint wrist brace showed 26.7°, and wearing a 3D printed wrist brace showed 20.0°. In all positions, wearing a wrist brace resulted in smaller maximum angles compared to not wearing one, with the 3D printed wrist brace showing the lowest values, particularly. Regarding the clothing pressure measurements, in the flexion, at measurement point A, the pressure of the 3D printed wrist brace was 3.36 kPa, while the pressure of the aluminum splint wrist brace was 5.75 kPa. In the extension, at measurement point C, the pressure of the 3D printed wrist brace was 3.22 kPa, while the pressure of the aluminum splint wrist brace was 4.96 kPa. In all positions, the pressure exerted by the 3D printed wrist brace was lower than that of the aluminum splint wrist brace.

Conclusion

In this study, the maximum angles of wrist bending and pressure was measured aimed to objectively verify the wrist support of the 3D printed wrist brace. Results showed that wearing the 3D printed wrist brace not only reduced the range of motion of the wrist but also maintained pressure within 4 kPa at all measurement points, indicating that it did not exert excessive pressure on the wrist. The threshold of 4 kPa is known to be the minimum pressure that can cause impairment of nerve blood flow (Kim, 2008), suggesting that the 3D printed wrist brace prevents excessive pressure even when the wrist is bent. This reflects that the 3D printed wrist brace not only helps maintain correct posture during computer work but also prevents excessive movement and pressure on the wrist, thus expected to be effective in preventing and alleviating carpal tunnel syndrome. In this study, experiments were conducted on the general public. If additional experiments are conducted on patients suffering from carpal tunnel syndrome in the future, the effectiveness of the 3D printed wrist brace will be medically verified.

References

Choi, W. S., Jang, W. H., & Kim, J. B. (2018). A Pilot study for Usefulness of Customized Wrist Splint By Thermoforming Manufacture Method Using 3D printing: Focusing on Comparative Study with 3D scanning Manufacture Method. *Journal of Rehabilitation Welfare Engineering & Assistive Technology, 12*(2), 149-158.

De Angelis, R., Salaffi, F., Filippucci, E., & Grassi, W. (2006). Carpal tunnel syndrome treatment. *Reumatismo, 58*(1), 5-10.

Kim, D.-H. (2008). Carpal Tunnel Syndrome: Open Carpal Tunnel Release. *Korean Journal of Neurotrauma, 4*(1), 1-7.

Koo, D. S., & Lee, J. R. (2017). The Development of a Wrist Brace using 3D Scanner and 3D Printer. *Journal of The Society of Fashion & Textile Industry, 19*(3), 312-319

Lee, J. M., Jeong, J., Seo, W. S., Heo, G. Y., Kim, D. A., & Jun, S. C. (2020, September 14-16). *Analysis of Dimension Measurement and Mechanical Test on the 3D Printed Hand and Wrist Orthotics* [Conference session]. KSPE 2020 conference, Korea. https://www.kspe.or.kr/data2/KSPE2020f_02.pdf

Seo, J.-Y., Hwang, W.-J., Noh, Y.-H., Nam, H. S., & Jeong, D.-U. (2019). Implementation of the carpal Tunnel Syndrome Preventive System based on Wrist Motion Recognition. *Journal of The Institute of Electronics and Information Engineers, 56*(12), 75-82.

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A STUDY OF THE STATUS AND REVIEW OF AI CHATBOT SERVICES IN FASHION ACCESSORY BRANDS

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Introduction

It is known that AI chatbot services are widely used in the fashion industry, especially the jewelry sector. Investigating AI chatbot services by fashion accessory item would allow us to better understand the status of AI chatbot services in the fashion industry. Therefore, this study analyzes the status of AI chatbot services introduced by fashion accessory brands to their online shopping malls and classifies the types of the chatbots. By doing so, this study would hopefully serve as a reference for future research.

Literature Review

Chatbot, which stands for chatter robot, refers to a computer program or artificial intelligence (AI) with the ability to engage in conversations via text or voice. Lately, AI chatbots have been introduced increasingly quickly across all industries, and many fashion brands adopt AI chatbot services to facilitate customer services. Considering the expected expansion of AI chatbot services in the fashion industry in the future, it would be necessary to identify the current status and discuss directions for the future.

Research Method

First, we examined the ratio of general chatbot services to AI chatbot services and service platforms by fashion accessory brand. We examined the chatbot services of fashion accessory brands available on their official websites, including hat, jewelry, and shoe brands, in Musinsa, the largest online store in Korea. We chose the brands available in Musinsa as the sample for this study, because Musinsa only includes the brands that sell and handle authentic products made by themselves, and sets strict inclusion criteria for sales and after-sales management, such as delivery, customer service, and product registration. For the analysis, we defined an AI chatbot as an AI-based chatbot service which provides chat services to customers outside the business hours of 9:00 to 18:00. We investigated service platforms by checking information listed under the chatbot chat pop-up. Second, we examined the types of AI chatbots by fashion accessory brand. After chatting with AI chatbots, we used the classification tool for the types of AI chatbots (Yoo & Lee, 2019) to identify their types. While chatting with AI chatbots, we asked functional questions, such as greetings, product recommendations, refund questions, or inventory questions, and attempted other daily conversations. Third, we discussed directions for the development of AI chatbot services in fashion accessory brands based on the results.

Results & Discussion

As of January 18, 2024, we collected the sample of 805 brands in total, including 80 hat brands, 378 jewelry brands, and 347 shoe brands, available in Musinsa, and we obtained the following results. First, 322 brands offered chatbot services, which accounted for 40% of the total. Eleven out of the 322 brands provided AI chatbot services, accounting for 1.4% of the total and 3.4% of the brands offering chatbot services. Six (7.5%) of the hat brands provided chatbot services on their official websites, and all of them used the platform of KakaoTalk Plus Friends to provide the services. None of the brands, however, provided AI chatbot services. Instead, they only provided connections to customer service representatives or buttons. Additionally, 146 (37.8%) of the jewelry brands offered chatbot services, with 3 brands providing AI chatbot services. The chatbots of the jewelry brands often used KakaoTalk Plus Friends and Channel Talk simultaneously, and the AI chatbot services were provided via KakaoTalk Plus Friends. Forty-five (13%) of the shoe brands provided chatbot services on their official websites, and many of them used Channel Talk and KakaoTalk Plus Friends at the same time, while others used HappyTalk or the chatbots they developed themselves. Eight brands provided AI chatbot services, and all of them were

offered via KakaoTalk Plus Friends. Second, except for those that were hardly considered AI chatbots, 2 out of 3 AI chatbots of the jewelry brands were classified into a task chatbot, which provides answers focused on information needed by the user, and a responsive chatbot, which provides answers based on simple algorithms tailored to the individual user's questions, and were confirmed as T1D3. Furthermore, 3 out of 8 AI chatbots of the shoe brands were identified as T1D3. Third, although there were many news reports about introducing chatbot services in the fashion accessory industry, we found very few AI chatbot cases in which AI chatbots could be used in practice. Overall, chatbot services often failed to recognize keywords and give answers out of context, or failed to move onto the next step even if they recognized keywords. Therefore, it is necessary to prioritize providing the correct answers that the user wants functionally. In addition, it would be important to prepare response scenarios customized to the characteristics of different chatbot users, and train the scenarios to chatbots to provide answers more proactively.

Conclusion

Overall, we found that 40.0% of the fashion accessory brands offered chatbot services. However, only 3.4% provided AI chatbot services mostly by using KakaoTalk Plus Friends. Furthermore, the type of AI chatbot was T1D3 (which provides answers based on the user's question and performs a specific function that the user wants). A lot of improvement needed to be made for AI chatbot services currently used by fashion accessory brands. A follow-up study should consider how to improve natural language processing both qualitatively and quantitatively to develop AI chatbot services in the fashion accessory sector, which sees growing online consumption.

References

Yoo, Hanna., & Lee, Jihyun (2019). A study on the development of interaction design framework based on personality of customized chatbot design. *Journal of Integrated Design Research*, *18*(1), 79-94.

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DEVELOPMENT OF THE BODY TYPE MATRIX FOR OPTIMIZED MASS CUSTOMIZATION OF APPAREL PRODUCTION FOR VARIOUS BODY SHAPES

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Introduction

With the trend on digital technology and consumer-centered automated production processes, the clothing manufacturing industry is also attempting to establish customer-centric automated garment manufacturing systems (MTM systems) based on big data, and utilizing technologies such as smart factories (Gartner, 2019, Song, E. Y., 2021). The prerequisite for developing MTM system is to classify human body data that cause differences in fitting of clothes during the clothing development process. Since structural problems with clothing occur depending on the wearer's body shape and posture factors (Müller & Sohn, 2019), it is necessary to classify and standardize not only the size factor but also the body shape and posture factor of the human body in classifying body data. Therefore, an effective integrated classification model is needed that can accommodate a variety of body types and intuitively apply them to master pattern design to correct the appearance of body types.

Literature Review

There has been research to categorize body types for applying to patterns as some part of the body, and the pattern development system by flattening the body surface by customization (Huang, et al., 2012, Yunchu, & Weiyan, 2007). However there is a limitation that does not reflect structural parts or postures, so a pattern correction algorithm that integrates all body types is needed. Furthermore, the Size Korea project is collecting 3D body data of Korean people every five years. Therefore, it is necessary to support clothing manufacturing industry that require digital fashion platform design by establishing a clothing manufacturing data platform using big data of Korean three-dimensional human body shapes accumulated through the Korean Human Body Measurement Survey (The Size Korea) project (Park et al., 2018). Therefore, this study aims to develop an integrated body classification method and the body type matrix that is suitable for various existing body types for applying them to clothing patterns.

Research Method

Due to the need for clear distinctions and criteria for body shape and posture factors in classifying anthropometric data, factors (11 measurements, 20 calculated measurements) have extracted that influence clothing fit for integrating body types using SPSS 26.0. In this study, 716 Korean men aged 20 to 69, whose direct measurements of chest circumference matched the 3D measurements in the 8th Size Korea dataset, were used as subjects. Based on KS standards and previous research, each factor was examined to apply existing classification methods. For factors without existing classification methods or lacking quantification, new criteria were established through cluster analysis to select a method for segmenting body types by body parts for the integrated model for final classification method and the body type matrix.

Results & Discussion

[Extraction of Factors for Integrated Body Type] In order to establish a made-to-measure (MTM) system aiming for sustainable industrialization, we analyzed and extracted the key factors that directly influence the fit of clothes. By consolidating and adding important factors that were previously scattered in previous studies, we derived eight factors (Proportion, Drop, Scapular slope, Lumbar slope, Shoulder tilt, Shoulder shape, Abdominal protrusion, Hip protrusion) for body part-based type determination in developing pattern

correction algorithms for various body types. These factors accounted for a cumulative contribution rate of 83.1%.

[Construction of Integrated Body Classification Model] Through the analysis of important factors from both the perspective of human classification and garment design, as well as discussions on the feasibility of industrialization, an intuitive classification model that can classify body types for each body part was established and integrated. The factors of Proportion (height) and Drop (chest circumference - waist circumference) were classified according to the widely used KS standard (KS K 0050) for MTM application. For the intuitive typification of Scapular slope, Lumbar slope, Shoulder tilt, Shoulder shape, Abdominal protrusion, and Hip protrusion, which showed significant relevance with angles in previous studies, an additional extraction of relevant angle factors with high explanatory power was conducted using 126 subjects within the most frequent range of chest circumference (98.5~ 101.4 cm). Factor analysis was performed, resulting in the extraction of six factors (Scapular slope, Lumbar slope, Shoulder slope, Shoulder shape, Abdominal protrusion, Hip protrusion) with a cumulative contribution rate of 92.1% based on the final 15 angle items. Cluster analysis was conducted using the extracted angle factors with high explanatory power to determine the final classification criteria for each body part. Through this body classification model, it is possible to quantitatively and intuitively classify body shapes for each body part, objectively addressing the reliability issues of low agreement rates in expert visual evaluations that were caused by subjective body typing.

[Construction of Virtual Body Type Matrix for Korean men] Through the developed integrated body classification model, utilizing measurement data of 8th Size Korea and 3D body shapes, a virtual body typing library for Korean men was constructed by classifying and analyzing 716 individuals. The introduction of the integrated body typing method was aimed at improving fit suitability. Additionally, an individual body barcode system was implemented to independently apply body types to each body part, enabling the development and adjustment of clothing patterns specific to body types. This system allows for direct application and partial extraction depending on the target group.

Conclusion

By applying the Size Korea anthropometric data, conducted every five years, to the developed Virtual Human Body Matrix, it would be possible to establish an effective big data system. This would enhance the utilization scope of national data and enable the continuous utilization of accumulated data. Furthermore, in the development of industrial or research-oriented clothes, by extracting the desired clusters of body types and setting the range of target users, customized parametric patterns can be generated. Although there are limitations that require further research on the female body type, and it should ensure that the developed classification method shows consistent results in the actual fit of wearing, it is expected that the system can be flexibly utilized for various purposes and targets when the overall matrix is established in the future.

References

Gartner. (2019). Top 10 Strategic Technology Trends for Manufacturing Industries: Smart Factory. https://www.gartner.com/en/documents/3906991

Huang, H. Q., Mok, P. Y., Kwok, Y. L., & Au, J. S. (2012). Block pattern generation: From parameterizing human bodies to fit feature-aligned and flattenable 3D garments. *Computers in Industry*, *63*(7), 680-691.

Kim, H. S., Choi, H. E., Park, C. K., & Nam, Y. J. (2019). Standardization of the size and shape of virtual human body for apparel products. *Fashion and Textiles*, *6*(1), 33.

M. Müller & Sohn. (2019). *FUNDAMENTALS MENSWEAR*. 88-91.

Park, J., Park, M., Kim, S., & Song, Y. (2018). A Study on the Design of Digital Fashion Platform Prototype Based on 3D Digital Technology. *Fashion Business*, 22(2), 88-106.

Song, E. Y. (2021). A study on the perception of fashion platforms and fashion smart factories using big data analysis. *Fashion & Textile Research Journal*, 23(6), 799-809.

Yunchu, Y., & Weiyuan, Z. (2007). Prototype garment pattern flattening based on individual 3D virtual dummy. *International Journal of Clothing Science and Technology*, *19*(5), 334-348.

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DOMESTIC RESEARCH TREND ANALYSIS FOR ESTABLISHING A CLOTHING WEAR TEST EVALUATION SYSTEM APPLICABLE TO THE DIGITAL TWIN ENVIRONMENT -FOCUSING ON QUANTITATIVE FIT EVALUATION–

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Introduction

The rapid advancement of digital technology is impacting overall global industry and changing the lifestyles of individuals. The emergence and development of the 'Digital Twin' environment, which breaks down the boundaries between reality and digital space, is a representative example (Kang & Kim, 2018). This digital twin environment has been diversely established in the clothing industry, leading to extensive attempts across the entire industry. The development and progress of virtual fitting systems, such as 3D CLO, Optitex, and Browzwear, have a substantial impact on the industry by efficiently reducing costs and time, not only in the phases of clothing development and design but also in the subsequent production and distribution processes. In addition, the introduction of virtual fitting systems for clothing wear tests has proposed methodological approaches based on digital data which can measure various evaluation elements of garment fit in objective and quantitative way (Park, 2022; Lee & Lee, 2023). Despite the introduction of virtual fitting systems, the establishment of systematic and objective quantitative evaluation criteria for the fit of clothing remains inadequate. Therefore, this study aims to provide foundational data for establishing quantitative fit evaluation criteria by collecting and analyzing previous research papers in the field of clothing wear test evaluation.

Research Method

In this study, a survey of previous researches conducted from September 1, 2023, to September 5, 2023, was carried out by searching the Korea Citation Index for keywords such as 'wear test evaluation', 'virtual fitting', 'fit evaluation', 'quantitative evaluation', 'shape fitness, and 'motion suitability'. A total of 35 relevant previous studies, published as regular papers in academic journals or presented at academic conferences within the last 10 years, were identified and analyzed based on the alignment with the subject of this study. The analysis included the evaluation content, evaluation criteria, fitting methods, and the quantification methodologies for evaluation data. To align with the objectives and scope of this research, studies that conducted 'functional assessment' and 'design assessment' based on physiological or subjective aesthetic grounds were excluded from the final analysis. The elements of fit evaluation used in this study are based on the classification of qualitative and quantitative evaluations in a previous study (Kim & Nam, 2012).

Results & Discussion

Researches on clothing wear test evaluation can be broadly categorized into studies that evaluated either shape fitness or motion suitability and studies that conducted evaluations for both. Studies evaluating shape fitness (15 studies) and those evaluating both shape and motion suitability (15 studies) accounted for approximately 43% each of the total studies. However, excluding three studies that focused only on evaluating shape fitness to verify the similarity between virtual and real try-on fitting, studies evaluating both shape and motion suitability (15 studies, 46.9%) were the most prevalent for assessing quantitative fit. Evaluation criteria for shape fitness included 'ease', 'position & angle of reference lines', 'length & area of cross-section', 'silhouette', 'appearance', 'wrinkles & drag', and 'balance'. In motion suitability evaluation, criteria included 'ease of movement', 'tension', 'clothing pressure', 'air-gap', 'fabric strain' and 'hiking-up or drooping at hemline'. Despite using the same terminology, challenges in research emerge due to lack of

clarity in the definitions of concepts or differences of evaluation criteria and methods. This fact has the potential to restrict the broad use of the collected data. Therefore, there is a necessity for standardized criteria that can enhance the quantification and utility of objective data acquired through clothing wear test evaluation.

Regarding the method of wear for quantitative fit evaluation, there were three approaches: real try-on, virtual fitting, and a hybrid method (actual + virtual). Studies were predominant which singly used the real try-on method (14 studies, 40%). However, the proportion of studies utilizing virtual fitting or the hybrid method were approximately 60% of the total, indicating that research using virtual fitting surpassed that using real try-on only. Among these studies evaluating shape fitness, those were using virtual fitting more than half; however, in studies evaluating motion suitability, the frequency of using virtual fitting was only 20%. This result suggests that assessing motion suitability requires subjective judgments based on the wearer's perceptions and psychophysics considerations, and there is a gap between virtual and real environments, making it challenging to embody complex wearing condition and situations realistically.

For quantitative fit evaluation, surveys using the Likert scale for subjective evaluation were more prevalent (22 studies, 62.8%) than studies using observed objective numerical data for quantitative evaluation (13 studies, 37.1%). Despite the limited use of virtual fitting methods mainly as tools for facilitating subjective assessments, it is remarkable that approximately 75% of the studies (13 studies) using the approach of utilizing observed objective numerical data for quantitative evaluation utilized virtual fitting. These studies analyzed elements of fitness such as air-gaps/volume, garment pressure, fabric strain during wear, and changes in the position and angles of reference lines on garment, suggesting that virtual fitting methods are advantageous for obtaining more objective and quantitative data compared to real try-on methods. Using virtual fitting, which allows for maintaining consistent fitting conditions, can reduce errors that occur during real try-on fitting. Additionally, virtual fitting enables the measurement and analysis of factors that are difficult to assess directly during real try-ons, such as air gaps or fabric strain, making it advantageous for quantitative evaluation and obtaining objective data.

Conclusion

In this study, we investigated the usage of quantitative fit evaluation and virtual fitting methods through an analysis of previous research papers on clothing wear test evaluations. As a result, we found that while there are key evaluation items commonly addressed in quantitative fit evaluations, such as evaluated elements, terminologies, and methods varied across studies, highlighting the necessity of establishing systematic and objective fit evaluation criteria for quantitative fit evaluation. It was confirmed that evaluation criteria and methods should be applied according to the evaluation content, emphasizing the importance of setting systematic and objective fit evaluation criteria and applying evaluation items and methods accordingly for quantitative fit evaluation. Furthermore, if the evaluation criteria were consistently employed to obtain and analyze objective data aligning with quantitative clothing fit evaluation, implementing subjective assessments from wearers and evaluators, there is vast potential for the versatile application and utilization of virtual fitting technology in facilitating and enhancing quantified evaluation of fit.

References

Kang, H. E., & Kim. H. W. (2018). Manufacturing Industry-Based Digital Twin: Technological Elements and Trends. *Information and communications magazine*, *35*(8), 24-28.

Park, G. N. (2020). The Evaluation of the Work Motion Suitability of Men's Coverall Type Painting Work Clothes Using 3D Virtual Clothing Simulation. *Journal of Fashion Business, 24*(4), 63-84.

Lee, O. K., & Lee, H. R. (2023). Evaluation of Protective Clothing Using 3D Virtual Fitting. *The Korean Society of Dyers and Finishers, 35*(2), 107-120

Kim, S. Y., & Nam, Y. J. (2012). A Study on Establishing of Fit Test Conditions for Slacks. *The Korean Fashion and Textile Research Journal*, *14*(3), 454-464.

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EVALUATION OF WEAR COMFORT OF SPINAL SUPPORTS DEPENDING ON TYPES OF 3D PRINT MATERIAL

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Introduction

Recently, the number of people experiencing low back pain has increased due to a long drive or a computer work. Keeping proper posture is especially crucial since repetitive incorrect posture can strain the spine, joints, and muscles, potentially leading to degenerative changes like spinal arthritis (Sin, 2009). Proper posture involves aligning the head, neck, and waist straightly, with the ears and shoulders on the same side of the line (Moon & Park, 2010). Various products like posture correction bands or lumbar support aids have been developed to help keep proper posture; however, precedent products often considered to be inconvenient because they not only immobilize and compress wearer's shoulders and waist in order to support the spine, but also separated into two parts, making the wearer to put them on separately. Previous studies have developed the compression wear that includes spinal support to let wearer keep proper posture. However, due to the thin thickness of compression wear, wearers might experience discomfort from the spinal support. Therefore, this study is aimed to minimize the discomfort of the spinal support by developing the auxiliary support using flexible materials and to evaluate comfortability by measuring breathability of support and satisfaction of users depends on the 3D printing material.

Literature Review

Recently, various spine correction products have been developed using 3D printing technology. Park (2022) developed a lumbar support brace for obese women using a 3D scanner and 3D printer and conducted a survey evaluation of its appearance and functionality. Jo (2017) developed a 3D printed spine correction chair that is designed to fit the spine's shape and correct scoliosis or prevent spinal diseases. Additionally, Redaelli et al. (2020) applied 3D printing technology in developing a scoliosis correction device and evaluated its mechanical characteristics.

Research Method

In this research, the spinal support was modeled by making holes on the precedent spinal support with consideration of body structure in order to minimize the uncomfortableness. Geomagic Design X software (3D Systems, Inc., Korea) was used for design. The support was printed through Single Plus-320C printer (Cubicon, Inc., Korea) with TPU filament, and through Formlabs Form 3+ printer (Formlabs, Inc., USA) with Flexible 80A filament. The variables were set to be thickness of 2 mm and 3 mm, and presence of the holes. At this time, the thickness was set to the optimal thickness of 2 mm and 3 mm according to previous research. The subjects were 7 men with an average body size in their 20s and 30s according to Size Korea. A subjective satisfaction evaluation was conducted by comparing the cases of wearing only the spine supporter and the cases of wearing the spine supporter and auxiliary support (2mm, 3mm). Subjects were asked to evaluate their subjective satisfaction after performing the following movements: walking for 5 minutes, running for 5 minutes, maintaining a sitting position for 5 minutes, and maintaining a standing position for 5 minutes while wearing a spinal support and auxiliary support. At this time Satisfaction evaluation included evaluating pressure, fit, and support using a 7-point Likert scale (1 point: Very Dissatisfied, 4 points: Neutral, 7 points: Very Satisfied). The breathability of the support is evaluated by heat plate experiments. Five measurement points were selected for the heat plate experiment, and the surface temperature of the 3D printed support was measured as the heat plate temperature rose from 0 to 50 °C, increasing by 10 °C increments.

Results & Discussion

In the subjective satisfaction evaluation, higher satisfaction was presented when wearing both the auxiliary support and the spinal support compared to wearing only the spinal support. Particularly, satisfaction was rated highest when the TPU support was 2 mm and the auxiliary support was 2 mm. Furthermore, satisfaction with the level of support was significantly higher when subjects also wore the Flexible 80A support. In the heat plate experiment, it took longer for surface temperature of the support with holes to reach the set than the support without holes. This trend tends to be shown in all temperatures, without being affected by the temperature of the heat plate.

Conclusion

In this study, the auxiliary support was made with flexible and elastic Flexible 80A material to alleviate discomfort from the 3D printed spinal support. The subjective satisfaction evaluation results show that wearing the auxiliary support with the spinal support significantly enhances satisfaction, demonstrating its effectiveness in reducing discomfort from the spinal support. Additionally, through the heat plate experiment, it was observed that the auxiliary support with holes reached the set surface temperature of the heat plate faster than the auxiliary support without holes. Therefore, it was found that the 3D printed spine support with a hole and a combination of 2 mm TPU support and 2 mm Flexible 80A auxiliary support was most suitable. It is expected that the wearer's satisfaction will be high when inserted into compression wear, as it not only provides satisfaction with wearing, but also provides excellent support and breathability. As a result, it is expected that the developed compression wear will be comfortable for daily life due to less discomfort from the support and efficient perspiration and heat dissipation, unlike commercially available products.

Acknowledgement

References

Jo, J. H. (2017). A study on chiropractic using 3D printer. *The Journal of Next-generation Convergence Technology Association, 1*(1), 42-44.

Moon, S.-J., & Park, Y.-S. (2010). The Design and Implementation of the Position Calibration System Using Sensor on u-WBAN. *Journal of Korean Institute of Intelligent Systems, 20*(2), 304-310.

Park, S. Y. (2022). *Development of an innerwear combined lumber support using 3D printing: For obese women in their 30s and 40s* [Master's thesis, Ewha Womans University]. https://dcollection.ewha.ac.kr/public_resource/pdf/000000184362_20240214163234.pdf

Redaelli, D. F., Abbate, V., Storm, F. A., Ronca, A., Sorrentino, A., De Capitani, C., Biffi, E., Ambrosio, L., Colombo, G., & Fraschini, P. (2020). 3D printing orthopedic scoliosis braces: a test comparing FDM with thermoforming. *The International Journal of Advanced Manufacturing Technology, 111*(5-6), 1707-1720.

Sin, G. C. (2009, September 5). 노인성 질환 유발 척추질환과 바른자세. *Life and Agrochemicals*, 30-31, https://koreascience.kr/article/JAKO200970952052720.pdf

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**A SURVEY ON THE SUSTAINABLILITY COURSES IN KOREAN UNIVERSITIES'
CLOTHING/FASHION- RELATED DEPARTMENTS & GLOBAL FASHION SCHOOLS
-FOCUSING ON BACHELOR'S DEGREE PROGRAMS OR HIGHER-**

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Introduction

The significance of sustainability in the fashion industry is increasingly emphasized. Rapid changes and production based on consumer preferences contribute to environmental issues, including resource depletion, energy consumption, and waste generation. The industry also raises concerns about working conditions and workers' rights, often exploiting cheap labor. Additionally, there is a lack of awareness regarding sustainable consumption, leading to excessive waste and environmental pressure. The Paris Agreement, established in 2015, aims to address climate change and sustainability globally, setting targets to limit global warming. Countries, including Korea and the United Kingdom, have committed to reducing greenhouse gas emissions. However, challenges persist, with some nations falling short of their goals. The fashion industry, identified as a major contributor to environmental problems, requires urgent attention to meet carbon neutrality goals. Notably, fashion education institutions in leading countries actively promote sustainability, while in Korea, there is a lack of emphasis on sustainable fashion in the universities' curriculum. Talents required in the fashion industry requires a sound understanding of clothing materials, design, and production processes based on sustainability. Therefore, in this study, we investigated the practice of sustainable courses and activities of the global fashion schools. Also, by analyzing the clothing/fashion-related departments in Korean universities and graduate schools that included the courses in their major curriculum, we would like to emphasize the need for curriculum revision at the majority of universities that do not yet provide sustainability-related courses in undergraduate and graduate programs.

Literature Review

Sustainability involves pursuing long-term development that considers environmental, social, and economic aspects for both current and future generations. It aims for economic prosperity while using resources efficiently, protecting the environment, and ensuring social fairness. The three dimensions of sustainability include environmental protection, social fairness, and economic prosperity, working together to achieve long-term sustainable development. Recent research on sustainable fashion covers various aspects such as consumer behavior, sustainable materials, production methods, and supply chain management. Studies by Rahman et al. (2023), Banytė et al. (2023), Shekarian et al. (2022), Mukendi et al. (2020), Wagner & Heinzel (2020), and Vladimirova et al. (2023) explore different facets of fashion and sustainability, although most are based on literature analysis or social media comments.

Research Method

This study conducted an Internet survey to identify sustainability-related courses of the curriculum and extracurricular activities of top fashion design schools globally. Focusing on advanced fashion countries like the UK, the US, Italy, and France, three fashion schools per country were chosen based on QS World University Rankings and public awareness. The final selection involved analyzing search results and assessing a total of 12 global fashion schools for sustainability-related courses and practices. In Korea, a similar survey was carried out on all universities with bachelor's degree program and higher, excluding two universities with suspended student recruitment. The analysis included courses related to "sustainability," examining those with terms like "sustainable" or "sustainability" in the course name or indirectly indicating sustainability such as "natural", "ethical" and "craft" etc. These surveys, conducted from November 15 to December 25, 2023, applied the 2023 academic year as the standard.

Results & Discussion

1.   Analysis of sustainability-related subject offer and practice cases at global fashion schools

London College of Fashion is a leading institution for sustainable fashion education and research, housing the Center for Sustainable Fashion. Central Saint Martins in London focuses on regenerative luxury through the Maison/0 project with LVMH. The Royal College of Art, ranked as the world's No. 1 art and design graduate school, emphasizes sustainability in its research program and has a Textile Circularity Centre. Fashion Institute of Technology (FIT) in New York offers undergraduate and graduate programs with a strong emphasis on sustainability. Parsons School of Design in New York provides a "Fashion & Sustainability" course and an online Fashion Sustainability Certificate. California College of the Arts (CCA) prioritizes sustainability in its Fashion Design Department, offering courses like "Fashion studio-sustainability". Polimoda in Florence, Italy, offers specialized courses in sustainable design processes and ethical manufacturing. Istituto Marangoni in Milan integrates sustainability throughout its fashion design courses. Domus Academy in Milan focuses on sustainability in its master's degree programs in fashion design and business. ESMOD in Paris incorporates sustainability into its curriculum, organizes events like the "detox" day, and offers courses on fashion and sustainability. Paris College of Art (PCA) actively integrates sustainability into its fashion design courses, organizes events and exhibitions focused on sustainable fashion, and collaborates with sustainable brands. École nationale supérieure des arts décoratifs (ENSAD) in Paris explores sustainability in fashion and textiles through its research institute, EnsadLab, and offers subjects like "Fashion sustainability" and "Fashion marketing & sustainability".

2.   Offering status of sustainable fashion courses in Korean universities' fashion departments

The survey included 18 departments in Seoul, 12 departments in Incheon and Gyeonggi region, 16 departments in the Gyeongsang region, 12 departments in the Chungcheong region, 11 departments in the Jeolla and other regions, for a total of 69 departments. Of these, 17 sustainability courses were offered at the undergraduate level. There were 61 sustainability courses offered in the course at the graduate school. When compared by region, there was no significant difference in the opening of undergraduate courses. In the case of graduate school courses, there were many courses in Seoul (25) and Incheon and Gyeonggi region (12), followed by courses in the Gyeongsang region (13). It was found that there were only 9 courses in the Jeolla and other regions, and that courses were opened in the Chungcheong region, with only 2 courses.

Table 1. Sustainability-related Course Titles by the Majors- Undergraduate

Detailed major field classification					
Textile Science(3)	Marketing & management(4)	Fashion design (5)	Construction & development(1)	History of costume(1)	Entire fields (3)
Textile & environment	Fashion ESG management	Sustainability & fashion design	Zero waste fashion product development	Natural dyeing & traditional craft	Life industry & sustainability
Fashion material & environment	Current issues in global fashion business	Sustainable design1			Environment & fashion
Natural dyeing	Entrepreneurship practice	Upcycling fashion design(2)			Upcycling fashion
	Sustainable fashion industry innovation PBL	Upcycling design			

Table 2. Sustainability-related Course Titles by the Majors- Graduate

Detailed major field classification					
Textile Science(20)	Marketing & management(7)	Fashion design (14)	Construction & development(4)	History of costume(9)	Entire fields (7)
Research on the development of sustainable apparel materials	Circular economy and the fashion industry	Sustainable fashion design	Development of eco-friendly apparel products	Experiment of traditional dyeing process	Sustainable development (SDGs) & fashion industry

Introduction to eco-friendly green fibers	Sustainable apparel consumption behavior	Slow fashion design planning	Development of sustainable design products	Restoration of excavated costumes I	Sustainable fashion culture
Eco-friendly industry and textile technology	Slow fashion business	Natural dyeing and eco-friendly fashion design	Sustainable 3D fashion product development	Restoration of excavated costumes II	Sustainability & fashion industry
Fashion trend & sustainable textiles	Sustainable fashion marketing communication	Sustainable fashion design research	Sustainable apparel production process	Practice and application of Korean traditional dyeing	Special topics in sustainable fashion
Study of sustainability in textile	Sustainable fashion marketing research	Sustainable fashion Product design		Korean traditional textile crafts	Sustainability in fashion
Study of natural dyeing	CSV fashion merchandising & sustainable VMD design	Natural dyeing design 1		Traditional costume & natural dyeing	Seminar in sustainable fashion industry-university collaboration
A study of traditional natural dye	Fashion business ethics	Natural dyeing design 2		Traditional costume & natural dyeing	Sustainability in the textile & fashion Industry
A study of traditional natural dye 2		Sustainable design1		Special topics in fashion craft	
Textiles & sustainability		Sustainable design2		Advanced craft for apparel	
Advanced textile dyeing		Topics in sustainable fashion design			
Dyeing and natural dyeing		Universal fashion design			
Natural dyeing research		Upcycling fashion design research			
Sustainable fashion textiles		Sustainable fashion design studio			
Theory of dyeing & practice		Studies in sustainable fashion design			
Natural fiber science					
Advanced sustainable materials & assessments					
Eco-friendly materials research					
Natural dyeing Study					
Theory & practice of natural dyeingI					
Theory & practice of natural dyeing II					

Conclusion

As a result of comparing the status of sustainability-related courses offered by famous global fashion schools and Korean clothing/fashion-related departments, global institutions do not stop at simply opening courses, but also go through a process of solving problems in cooperation with university affiliated research institutes or companies. Sustainable fashion was being practiced in a more advanced and mature way. On the other hand, in the case of Korean universities, even though the majority of fashion industry workers receive undergraduate education, the frequency of courses' offerings is very low, and the problem is that the completion of basic courses does not lead to subsequent actions to practice sustainable fashion.

When looking at the courses offered, courses related to 'natural deying' investigated to be the highest, and this course has been offered in the field of Korean traditional clothing even before sustainability received global attention. In addition, courses related to sustainability and design were observed with high frequency, and there were many courses in the sustainability-related marketing field. In order to practice sustainability, it is important to investigate various cases in marketing and design courses, but it is also desirable to offer courses on planning and manufacturing products through all stages of clothing production. Furthermore, it will be necessary to encourage students' independent participation through the establishment of problem solving project based learning and capstone design courses, and it is also considered effective to provide various types of extracurricular programs such as recycling fashion shows and recycling product sales.

In conclusion, it is necessary to open many sustainability-related courses and extracurricular programs in clothing/fashion-related bachelor's programs in Korea, and it is urgent to train future experts for the environmentally friendly and ethical fashion industry through sustainability education.

References

Osmud Rahman, Dingtao Hu and Benjamin C. M. Fung(2023), A systematic literature review of fashion, sustainability, and consumption using a mixed methods approach, *Sustainability*, *15*(16), 12213; https://doi.org/10.3390/su151612213

Jūratė Banytė. Šarūnė Vaidelinskaitė. And Laura Šalčiuvienė. (2023). Investigating the link between consumer attitudes and behaviour in the context of sustainable clothing: The role of social norms. *Sustainability* 2023, *15*(24), 16800; https://doi.org/10.3390/su152416800

K. Vladimirova, C. E. Henninger, & S. Zhou (2023), Exploring the influence of social media on sustainable fashion consumption: A systematic literature review and future research agenda. *Journal of Global Fashion Marketing*; https://doi.org/10.1080/20932685.2023.2237978

Melissa Monika & WagnerTincuta Heinzel. (2020). Human perceptions of recycled textiles and circular fashion: A systematic literature review. *Sustainability, 12*(24), 10599; https://doi.org/10.3390/su122410599

Mukendi, A., Davies, I., McDonagh, P., & Glozer, S. (2020). Sustainable fashion: current and future research directions. *European Journal of Marketing. 54*(11), 2873-2909; https://doi.org/10.1108/EJM-02-2019-0132

Ehsan Shekarian. Behrang Ijadi. Amirreza Zare and Jukka Majava. (2022). Sustainable supply chain management: A comprehensive systematic review of industrial practices. *Sustainability*, *14*(13), 7892; https://doi.org/10.3390/su14137892

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PROPOSAL ON CLOTHING EVALUATION CRITERIA FOR MOTION SUITABILITY OF FUNCTIONAL SLEEVE PATTERN USING VIRTUAL FITTING SYSTEMS

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Introduction

The primary factor affecting activity and comfort of upper body is the movement of the shoulder joint. The comfort and motion suitability of upper garments are directly linked to the functional patterns of the sleeves. The necessity of functional sleeve patterns is further emphasized not only in active wear such as hiking clothing and golf wear but also in specialized garments such as those used in rescue operations, military operations, and other situations directly related to safety and life. In case of soldiers with a wide range of training motion, sleeve patterns designed without considering mission movements caused hiking-up at the hem of sleeves and jackets, resulting in discomfort and hindrance during mission performance (Choi & Choi, 2020). Therefore, it's essential to design sleeves that align with the purpose of garment wear to ensure wearers' activity and comfort.

Pattern construction for garment motion suitability typically involves considering ease at the armpit and side seams to accommodate body surface changes during maximal upper body movements, thus enhancing functionality. While the range of maximal shoulder joint movement can be extensive, the level of motion may vary depending on the intended purpose of the garment. Excessive ease in garments where maximal movement is unnecessary can cause discomfort and interference with movement during daily activities.

Therefore, this study aims to study the optimal armpit ease for sleeve patterns designed for different levels of motion and proposes evaluation criteria to establish an evaluation system for motion suitability in virtual fitting systems.

Research Method

In this study, the research pattern was based on the functional sleeve construction method of a functional jacket sloper that was excellent in appearance evaluation and wear test (Choi, 2020). We developed various functional sleeve patterns 135, 150, 165, and 180 degrees to establish motion functionality standards. The armpit ease for each sleeve pattern was given as 3.5, 5.5, 7.5, and 9.5 cm based on the line connecting the armpit point and the sleeve construction angle.

Virtual fitting evaluations were conducted using CLO3D (CLO Virtual Fashion Inc., Korea), with avatar dimensions adjusted to the average dimensions of Korean adult male aged 20-29 of the 8th size Korea (chest circumference 101.7 cm, waist circumference 82.9 cm, hip circumference 97.2 cm, arm length 59.0 cm, back length 42.5 cm, shoulder width 42.8 cm).

Functional evaluations were conducted based on the amount of hiking at the hemline of the bodice and sleeve pattern, and fabric strain distribution during the maximal shoulder joint movement. For the hemline of the bodice, we measured the amount of hiking at the side seam on wearer's right (S.S.), center front (C.F.), center back (C.B.), and for the hemline of the sleeve, we measured them at outer wrist point, inner wrist point, 1/2 back hand (overarm) point, 1/2 palm hand (inseam) point. Stress points were measured at the points where the sleeve and bodice patterns intersect and the midpoint connecting those points.

Results & Discussion

The measurements of the amount of hiking at the hemline of the bodice pattern during the maximal shoulder joint movement had a discrepancy that the order of size is as follow; C.F. > S.S. > C.B.. This suggests that the amount of hiking at C.B. is influenced by the backward orientation of the garment due to shoulder joint movements and tilted body posture. The amount of hiking at the hemline of the bodice pattern was least

affected when measured at the S.S. (right) at 135, 150, and 165 degrees with 7.5 cm of ease, showing 8.95, 8.08, and 7.15 cm respectively. At 180 degrees, with a 9.5 cm ease, it was 7.34 cm, less than with other ease. Through this result, measuring the amount of hiking at hemline of bodice pattern on the side seam (wearer's right) is more suitable as an evaluation indicator for evaluating the functionality of sleeves than C.F. and C.B. of the bodice pattern. The appropriate amount of ease for sleeve pattern based on different levels of motion, a 7.5 cm ease was adequate for 135, 150, and 165 degrees, while a 9.5 cm ease was suitable for 180 degrees.

The amount of hiking at hemline of the sleeve tended to decrease as the armpit ease increased, and the difference in amount of hiking at hemline of the sleeve according to the armpit ease was clear when measured at overarm point and inseam point. While sleeve functionality should ideally be measured at inseam point indicating the length of sleeve inseam, there was no difference in the amount of hiking at the hemline of sleeve between overarm point, inseam hand point and it was easier to measure at overarm point of the hand than at inseam point due to the lifting of the hemline of the sleeve.
Thus, we proposed the amount of hiking at the hemline of the sleeve as criteria for motion suitability of functional sleeve pattern in virtual fitting systems. We also suggested the amount of sleeve hem hiking at overarm, which is no different from the inseam measurement and is easy to measure in virtual fitting system.

Regarding fabric strain rate, we confirmed that stress accumulates at the cross-section of seams in the current virtual fitting system. Therefore, we examined stress data at the point where the sleeve and bodice patterns meet and at the midpoint connecting those points (similar to armpit point). The results showed a tendency of front bodice point > back bodice point > armpit point in terms of size, although there were no apparent differences in fabric strain data among the different level for motion functionality.
Therefore, the current stress distribution provided by the virtual system does not show differences among different levels of functionality, indicating a low potential for its utilization as an evaluation indicator.

Conclusion
In conclusion, it has been confirmed that evaluating functional sleeve patterns for upper body mobility is feasible through the analysis of hiking amounts at the side seam and sleeve hem. Previous evaluations of functional garments have mainly relied on subjective assessments by wearers, which involve physical constraints of space and time associated with wearing the garments in person. However, this study demonstrated that objective evaluation criteria for motion suitability assessment can enable evaluation even in virtual fitting environments. Subsequent research will aim to systemize and concretize these evaluation criteria for versatile use.

References
Choi, H. E., & Choi, K. M. (2021). Development and Evaluation of the Korean Army's Ergonomic Flight Jacket, *Fashion & Text. Res. J.*, *23*(1), 118-128.
Choi, H. E. (2020). *Development of ergonomic jacket pattern for the Korean army's tracked vehicle crew*. Unpublished doctor's thesis, Seoul National University, Seoul.

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Poster Session 2.
Economics of Clothing & Textiles/ Fashion Business

Proceedings

MATERIALIM, ECONOMIC MOTIVES, AND LIFE SATISFACITON IN LUXURY FASHION CONSUMPTION

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Introduction

Collaborative consumption represents contemporary consumers' environmentally and socially conscious behavior in the sharing economy marketplaces. As humans, individuals cannot live without things. Individuals recognize that goods have value and can improve quality of life. To meet their needs and wants, individuals use a mix of material and experiential means. Some individuals prioritize material possessions to fulfill their needs and consider acquisition crucial for achieving significant life goals. For instance, luxury goods exist to meet beyond functional needs, including the hedonic and social status needs of consumers, among others (Ruan et al., 2022). The previously owned luxury resale market is growing rapidly in Europe and the US, supported by the rise of the new rich in emerging markets, the affordability of pre-owned luxury, and sustainable consumption trends. Based on emerging findings supporting the positive impact of one's materialism on satisfaction with life (Sirgy et al., 2021), this study aims to explore Gen Z consumers' level of materialism, satisfaction with the standards of living, economic motives, and satisfaction with life based on their luxury goods ownership status.

Literature Review

Luxury goods consumption entails positive consequences for consumers regardless of their level of materialism (Hudders & Pandelaere, 2012). Luxury consumption increases the frequency of positive affect, while reducing the frequency of negative ones. Individuals who prioritize material possessions are more prone to consume luxury goods, compared to their counterparts. Engaging in luxury consumption contributes to a heightened positive emotional state as well as enhanced life satisfaction (Hudders & Pandelaere, 2012). Materialism was defined as "the importance a person places on possessions and their acquisition as a necessity of a desirable form of conduct to reach desired end states" (Richins & Dawson, 1992, p. 307). These researchers considered materialism as a set of value-laden beliefs that guide individuals' daily lives and their consumption decisions. Materialism primarily has two dimensions: success and happiness (Fournier & Richins, 1991; Sirgy et al., 2021). Materialism is negatively associated with various areas of individuals' lives. Individuals with high materialism tend to experience dissatisfaction with social life (Kasser & Ryan, 1996), dissatisfaction with financial well-being (Sirgy et al., 2021), and excessive consumerism (Dittmar, 2005).

On the contrary, other studies found that materialism may lead to one's well-being (e.g., Sirgy et al., 2021). As material wealth is viewed as an economic achievement in developed countries (e.g., the U.S.), Dittmar et al. (2014) suggested that materialism becomes a significant positive predictor of life satisfaction when materialism is assessed through a broader array of materialistic goals (e.g., image and status) other than exclusively money-related goals. These mixed findings on the relationships between materialism and well-being and life satisfaction call for further investigation (Sirgy et al., 2021). Based on the literature, we aim to add empirical findings by investigating the levels of a) materialism - success, b) materialism - happiness, c) satisfaction with standards of living, d) economic motives, and e) present satisfaction with life among various luxury ownership statuses (e.g., non-owners, used luxury owners, and brand-new luxury owners).

Research Method

A self-administered questionnaire was developed with five sections: a) materialism (success and happiness), b) satisfaction with the standard of living, c) economic motives, d) present satisfaction with life, and e)

demographic and luxury ownership information. Instruments were adopted from previous studies (e.g., Kim & Joung, 2016; Sirgy et al., 2021). All items were measured on a five-point Likert scale, ranging from 1 being "strongly agree" to 5 being "strongly disagree. We collected data from a US Midwestern university based on literature supporting the significance of Gen Z consumers as the rising target for the consumption of luxury goods (e.g., Pentina et al., 2018). We received 476 responses. After excluding 24 incomplete responses, a final sample of 452 was utilized for data analysis. Eighty-eight percent were females who were between 18 and 20 years old. Over 95% reported being single, and over 74% identified themselves as Caucasian American or non-Hispanic White. Over 65% indicated that they have less than $200 in monthly discretionary income.

Results & Discussion

Using principal factor analyses with varimax rotation and reliability tests, we verified the dimensionality of all multiple-item constructs (factor loadings = .66 -.86, Cronbach's α = .81- .91). ANOVA revealed that there were significant mean differences among no luxury owners (a), used luxury owners (b), and brand-new luxury owners (c) regarding materialism–success (M_a = 3.38, M_b = 3.07, M_c = 2.73; F = 10.55, p < .001), satisfaction with standards of living (M_a = 2.89, M_b = 2.23, M_c = 2.00; F = 8.32, p < .001), economic motives (M_a = 1.64, M_b = 1.43, M_c = 1.43; F = 5.20, p < .01), and satisfaction with life (M_a = 2.66, M_b = 2.62, M_c = 2.20; F = 4.85, p < .01), except for happiness (M_a = 2.86, M_b = 2.69, M_c = 2.77; F = 1.10, p = .34). The findings indicated that brand-new luxury owners showed a higher level of materialism-success, satisfaction with standards of living, and present satisfaction with life, compared to non-luxury owners and used luxury owners. These are consistent with the previous findings that individuals who are materialistic tend to enhance positive mood and life satisfaction through luxury consumption (Hudders & Pandelaere, 2012). Brand-new luxury owners exhibited a higher level of materialism as a measure of success in life and feel satisfied with their lives. No luxury owners exhibited lower economic motives than did used luxury owners and new luxury owners as anticipated. Happiness materialism has been found to be negatively related to individuals' life satisfaction (Sirgy et al., 2021). Thus, luxury ownership may not distinguish individuals' level of happiness stemming from material possessions.

Conclusion

Our findings may be considered when brands develop their marketing messages to appeal to their target consumers. The new luxury industry may develop a marketing strategy focusing on luxury goods as a measure of success in life and a means of enhancing satisfaction with life. The luxury resale industry may focus on the monetary value of acquiring used luxury and the economic motives of potential customers. Further research could include multi-cultural samples to examine cultural differences and structural equation modeling analysis to explore causal relationships among the constructs.

References

Dittmar, H. (2005). Compulsive buying - A growing concern? An examination of gender, age, and endorsement of materialistic values as Predictors. *British Journal of Psychology, 96*, 467-491.

Dittmar, H., Bond, R., Hurst, M., & Kasser, T. (2014). The relationship between materialism and personal well-being: A meta-analysis. *Journal of Personality and Social Psychology, 107*(5), 879-924.

Fournier, S., & Richins, M. L. (1991). Some theoretical and popular notions concerning materialism. *Journal of Social Behavior & Personality, 6*(6), 403-414.

Hudders, L., & Pandelaere, M. (2012). The silver lining of materialism: The impact of luxury consumption on subjective well-being. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being, 13*(3), 411-437.

Kasser, T., & Ryan, R. M. (1996). Further examining the American dream: Differential correlates of intrinsic and extrinsic Goals. *Personality and Social Psychology Bulletin*, *22*(3), 280-287.

Kim, J., & Joung, H.-M. (2016). Psychological underpinnings regarding luxury brand goods repurchase intentions: Brand-self congruity, emotional attachment, and perceived level of investment made toward luxury brand goods. *Journal of Global Scholars of Marketing Science, 26*(3), 284-299.

Pentina, I., Guilloux, V., & Micu, A. C. (2018). Exploring social media engagement behaviors in the context of luxury brands. *Journal of Advertising, 47*(1), 55–69.

Richins, M. L., & Dawson, S. (1992). A consumer values orientation for materialism and its measurement: Scale development and validation. *Journal of Consumer Research, 19*(3), 303-316.

Ruan, Y., Xu, Y., & Lee, H. (2022). Consumer motivations for luxury fashion rental: A second-order factor analysis approach. *Sustainability, 14*(12), 7475.

Sirgy, M. J., Yu, G. B., Lee, D. J., Joshanloo, M., Bosnjak, M., Jiao, J., Ekici, A., Atay, E. G., & Grzeskowiak, S. (2021). The dual model of materialism: Success versus happiness materialism on present and future life satisfaction. *Applied Research Quality Life, 16*, 201-220.

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THE IMPACT OF SOCIAL MEDIA FASHION INFLUENCER ATTRIBUTES ON PURCHASE INTENTIONS AMONG GENERATION Z CONSUMERS

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Introduction

The purpose of this study is to examine how the attributes of social media fashion influencers affect Generation Z consumers' purchase intention. The influence of social media fashion influencers, as opposed to traditional celebrities, is growing among Generation Z social media users (Kim, & Hwang., 2019). In previous studies, few studies involved the psychological dimension of consumers' love for fluence and perceptions of the emotional value of their recommended products. Therefore, this study hypothesized that consumers would form attachment to social media fashion influencers, and due to this emotional attachment, they are likely to perceive high emotional value of the products influencers recommend. This perceived emotional value of products is expected to affect consumers' purchase intention.

Literature Review

According to the literature, fans as consumers form a love for social media fashion influencers (Kim, 2022). Previous research points out that the main characteristics of information sources that have a huge impact on the communication effect of social media influencers are expertise, trustworthiness, and attractiveness (Hovland et al., 1953; Ohanian, 1990). Due to the halo effect, consumers tend to trust the information provided by the influencers and perceive the products they recommend to have high emotional value (Wang, 2018). Social media fashion influencer can induce positive reactions to products or brands they recommend through their relationships with followers. The influence of these social media fashion influencer is growing, especially in the modern society where consumers are more informed and less judgmental about consumption (Liu, 2017; Kwak & Yoh, 2021). And the high perceived emotional value will further stimulate consumers' purchase intentions (Wang, 2018).

Research Method

For this study, an online survey was conducted to Generation Z consumers (aged between 20 to 27) who use social media and follow at least one fashion influencer. A total of 606 responses were collected from March 27 to April 23, 2023. Out of the 606, 567 valid responses were used for the analysis. The questionnaire included measures of influencer attributes (i.e., trustworthiness, expertise, and attractiveness), attachment to social media fashion influencers, perceived emotional value of product, and purchase intention, which were all measured on 5-point Likert scales. Descriptive statistical analysis and frequency analysis were then conducted using the SPSS 27.0, followed by factor analysis and multiple regression analysis. To verify the mediating effect more accurately, this study conducted Sobel test using non-standardized regression coefficients and standard errors in Baron and Kenny's three-step methodology.

Results & Discussion

The original measure of the attributes of social media fashion influencers were comprised of trustworthiness, expertise, and attractiveness, but based on the results of the exploratory factor analysis, two factors, trustworthiness and expertise, were combined into one factor. As a result, two influencer attribute factors were identified: public confidence and attractiveness. When consumers' attachment to the social influencer is regressed on the public confidence and attractiveness, the results showed that social media fashion influencers' public confidence and attractiveness significantly affect consumers' attachment to social media fashion influencers.

Second, when the perceived emotional value of the product was regressed on social media fashion influencers' public confidence, attractiveness, and consumers' attachment to them, the results showed that all three independent variables had significant effects on the perceived emotional value of the product.

Third, the mediating effect of attachment was significant for both public confidence and attractiveness, and the direct effects of public confidence and attractiveness on the perceived emotional value of the product were also significant, suggesting a partial mediation effect. In addition, the mediating effect of the perceived emotional value of the product on attachment and purchase intention and the direct effect of perceived emotional value on purchase intention were both significant, indicating a partial mediation effect.
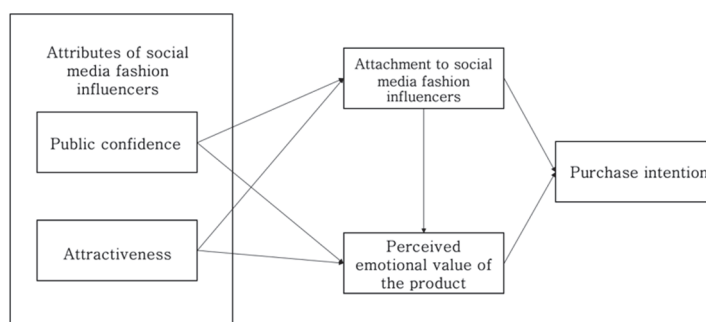
Conclusion

This study has several academic and marketing practical implications. The academic implications are that Generation Z consumers will develop an attachment to social media fashion influencers through their attributes, this attachment triggers the transfer of the emotional attachment to the recommended products through the halo effect. It is recommended that social media fashion influencers increase their public confidence, and they need to utilize their unique fashion style and a good sense of trends. Companies should discover reliable and attractive social media fashion influencers. In addition, companies can work with social media fashion influencers to promote their products to consumers who feel a bond with social media fashion influencers. Through this, it is possible to effectively spread and promote products by utilizing the interaction between social media fashion influencers and followers. This study emphasized the mediating effects of attachment and the perceived emotional value of the product. In the age of social media, Influencers can exert influence on consumers' purchase decisions once emotional attachment is established. The findings suggest that it is important for companies to pay attention to the attributes of social media fashion influencers and to increase communication and interaction with consumers to understand their characteristics and preferences and maintain an emotional connection.

References

Hovland, C. I., Janis, I. L., & Kelley, H. H. (1953). Communication and persuasion. New Haven: Yale University Press.

Hwang, K., & Zhang, Q. (2018). Influence of parasocial relationship between digital celebrities and their followers on followers' purchase and electronic word-of-mouth intentions, and persuasion knowledge. Computers in Human Behavior, 87, 155–173.

Kim, & Hwang. (2019). A Study on Advertising Effect Depending on Type of Information Source and Displaying of Economic Support in Influencer Marketing: Focusing on YouTube. Journal of Digital Contents Society, 20(2), 297-306.

Kim, S. J. (2022). Excavation of Influence Factors of Influencer Attachment, while Exploring the Moderating Effects according to the Frequency of Interaction between Followers (Master's thesis). Jinju: Gyeongsang National University.

Kwak, J. H., & Yoh, E. A. (2021). Effect of influencers' characteristics and consumer need satisfaction on attachment to influencer, content flow and purchase intention. Journal of the Korean Society of Clothing and Textiles, 45(1), 56–72.

Liu, H. C. (2017). The formation mechanism of fan enthusiasm of Internet celebrity and its influence on purchase intention. 企业经济, 36(2), 7.

Ohanian, R. (1990). Construction and validation of a scale to measure celebrity endorsers' perceived expertise, trustworthiness, and attractiveness. Journal of Advertising, 19(3), 39–52.

Wang, X. (2018). Internet celebrity's characteristics effect on consumer's impulsive purchasing behavior (Unpublished master's thesis). Tianjin: Tianjin University of Technology.

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AI SERVICES IN FASHION RETAIL: UNDERSTANDING PRIVACY PARADOX

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Introduction

The integration of Artificial Intelligence (AI) into the fashion retail industry is anticipated to generate up to a $275 billion increase in industry profits within the next five years (Khanna, 2023). This growth is primarily driven by AI's capacity for personalization, particularly in services that require detailed personal information. Stitch Fix exemplifies this trend, leveraging AI to compile personalized style profiles based on 90 different data points gathered through detailed customer surveys (Harreis et al., 2023). These data points encompass a range of personal preferences and physical attributes, enabling the AI algorithms to offer clothing recommendations that align closely with individual customer tastes, particularly based on their unique body shapes and sizes. However, this high level of personalization raises significant concerns among consumers regarding information privacy. In certain instances, it induces feelings of privacy fatigue, which refers to the degree of belief that there are no effective ways of managing their personal or private information in the marketplace (Tang et al., 2021). These feelings show that consumers are getting tired of concerning themselves with their privacy as they have to share their personal and/or private information with retailers for purchasing or even browsing information in the marketplace. Consumers now face a significant dilemma: weighing the appealing benefits of customized shopping experiences against the potential risks of privacy invasion (Youn & Luan, 2023). This balance, crucial yet challenging, directly influences consumers' readiness to engage with these AI-driven personalized services in the fashion retail setting. In response to this emerging issue, this study aims to examine the effect of consumer privacy concerns, particularly focusing on Concerns for Information Privacy (CFIP), on their likelihood of experiencing privacy fatigue. Moreover, this study investigates how this factor impacts the critical dilemma between the benefits of personalized shopping and privacy risks, ultimately shaping consumers' intentions to adopt AI-driven personalized shopping experiences.

Literature Review

CFIP is understood as the individual's perception of the manner in which a company or organization gathers, handles, and oversees private information (Smith et al., 1996). This framework is categorized into four distinct dimensions: Information Collection, Errors, Unauthorized Secondary Use, and Improper Access. *Information Collection* addresses concerns about how organizations gather personal data. *Errors* refer to worries about inaccuracies in personal data due to insufficient protection. *Improper Access* focuses on fears of unauthorized access to stored information. Finally, *Unauthorized Secondary* Use involves concerns over the use or sharing of personal data by third parties without individual consent (Smith et al., 1996). CFIP can explain the potential to exacerbate privacy fatigue in consumers, which refers to a state of weariness and resignation experienced by individuals due to the overwhelming nature of managing privacy and constant concerns about data breaches and privacy violations (Tang et al., 2021). Interestingly, this fatigue can positively influence the consumer's dilemma of balancing the allure of customized shopping experiences with privacy risks. According to the Privacy Calculus Theory (PCT), this assessment is based on two main factors: perceived privacy risk and perceived benefit (Youn & Luan, 2023). Perceived privacy risk involves how much individuals believe they might lose by sharing personal data, and perceived benefit is the mental assessment of the advantages they might gain from revealing this information (Youn & Luan, 2023). Thus, the balance between these perceptions is important in determining consumer adoption of personalization services. Consequently, we put forward the following hypotheses:

H1-H4. In the fashion retail service context, consumers' privacy concerns toward the retailer's data management—(H1) collection, (H2) error, (H3) secondary use, and (H4) improper access—will increase privacy fatigue.

H5-H6. The feeling of privacy fatigue will increase (H5) the perceived risk and (H6) benefit of information disclosure of using the service.

H7-H8. Consumers' perceived risk will (H7) decrease the adoption intentions to use the retail service, whereas it will (H8) increase the adoption intentions.

Research Method

The survey participants were recruited through MTurk, and a screening question was used to verify that they were 18 years old or older. A total of 510 usable responses were collected, excluding invalid or incomplete answers. 45% of the total participants were male, 77% were Caucasians, 70% were in the age range between 25 and 44, 63% obtained a college-level degree, and 85% were living in urban cities. The survey questionnaire was constructed by adapting measurement scales from previous studies (Smith et al., 1996; Venkatesh et al., 2016; Youn et al., 2023). Participants were asked to answer questions regarding their previous experiences and perceptions toward the use of AI-driven personalized services that required their personal information in the fashion retail store. Survey items were measured with a 5-point Likert scale. Path analysis was performed based on partial least squares structural equation modeling (PLS-SEM) to test the proposed hypotheses.

Results & Discussion

After examining the measurement model, path analysis was conducted to determine how each construct relates to another. PLS-SEM results indicated that consumer concerns related to data collection and error management significantly increased feelings of privacy fatigue (H1: $\beta = 0.424$, $p < .001$; Hb: $\beta = 0.232$, $p < .001$). However, their concerns related to secondary use of data and improper access to shared personal information did not explain privacy fatigue. Thus, H1 and H2 were accepted while H3 and H4 were rejected. Interestingly, perceived privacy fatigue positively explained both perceived risk (H5: $\beta = 0.117$, $p < .001$) and benefit (H6: $\beta = 0.187$, $p < .001$). This indicates that even though consumers perceive privacy fatigue, they still expect the benefits of using personalization services in the retail service setting. Thus, H5 and H6 were accepted. Finally, perceived risk negatively explained the adoption intention (H7: $\beta = -1.217$, $p < .001$) while it positively explained the adoption intention (H8: $\beta = 0.600$, $p < .001$). Thus, H7 and H8 were accepted.

Conclusion

The findings of this study hold significant scholarly implications. The extended model of PCT, when incorporated with CFIP, underscores the importance of understanding privacy fatigue and paradox, especially within the fashion retail services sector. It becomes evident that consumers' concerns regarding massive information collection and error management practices are the primary factors inducing feelings of fatigue concerning privacy issues. This study also suggests managerial implications. It is crucial for retailers to adopt transparent and ethical data collection systems. This can help alleviate consumer concerns and reduce the likelihood of privacy fatigue. Additionally, while retailers should invest in robust data security measures, they must reassure consumers about the safety of their shared personal information.

References

Hong, G. (2014). Study on the Korean traditional market. *The Research Journal of Fashion*, *20*(2), 200-214.

Mitchell, T. R., & Larson, J. R., Jr. (1987). *People in organizations: An introduction to organizational behavior* (3rd ed.). New York, NY: McGraw-Hill.

Parker, T. (2008, May 6). Psychiatry handbook linked to drug industry. *The New York Times*. Retrieved from https://well.blogs.nytimes.com/2008/05/06/psychiatry-handbook-linked-to-drug-indus try/?mcubz=3

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SUSTAINABLE FASHION IN EDUCATION: A STUDENT PERSPECTIVE ON CHALLENGES IN THE RETAIL SECTOR

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Introduction

There has been a significant shift toward sustainability in the fashion retail industry (Hwang et al., 2022). The shift is primarily driven by fashion retail companies' efforts to blend economic value with social responsibility. Well-known fashion retail players have embraced the challenge and dedicated themselves to the use of sustainable materials such as recycled, regenerative, and/or organic materials. For example, ASOS, H&M, Levi Strauss & Co., and Nike made a significant commitment. That is, they aim to ensure that most of their products are sourced sustainably by 2025 (e.g., 100% sustainable cotton) (Singha et al., 2023). This not only indicates the increasing consumer demand for sustainable apparel products but also shows retailers' commitment to advancing sustainable practices. However, despite these initiatives' success in enhancing environmental and economic outcomes, the practical challenges faced by retailers, especially in the context of fashion retail education, remain insufficiently addressed. Therefore, college students need to enhance their capability to identify and analyze the current challenges for fashion companies when they develop, source, and market sustainable products. It is imperative for college students in the textile and apparel discipline to gain practical knowledge by exploring current challenges in making sustainable fashion products available in the digital marketplace.

Literature Review

Students have few opportunities to learn the true environmental and economic impacts of sustainable products on society due to difficulties in gaining consistent knowledge about the consequences of sustainable efforts of fashion retailers and consumers (Jestratijevic & Hillery, 2023). Furthermore, there are limited teaching resources to bridge the gap between business perspectives and public demand for sustainable fashion products. Students need to learn how sustainable products can survive in the competitive digital marketplace. To do this, they must understand the current challenges that fashion companies face regarding their sustainable efforts. Thus, this study's education project enhances students' knowledge about the production of sustainable products by extending their understanding of the real world through situation-based learning (SBL) opportunities (Clark, 2009). According to SBL, the learning process is most effective when students acquire knowledge within its relevant context that reflects real-life decision making (Hwang et al., 2023). Therefore, SBL-based activities will provide students with motivation to fundamentally understand current challenges in developing and marketing sustainable fashion products for real-world applications. Consequently, this study aims to explore how education centered on sustainability issues can enhance students' capacity to identify and understand the challenges associated with sustainable fashion within the fashion retail sector.

Research Method

Learning modules focusing on sustainable issues in the fashion industry were developed for students who enrolled in the 'Fashion Digital Marketing' class. About 70% of senior students enrolled in the course who majored or minored in fashion retail merchandising. Over the semester, these students engaged in a semester-long project, where they simulated the launch of a new sustainable product line within fashion companies. This approach provided them with practical insights and experience in the field of sustainable fashion marketing. At the end of the semester, 20 students participated in an in-depth interview (about 30 minutes). The interview was designed to gather detailed insights into their learning experiences and opinions on sustainability in the fashion retail industry. We received Institutional Review Board (IRB) approval for this study, ensuring ethical research standards. For the data analysis, a qualitative content analysis approach

was conducted. This method involved a systematic examination of the interview transcripts to identify recurring themes and patterns in the responses. Specifically, we focused on their perceptions and understanding of sustainability challenges in the fashion industry.

Results & Discussion

In our analysis of student responses, the most prevalent theme was the 'Awareness and Knowledge Gap,' accounting for approximately 35.29% of the words. The first theme underscores the significant need for knowledge and awareness about sustainable practices in the fashion industry (i.e., not sure what aspects should be considered for transparency). 'Cost and Affordability' and 'Marketing and Communication Challenges' each comprised around 17.65% of the discourse. This highlights the importance of understanding practical approaches toward cost-effectiveness for sourcing sustainable products and marketing them. In addition, both 'Fast Fashion and Waste' and 'Consumer Behavior and Preferences' were equally represented, constituting about 11.76% of the words each. This shows their understanding of the importance of investing in quality pieces rather than fast fashion items. However, there is not enough information about the consequences of sustainable consumption for society. This reflects concerns about the environmental impact of fast fashion and the role of consumer choices in sustainability. Lastly, 'Ethical Concerns and Greenwashing' indicated approximately 5.88% of the words. This shows a recognition of ethical issues and deceptive sustainability claims in the industry.

Conclusion

This study reaffirms the importance of a situation-based learning approach in sustainability education in college settings, enhancing knowledge about the real-world problems associated with fashion companies' sustainable efforts and understanding the gap between sustainable and business goals. By conducting class projects simulating real industry tasks and settings, students have enhanced their practical knowledge to incorporate sustainability in sourcing and marketing. They have also learned about challenges that fashion companies may face while implementing sustainable business practices, such as simultaneously pursuing sustainable materials and cost efficiency. The results from the in-depth interview have provided implications for fashion retail education and the fashion industry. Students were able to identify the critical issues and challenges as future professionals to lead the fashion industry. Fashion companies can critically reassess their sustainable business practices, such as transparent consumer communications. As for future studies, fashion and retail college educations can allow students to explore business strategies to address sustainability awareness and knowledge gaps and the dilemma between cost reduction and sustainable material sourcing.

References

Clark, R., (2009). *Accelerating expertise with scenario-based learning.* Learning Blueprint. Merrifield, VA: American Society for Teaching and Development

Hwang, J., Youn, S. Y., & Zhao, L. (2022, December). How Resilient Coping Influences Goals and Sustainable Fashion Consumption Moving Toward the Next Phase of COVID-19. In *International Textile and Apparel Association Annual Conference Proceedings* (Vol. 79, No. 1). Iowa State University Digital Press.

Hwang, W. Y., Hariyanti, U., Chen, N. S., & Purba, S. W. D. (2023). Developing and validating an authentic contextual learning framework: promoting healthy learning through learning by applying. *Interactive Learning Environments, 31*(4), 2206-2218.

Jestratijevic, I., & Hillery, J. L. (2023). Measuring the Clothing Mountain: Action research and sustainability pedagogy to reframe (un) sustainable clothing consumption in the classroom. *Clothing and Textiles Research Journal, 41*(1), 10-25.

Singha, K., Maity, S., & Pandit, P. (2023). Organizations and certifications relating to sustainable fibres. In *Sustainable Fibres for Fashion and Textile Manufacturing* (pp. 355-384). Woodhead Publishing.

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WHEN A CELEBRITY ENDORSER GETS IN TROUBLE: THE EFFECTS OF BRANDS' RESPONSE TIME AND TYPE OF NEW ENDORSER ON BRAND ATTITUDE

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Introduction

When a celebrity endorser and brand are strongly linked, a spillover effect may occur when the endorser's image is damaged. Thus, the brand should appropriately cope with the incident to minimize the possibility of a negative effect. This study posited that a brand's response time and the type of new endorser can determine consumers' evaluations of whether or not the brand's response was appropriate. Previous studies have confirmed that the speed at which brands respond to crises is important (Iveson et al., 2023), yet the effects of the new endorser type have rarely been studied. In other words, when a celebrity endorser gets in trouble, would it be better to employ a completely different type of endorser? To bridge this gap, this study compared consumers' responses toward a celebrity endorsement with their character. Built on the attribution theory, this experimental study aimed to test consumers' perceived fit according to a brand's response speed and type of new endorser when the brand was faced with a celebrity endorser scandal. Then, a structural model of how the fit induced favorable brand attitude through consumer attribution was investigated.

Literature Review

Attribution theory refers to the psychological process of inferring the cause of a specific phenomenon. People who encounter a phenomenon tend to process attributions to deduce the cause, and their emotional and behavioral reactions can vary depending on what they perceive as the cause of the phenomenon (Kelley, 1973). This theory has been widely applied to explain how consumers evaluate firms' activities, which suggests that consumers' reactions are subject to the perceived motivations of a firm's actions (Marín et al., 2016). Previous studies have mainly employed value-driven (i.e., whether a company has the motivation to solve a problem sincerely) and strategic motivations (i.e., whether a company is responding as part of a strategy for improving profit and image) (Ellen et al., 2006). The brand's action toward the crisis may provide different cues for consumers to infer the cause, thereby inconsistently affecting perceived motivations. Regarding the brand's actions, this study termed the proper timing of the response as 'time-fit,' and 'endorser-fit' refers to the appropriateness of the replaced endorser, perceived by consumers. The perceived time-fit and endorser-fit may allow people to understand the various motivations underlying the brand's coping strategies. When a brand's effort is evaluated as value-oriented, consumers are more likely to have favorable responses toward the firm and a willingness to support it (Ellen et al., 2006). Conversely, the literature has argued that strategic motivation often elicits negative responses (Zasuwa, 2019). Therefore, the following hypotheses were proposed:

H1. Perceived time-fit affects (a) value-oriented motivations and (b) strategic motivations.

H2. Perceived endorser-fit affects (a) value-oriented motivations and (b) strategic motivations.

H3. (a) Value-oriented motivations positively affect brand attitude, whereas (b) strategic motivations negatively affect brand attitude.

Research Method

A virtual news article was developed as the experimental stimuli, reporting that a top fashion brand, called "B," had removed an advertisement featuring a celebrity endorser, "K," due to a recent illegal drug scandal, and the brand replaced the ad with a new advertisement featuring a different endorser. In this report, we manipulated the speed of removal and replacement after the incident (immediate: 1 day vs. delayed: 30 days) and the type of new endorser (same: a celebrity vs. different: a character), resulting in four different versions of the news article. Pre-tests were conducted to ensure that the manipulations were successful. An online research firm recruited general consumers in Korea and conducted an online survey.

The participants were randomly assigned to one of the four groups and answered the survey questionnaires corresponding to the given stimulus. A total of 386 responses were collected, out of which 315 valid responses were analyzed. The survey included items to measure time-fit and endorser-fit (Decker & Baade, 2016), value-driven and strategic motivations (Ellen et al., 2006), and brand attitudes (Kim & Lee, 2019). All items were measured on a 7-point Likert scale (1: strongly disagree, 7: strongly agree).

Results & Discussion

Confirmatory factor analysis ensured the reliability and validity of the measurement model in Amos 26.0 (factor loadings: .71-.96, CR: .81-.96, AVE: .59-.89). Then, independent t-tests were conducted to confirm the significant differences in the perceived time-fit between the speed of the response groups (1 day and 30 days), as well as in the endorser-fit perceptions between the new endorser groups (celebrity and character). As a result, consumers in the 24-hour group were more likely to perceive a brand's actions as being timely than those in the 30-day-group (M_{1day} = 5.43, M_{30days} = 3.67, t = 10.16, p < .001), and the new celebrity was perceived as being slightly more appropriate than the character ($M_{celebrity}$ = 4.88, $M_{character}$ = 4.53, t = 2.39, p < .05). To test H1-H3, structural equation modeling was used in Amos 26.0 ($\chi2$ = 438.02, df = 162, p < .001, CFI = .96, GFI = .88, TLI = .95, RMSEA = .07). The result showed that time-fit increased both value-driven (β = .58, p < .001) and strategic motivations (β = .33, p < .001), supporting H1a and H1b. In support of H2 and Hb, endorser-fit also enhanced both value-driven (β = .22, p < .001) and strategic motivations (β = .21, p < .01). While value-driven motivations positively affected brand attitude (β = .80, p < .001), strategic motivations did not have a significant effect on brand attitude (β = .07, p> .05) (Chen & Yang, 2023), and thus H3a was supported, but H3b was not.

Conclusion

The findings suggested that brands should immediately take action to prevent negative spillover when their celebrity endorsers are in trouble. Moreover, a celebrity endorser showed a slightly higher fit as compared to a character endorsement. However, this result may be influenced by the study setting, as the fashion brand's former endorser was a celebrity. Therefore, future studies are required to confirm these associations, considering factors such as brand category and similarities to the former endorser. Nonetheless, since the fashion industry increasingly capitalizes on characters as new ambassadors (e.g., BVLGARI x Loopy), this study can serve as a valuable attempt to understand consumer responses toward character endorsers as an alternative to a celebrity. Moreover, the findings of this study contribute to the consumer attribution literature by demonstrating how the brand's efforts simultaneously led to both motivations but at different extents, as suggested by Salmones and Perez's (2018) study. From a managerial perspective, it is critical to avoid damaging brand attitudes resulting from negative spillover from the scandalized endorser. Therefore, management should carefully consider how to deliver sincerity to consumers so that they can establish value-driven consumer attribution. The findings of this study can provide useful guidelines for crisis management strategies.

References

Chen, Y., & Yang, N. (2023). The effect of corporate donation motive attribution on investors' judgments of future earnings prospects: The moderating role of individual moral orientation. *Journal of Business Ethics, the Environment & Responsibility, 32*(2), 435-453.

Decker, C., & Baade, A. (2016). Consumer perceptions of co-branding alliances: Organizational dissimilarity signals and brand fit. *Journal of Brand Management, 23*, 648-665.

Ellen, P. S., Webb, D. J., & Mohr, L. A. (2006). Building corporate associations: Consumer attributions for corporate socially responsible programs. *Journal of the Academy of Marketing Science, 34*(2), 147-157.

Iveson, A., Hultman, M., Davvetas, V., & Oghazi, P. (2023). Less speed more haste: The effect of crisis response speed and information strategy on the consumer− brand relationship. *Psychology & Marketing, 40*(2), 391-407.

Kelley, H. H. (1973). The processes of causal attribution. *American Psychologist, 28*(2), 107–128.

Kim, S., & Lee, H. (2019). The effect of CSR fit and CSR authenticity on the brand attitude. *Sustainability*, *12*(1), 275.

Marín, L., Cuestas, P. J., & Román, S. (2016). Determinants of consumer attributions of corporate social responsibility. *Journal of Business Ethics, 138*, 247-260.

Salmones, M., & Perez, A. (2018). Effectiveness of CSR advertising: The role of reputation, consumer attributions, and emotions. *Corporate Social Responsibility and Environmental Management, 25*(2), 194-208.

Zasuwa, G. (2019). Do consumers really care about organisational motives behind CSR? The moderating role of trust in the company. *Social Responsibility Journal, 15*(8), 977-991.

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Proceedings

THE IMPACT OF SELF-EXPRESSION THROUGH AVATAR DECORATION BEHAVIOR ON METAVERSE ACTIVITY INTENTION THROUGH PSYCHOLOGICAL IDENTIFICATION AND PLATFORM ENGAGEMENT

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Introduction

As the prominence of virtual space utilization technology continues to rise, the transition towards the Metaverse era—a fusion of virtual and real worlds—is rapidly gaining momentum. Users in the Metaverse engage in social interactions within virtual environments, mediated by avatars. During these interactions, individuals adorn avatars as proxies for self-expression, experiencing a sense of identification with their avatars. This study empirically verifies that psychological identification with avatars influences avatar engagement, subsequently impacting the intention for Metaverse activities, through engagement with the avatar's activity space, the Metaverse platform. By understanding the psychological mechanisms driving user behavior, this research aims to offer insights for practical implementation, particularly in establishing marketing strategies utilizing avatar experiences.

Literature Review

Metaverse users project their real self-image into their avatar customization behaviors, aiming to create avatars with a high resemblance to themselves in reality. However, driven by a desire for idealization, they also freely express a more attractive and idealized version of themselves through their avatars. The level of psychological identification with avatars is determined by the extent to which users project their realistic or idealized self-images onto their avatars. The Metaverse serves as a realm where the limits of reality can be overcome. Within this space, individuals freely utilize avatars as proxies for self-representation, experiencing a sense of avatar-self-identification and a feeling of unity with their avatars. In this study, we adopt a hierarchical approach to the identification theory proposed by Van Looy et al. (2012), wherein avatar decoration behavior is segmented into expressions of realistic self-image and expressions of ideal self-image. Through self-expression via avatar decoration behavior, it is posited that individuals experience avatar-self-identification, characterized by a sense of presence embodied by their avatars. This identification is considered a potential catalyst for immersion in the virtual world and can stimulate continuous participation behaviors (Lee et al., 2021; Shin et al., 2023).

Research Method

The empirical study focused on women in their 20s who customized their avatars using virtual fashion items and engaged with the Metaverse platform using their personalized avatars. After filtering out insincere responses, 110 questionnaires were included in the final analysis. The collected data were analyzed using SPSS 27.0 and AMOS 25.0. Confirmatory factor analysis was conducted to assess the construct validity and reliability of the measurement items comprising the model. This analysis confirmed the robustness of the measurement model, ensuring the validity and reliability of the measurement items for each factor under consideration.

Results & Discussion

The structural equation model to test the hypothesis exhibited satisfactory fit indices: $\chi^2(df=142)=238.217$ ($p<0.000$), NFI=0.848, TLI=0.917, CFI=0.931, RMSEA=0.079. These results indicate that the model fits the data adequately, meeting the criteria for hypothesis testing satisfaction.. The empirical study results are as follows. Firstly, Metaverse users experience enhanced avatar engagement not only when expressing themselves similarly to their actual image but also when portraying their desired ideal image through avatar customization. While realistic self-image expression in avatar decoration behavior has a greater impact on

psychological identification compared to ideal self-image expression, ideal self-image expression has a greater influence on Metaverse platform engagement than realistic self-image expression. Secondly, ideal self-image expression driven by a desire for identification adds a significant direct path to Metaverse platform engagement, serving as an alternative to overcome real-world constraints, enhancing self-esteem, and providing greater entertainment satisfaction as a media platform. Thirdly, psychological identification, where the avatar and oneself are perceived as one, not only influences Metaverse platform engagement but also directly impacts the intention for Metaverse activities, becoming a crucial precursor to induce consumer behavior within the Metaverse. Fourthly, as the sense of engagement with the Metaverse platform strengthens, the intention for Metaverse activities increases, indicating that marketing strategies utilizing the Metaverse can positively influence attitudes toward brands offering virtual items and lead to positive word-of-mouth activities.

Conclusion

Through the empirical study results mentioned above, it has been validated that avatars within the Metaverse enhance immersion and elicit consumer behavioral responses in virtual worlds through avatar customization behaviors using virtual items, which make users feel conscience or desire to identify with their avatars, thus experiencing psychological identification where they perceive themselves as one with their avatars. Consequently, avatars mediated by virtual fashion items offered by numerous fashion brands can serve as tools to stimulate social activities within the Metaverse by not only representing users' real selves but also materializing their ideal selves. Furthermore, immersion experiences in virtual worlds mediated by avatars can lead to positive emotional transfers towards the brands providing such experiences, thus making the Metaverse a useful platform for fostering new communication between brands and consumers.

References

Ahn, K. H., Yoo, C. J., & Kim, S. H. (2004). The study on the structural model of avatar decoration needs, avatar self-identification and site attitude & loyalty. *Journal of Consumer Studies, 15*(2), 19-38.

Lee, Y., Hong, S., & Lee, W. (2021). A Study on the marketing performance of self-character identification and relation internalization in MMOPRPGs. *Journal of Korea Game Society, 21*(2), 111–121.

Van Looy, J., Courtois, C., De Vocht, M., & De Marez, L. (2012). Player identification in online games: Validation of a scale for measuring identification in MMOGs. *Media Psychology, 15*(2), 197–221.

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ANALYZING THE SUSTAINABLE PRACTICES AND STRATEGIES IN FASHION: A CASE STUDY ON KERING

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Introduction

The fashion industry is the second most polluting industry after oil and gas, consuming a significant amount of resources, causing environmental pollution, and generating a large amount of waste (Devic, 2023). Luxury fashion brands, in particular, have faced criticism for their indiscriminate disposal of inventory to drive shifts in fashion trends and tastes. Concerns have been raised regarding their limited commitment to sustainability initiatives, such as inadequate contributions to recycling, reuse, and remanufacturing efforts (Yoo & Lee, 2023). Previous researches on sustainable fashion includes the development of fashion design (Ha, 2023; Heo, 2019; Yim, et. al 2018), ESG strategies of domestic fashion companies (Cho & Seok, 2023), and analysis of sustainable strategies pursued by fashion brands (Kim, 2019; Lee & Ko, 2022; Yoo & Lee, 2023). The fashion industry, being a vast and intricate system, necessitates comprehensive consideration and alternative approaches from a macroscopic standpoint, particularly concerning sustainability. This entails embracing recent concepts, foremost among them being the adoption of the circular economy paradigm. This study aims to examine the sustainable practices and strategies implemented at the corporate level, aligning them with the characteristics of the circular fashion system, and drawing meaningful implications from this analysis. As the focal point of our research, we will investigate the sustainability strategy of the Kering Group. This global luxury fashion company holds the distinction of being the first to establish climate goals that decouple business growth from environmental impacts. The study will encompass the period from 2017 to 2023, a crucial timeframe during which the Kering Group introduced its comprehensive sustainability strategy under the banner of 'Crafting Tomorrow's Luxury'. The research questions of this study aim to analyze Kering Group's sustainability strategy. Firstly, we structure the case analysis framework by considering the EU Strategy for Sustainable and Circular Textiles. Secondly, we analyze Kering Group's sustainability strategy within this framework. Thirdly, we identify problems arising from the strategy and explore their implications.

Literature Review

Luxury is a concept related to scarcity, show-off, and extravagance, and is somewhat distant from the essence of sustainability, which focuses on ethical behavior and responsible consumption of resources (Fiorani, & Gerio, 2022). Fashion, as a phenomenon, is a temporal adoption by consumers that evolves over time, exhibiting temporal popularity and is inherently ephemeral (Bhardwaj & Fairhurst, 2010). Notably, it is distinguished by a rapid pace of change and a brief cycle, allowing it to promptly mirror current trends. The characteristics of the fashion system, defined by rapid shifts and transient consumer preferences, have propelled an accelerated production pace to fulfill the constant demand for novelty. Operating within a linear economy system, the industry traditionally prioritizes the creation of new products over manufacturing cost efficiency considerations. However, as the fashion industry faces problems such as such as excessive natural resource consumption and challenges in waste disposal, it is increasingly turning to sustainable economic models. Among these solutions, the adoption of a circular economy and a closed-loop system stands out as a strategic response to address these pressing concerns. Furthermore, to attain climate neutrality goals, the European Green Deal policy has been introduced, aligning with the UN SDGs (Sustainable Development Goals) that aim to address global social and environmental challenges. This commitment extends to corporate social and environmental initiatives, signifying a multifaceted approach to sustainability in both global and corporate contexts. The EU has incorporated the Strategy for Sustainable and Circular Textiles into its objective of ensuring circularity and sustainability for all textile products in response to climate change. Consequently, numerous companies are embracing ESG strategies and revealing information on ESG aspects to underscore corporate management transparency. As interest in sustainable behavior grows, companies are issuing sustainability reports as official data to promote social responsibility (CSR) activities.

Research Method

The research utilized a mixed-methods approach, with primary data sourced from the Sustainability Progress Report on the official website of the Kering Group. Supplementary data were collected and analyzed through secondary means, including media searches. The EU Strategy for Sustainable and Circular Textiles, endorsed by the EU, served as the theoretical framework for categorizing the sustainability strategy cases within the group. The outcomes highlighted key focus areas, encompassing recycling, reuse, and repair services, the adoption of sustainable materials, minimizing raw material waste, prohibiting product disposal, addressing challenges related to greenwashing, and implementing digitization of product information.

Results & Discussion

The results of analyzing Kering Group's sustainability strategy based on the EU Strategy for Sustainable and Circular Textiles are as follows. First, Kering Group implemented a circular fashion system by producing raw materials through regenerative agriculture, developing waste materials into new resources, and reclaiming products from customers for recycling and re-production. Second, a circular resource model was created by developing sustainable materials such as eco-fibers and vegan leather through a closed-loop system, or by using recycled materials and spinning textile waste into new fabrics. However, products made with sustainable fibers through this method were limited to some capsule collections. Third, it was announced that waste generated after the fashion show would be reused as store and office furniture, but according to Wang (2018), the interior of the Material Innovation Lab or recycling center was not disclosed to the media, so it is not clear whether it will be used or not. Additionally, detailed information regarding the disposal of excess product inventory was not available. Fourth, Kering reported that it achieved its goals for reducing waste and carbon emissions every year. However, according to The Business of Fashion, carbon emissions in 2022 increased by 12% compared to 2021 due to a 15% increase in sales (Kent, 2023). As sales increase, product production increases and carbon emissions increase. There was a fundamental problem that was increasing. Later, in 2023, Kering Group attempted to increase the transparency of its sustainability strategy by setting separate environmental and business growth goals. Fifth, the digitalization of product information is understood to be developing a demand forecasting process model using AI, and production information for some accessories has been provided.

Conclusion

The implications drawn from the case analysis are twofold. Firstly, while the annual sustainability report provides valuable insights into the current strategy, specific goals, and goal achievements, the standards for the numerical targets lack clarity. To avert perceptions of greenwashing, the company refrains from adopting a fully transparent sustainability strategy. However, it's noteworthy that detailed discussions regarding potentially controversial elements are consistently conducted. Secondly, the group is actively investing in startups focused on sustainable materials, establishing systems like demand forecasting programs utilizing AI technology, and recruiting skilled researchers dedicated to sustainable material development. While this approach is feasible for a large company with substantial capital and resources, its implementation presents significant challenges for individual brands or smaller companies due to substantial initial costs. However, since this study was conducted based on the EU Strategy for Sustainable and Circular Textiles, it is limited in its generalizability to the analysis of all sustainability strategies adopted by companies. This study suggests a pressing need for follow-up research to formulate sustainable strategies tailored to small and medium-sized fashion companies.

References

Bhardwaj, V., & Fairhurst, A. (2010). Fast fashion: response to changes in the fashion industry. *The International Review of Retail, Distribution and Consumer Research, 20*(1), 165-173. https://doi.org/10.1080/09593960903498300

Devic, S. (2023, May 2). *Five steps luxury brands can take to become more sustainable.* Forbes. https://www.forbes.com/sites/forbesbusinesscouncil/2023/05/02/five-steps-luxury-brands-can-take-to-become-more-sustanable/?sh=363ae54456c8

Fiorani, G., & Gerio, C. D. (2022). Measuring Sustainability in the Luxury Fashion Sector - A Comparison between LVMH and Kering. *Modern Economy, 13*, 356-369. https://doi.org/10.4236/me.202.1330220

Kent, S. (2023, March 23). *Kering's emissions increased 12 percent in 2022*. The Business of Fashion. https://www.businessoffashion.com/news/sustainability/kering-emissions-target-degrowth/

Kering. (n.d.). *Crafting tomorrow's luxury.* https://www.kering.com/en/sustainability

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EXPLORING THE INFLUENCE OF GEOGRAPHICAL INDICATION AND FAIR TRADE KNOWLEDGE ON PURCHASE INTENTIONS: A BRAND EQUITY PERSPECTIVE IN FAIR TRADE HANDICRAFTS

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Introduction

Handicrafts, rich in tradition and culture, play a vital role in preserving the heritage of countries worldwide, as noted by UNESCO (2022). They are crucial for income and employment in developing countries. However, the rise of counterfeit handicrafts has threatened this sector, prompting discussions on preservation and development of traditional crafts (Basole, 2015). International organizations like WIPO and UNESCO are integrating handicrafts into intellectual property regimes to protect and value artisanal works (WIPO, 2021). Unlike well-capitalized multinational companies, the handicraft sector, primarily small-scale and informal (Basole, 2015), struggles with branding and marketing. This study addresses the gap in understanding the impact of Geographical Indication (GI) and Fair Trade (FT) certifications on consumer perceptions and purchase intentions, focusing on textile and clothing handicrafts due to their unique market and social dynamics (Marcketti and Parsons, 2016) and the significant role of female consumers (Pentecost and Andrews, 2010). It aims to show the benefits of GI certification for fair trade handicrafts and offer insights for market improvements.

Literature Review

Star and Griesemer (1989) introduced the concept of boundary objects, which adapt to the needs of various stakeholders while maintaining a common identity. This theory is applicable to GI certified Fair Trade (FT) textile and clothing handicrafts, where the GI certification serves as a boundary object. It not only signifies the product's authenticity but also aids in distinguishing it from counterfeit goods. Eden (2011) applied this concept to food labels, suggesting that boundary objects like GI labels simplify and communicate the cultural and traditional knowledge embedded in FT handicrafts to consumers. This facilitates consumer recognition of the value of GI certified handicrafts, even with limited information.

Social Learning Theory (SLT), developed by Bandura (1977), posits that behavior results from the interplay between individuals and their environment, encompassing learning through both direct experience and observation. This theory is relevant to consumer behavior in the context of Fair Trade. McGregor (2009) suggests that observing ethical consumption behaviors can influence others. Research by Hunt (2012) and Doherty and Taplin (2008) demonstrates that FT education in schools not only raises awareness about global issues but also influences consumption patterns, leading to increased availability of FT products in mainstream markets.

In developing a Consumer Based Brand Equity (CBBE) model for FT handicrafts, this study focuses on elements like perceived quality, brand awareness, and brand association (Aaker, 1991; Aaker and Keller, 1990). However, brand loyalty is excluded due to the creation of a virtual brand for the experiment. Instead, the model incorporates the perceived uniqueness of FT products (Davies et al., 2010; Nicholls and Opal, 2005) and willingness to pay a price premium (Andorfer and Liebe, 2012; Didier and Lucie, 2008; Loureiro and Lotade, 2005) as key dimensions. The final CBBE model for FT textile and clothing handicrafts thus includes five dimensions: perceived quality (PQ), brand awareness (BA), brand association (BS), uniqueness (UQ), and willingness to pay a price premium (PP). The following hypotheses were developed:

H1*:* GI certification has a positive influence on consumers' perceived quality of FT textile and clothing handicrafts.

H2-H3: GI certification has a positive influence on *brand awareness (brand association)* of FT textile and clothing handicrafts.

H4-H5: GI certification has a positive influence on the uniqueness (on willingness to pay a price premium) of FT textile and clothing handicrafts.

H6-H9: The effect of GI certification on perceived quality (brand awareness, brand association, being willing to pay a price premium) is moderated by FT knowledge.

H10-H14: Perceived quality (Brand awareness, Brand association, Being willing to pay a price premium, Uniqueness) has a positive influence on the purchase intention of FT textile and clothing handicrafts.

Research Method

The experiment was performed in a post-test-only control group design in which the participants first saw the virtual brand images and the stimuli on website and later answered the survey questionnaire. The online survey was conducted for U.S. female consumers by commissioning a survey specialized company, Qualtrics. A total of 239 people participated but, excluding 33 unfaithful responses, the data from 206 participants were collected in in July 2020. The 104 participants viewed the brand website images that included GI stimuli, and the other 102 participants viewed the brand website images without GI. Based on the hypothesized conceptual model presented in this study, a structural model was developed. Structural equation modeling (SEM) was applied as a quantitative statistical method in order to test hypotheses from the structural model. The two-step approach proposed by Anderson and Gerbing (1988) and a bootstrapping approach were followed for SEM performance.

Results & Discussion

The study analyzed the mean difference of latent variables between groups exposed and not exposed to GI, focusing on the impact of GI on five key variables: PQ, BA, BS, UQ, and PP. The model's fit was adequate ($\chi 2 = 459.051$, df = 300, N = 206, $p < .001$; CFI = .955; TLI = .948; RMSEA = .051; SRMR = .048). Of the latent variables, only PP showed a significant difference between the groups ($p = .039$; latent mean = .289), with a medium effect size (Cohen's d = .326). This supported hypothesis H5, while H1, H2, H3, and H4 were rejected. Further analysis indicated a positive influence of the interaction term GI*MC_FTK on PQ and BS, confirming H6 and H8, while H7 and H9 were rejected due to no moderating effect on BA and PP. The structural model assessing the relationship between female consumers' perception of FT handicraft brand equity and purchase intention (PI) also showed acceptable fit ($\chi 2 = 303.612$, df = 141, N = 206, $p < .001$; CFI = .953; TLI = .943; RMSEA = .075; SRMR = .082). BS, PP, and UQ positively influenced PI, while PQ and BA did not. The squared multiple correlation (SMC) for UQ and PP was .327, and .801 for FT handicraft brand equity and PI. The indirect effect of UQ on PI was significant ($p < .01$; B = .368; 95% CI [.252, .521]; $\beta = .362$; 95% CI [.271, .468]), supporting H12, H13, and H14, and rejecting H10 and H11.

Conclusion

This study contributes significantly to understanding the brand equity of Fair Trade textile and apparel handicrafts, presenting a model based on five dimensions of CBBE. It highlights the importance of handicrafts in cultural preservation and employment and uniquely explores brand equity for a virtual FT handicraft brand. The study finds that GI positively influences price premium perception, suggesting its role in enhancing brand value. Furthermore, it underscores the impact of FT knowledge on consumer behavior, emphasizing the need for continuous FT education. Practically, the study guides FT handicraft organizations in brand equity building, especially in the challenging market conditions exacerbated by the Covid-19 pandemic. It suggests prioritizing certain brand equity elements, using storytelling in brand narratives, and promoting FT education to enhance consumer engagement and ethical consumption behaviors.

References

United Nations Educational, Scientific and Cultural Organization. (2022). *Basic texts of the 2003 convention for the safeguarding of the intangible cultural heritage*. Retrieved from https://ich.unesco.org/doc/src/2003_Convention_Basic_Texts-_2022_version-EN.pdf

Basole, A. (2015). Authenticity, innovation, and the geographical indication in an artisanal industry: The case of the Banarasi Sari. *The Journal of World Intellectual Property, 18*(3-4), 127-149. https://doi.org/10.1111/jwip.12035

Marcketti, S. B., & Parsons, J. L. (2016). *Knock it off: A history of design piracy in the US women's ready-to-wear apparel industry*. Texas Tech University Press.

Pentecost, R., & Andrews, L. (2010). Fashion retailing and the bottom line: The effects of generational cohorts, gender, fashion fanship, attitudes, and impulse buying on fashion expenditure. *Journal of Retailing and Consumer Services, 17*(1), 43-52. https://doi.org/10.1016/j.jretconser.2009.09.003

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THE EFFECTS OF INFORMATION MESSAGES AND ATMOSPHERE OF VR FASHION RETAIL SPACES ON ECO-FRIENDLY FASHION CONSUMPTION

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Introduction

VR retail channels, which can recreate an offline store environment vividly without actual resource investment, are also mentioned as tools that don't burden the environment. One significant distinction between 2D online shopping sites and 3D VR mall is the ability to more realistically feel the atmosphere of the store. Especially in the fashion industry, where visual stimulation is crucial, brands aim to communicate their core messages to consumers through retail space. We aim to explore whether the communication approach and environmental atmosphere in 3D VR retail spaces effect on eco-friendly fashion consumption.

Literature Review

VR Fashion Retail Space. Atmospheric cues in retail spaces play a crucial role in determining consumer responses, so fashion retail stores can communicate their environmental efforts with the help of an eco-friendly atmosphere. Bao and Huang (2018) highlighted that positively perceived shopping environments lead consumers to process more information and exhibit more positive behavioral outcomes. Similarly, Luchs et al. (2010) demonstrated that, despite the same product, consumers' intention to use a product showed difference based on the surrounding interior and eco-friendly messaging. In light of this, we speculate that creating an eco-friendly atmosphere in retail spaces can enhance consumers' informational perception of eco-friendly fashion consumption.

Informativeness of Eco-friendly Fashion Consumption (EFC) Messages. The fundamental role of online shopping malls is to provide information about products, services, and brands. The informativeness of messages communicated in online VR stores can be measured in terms of the diversity, reliability, expressiveness, and persuasive aspects of the information (DeLone & McLean, 2003). An et al. (2021) described that the informativeness of VR content can increase the intention to visit VR websites. Shin (2019) argued that the depth and breadth of information are components of immersive informativeness, suggesting that in a VR environment, sensory acceptance of content can be achieved through the depth and breadth of information. Thus, we hypothesize that the perceived informativeness of EFC messages enhances persuasion and ultimately leads to an intention for EFC.

H1: Eco-friendly atmosphere cues in VR fashion stores increase perceived informativeness (a. diversity, b. reliability, c. expressiveness) of the EFC messages.

H2: Perceived informativeness (a. diversity, b. reliability, c. expressiveness) of the EFC messages increases persuasiveness of the messages. And this will lead to improved intention for EFC.

Elaboration Likelihood Model (ELM) and Shopping Motivation. ELM is a dual-process theory that explains two routes through which persuasion can occur: the central route and the peripheral route. For example, consumers tend to use peripheral cues to make decisions and are likely to focus on new or interesting stimulation when their purchase goals are unclear (Kim et al., 2010). Meanwhile, consumers with clearly defined shopping motivations for product purchases are likely to go through a careful information processing process to make optimal decisions (Moe, 2003). Therefore, we thought that shopping mall design elements can easily induce attitude changes in consumers who are not well-prepared for purchases. We aim to investigate whether consumers visiting VR stores with 'exploration' shopping

motivations, not a specific purchase goal, can enhance EFC message processing and behavioral responses through atmospheric cues in the store. <Fig. 1> is showing our research model and hypotheses.

H3: The effect of eco-friendly atmosphere cues in VR fashion stores is greater when consumers' shopping motivation is 'exploration' rather than 'purchase'.
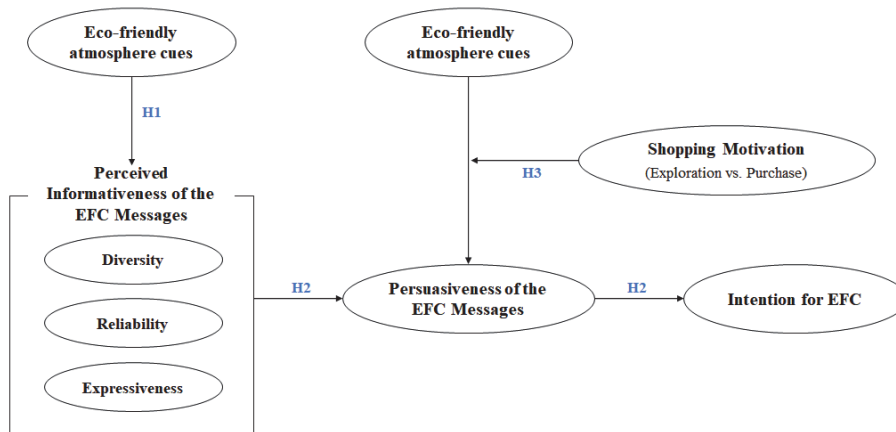
Fig. 1. Research model and hypotheses

Research Method

We recruited Korean fashion consumers in their 20s and 30s through the online research company Embrain. An online experiment and survey were conducted with two shopping motivation framing scenarios (1: Purchase, 2: Explore) and two versions of VR fashion stores with different atmospheric cues (1: Eco-friendly, 2: Modern). Concerned that participants' existing brand attitudes would be involved if using VR stores operated by fashion companies, we created and distributed two new VR stores based on the same items and store structure, with differences only in atmospheric interior elements. Each participant randomly viewed one of the two scenarios and then experienced one of the two VR fashion stores randomly assigned to them. Subsequently, participants responded to survey items on a 7-point Likert scale (1: "Strongly Disagree," 7: "Strongly Agree"). After dropping responses that failed screening and were deemed insincere, 251 responses were used in the final analysis with SPSS 26.0 and AMOS 25.0.

Results & Discussion

This The manipulation checks were successfully confirmed for two shopping motivation priming scenarios (t=-3.024; p=.003) and two versions of the VR fashion store experience (t=3.639; p=.000). Analyzing the mean differences between groups according to the store atmospheric cues using an independent-samples t-test, the group that enjoyed shopping in the eco-friendly design VR store perceived significantly higher informativeness for all three dimensions compared to the group that used the modern design VR store (a: t=4.339, p=.000; b: t=3.750, p=.000; c: t=4.132, p=.000). Thus, *H1* was supported. As presented in <Fig. 2>, structural equation modeling for *H2* showed that the three dimensions of informativeness significantly influenced the persuasiveness of the EFC messages (a: β=.229, p<.000; b: β=.606, p=.000; c: β=.218, p=.007), and the effect of persuasiveness was significant on EFC intention (β=.765, p=.000). Additionally, we performed PROCESS Macro Model 4 to test the mediation of persuasiveness in the relationship between perceived informativeness and EFC intention. The mediation of persuasiveness was significant in the path between all three informativeness dimensions and EFC intention. Finally, one-way ANOVA results showed a significant interacting effect between the eco-friendly store design and shopping motivation on the persuasiveness of the EFC messages (F=7.021; p=.000), supporting *H3*. Therefore, consumers with an 'exploration' shopping motivation, who are likely to focus on peripheral atmospheric cues, increase the perceived persuasiveness of the EFC messages.

Model Fit: X²/df = 1.817, CFI = .977, NFI = .950, RMSEA = .057
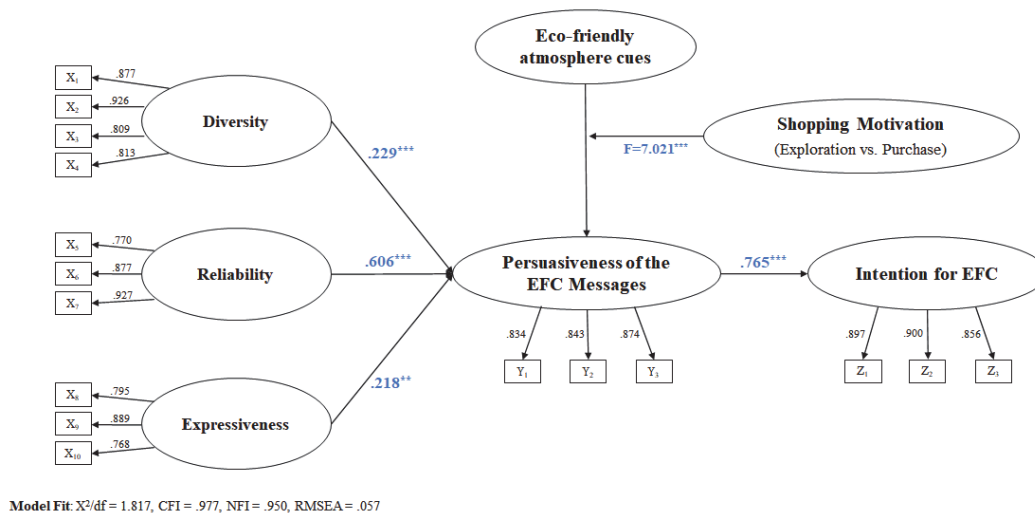
Fig. 2. The analysis results of structural equation modeling and moderation

Conclusion

This study is meaningful as an initial study that identified the informativeness of EFC messages and the influence of atmospheric factors in online VR fashion stores. As the reliability of the EFC messages showed the greatest effect on the persuasion, fashion brands and retailers need to give trust about their environmental sustainability. We presented the research context for the VR fashion store as a retail space effectively giving EFC messages and leading EFC behavior. The eco-friendly atmosphere of VR spaces can amplify the message persuasion to fashion consumers who are exploring the store without specific purchase motivation. Our study suggested to the business academia and industry a new way of the communicating information messages and consequently increasing EFC intentions. Lastly, the participants responded after having enjoyed shopping by directly exploring 3D VR stores. Therefore, this study has the significance of being differentiated from previous research, which has been based on limited contents of existing brands or participants' recall.

References

An, S., Choi, Y., & Lee, C. K. (2021). Virtual travel experience and destination marketing: Effects of sense and information quality on flow and visit intention. *Journal of Destination Marketing and Management, 19*, 100492.

Bao, Z., & Huang, T. (2018). Exploring stickiness intention of B2C online shopping malls. *International Journal of Web Information Systems, 14*(2), 177-192.

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems, 19*(4), 9-30.

Kim, J. U., Kim, W. J., & Park, S. C. (2010). Consumer perceptions on web advertisements and motivation factors to purchase in the online shopping. *Computers in Human Behavior, 26*(5).

Luchs, M. G., Naylor, R. W., Irwin, J. R., & Raghunathan, R. (2010). The sustainability liability: Potential negative effects of ethicality on product preference. *Journal of Marketing, 74*(5).

Moe, W. W. (2003). Buying, searching, or browsing: Differentiating between online shoppers using in-store navigational clickstream. *Journal of Consumer Psychology, 13*(1-2), 29-39.

Shin, D. (2019). How does immersion work in augmented reality games? A user-centric view of immersion and engagement. *Information, Communication and Society, 22*(9), 1212-1229.

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EXPLORING HEDONIC AND UTILITARIAN ASPECTS THROUGH PERCEIVED WARMTH IN HUMAN-DESIGNED VS. AI-GENERATED FASHION

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Introduction

Among various ways in which artificial intelligence (AI) is used in the fashion industry, its utilization in design has sparked public discussion about the potential replacement of human designers by AI. Along with this critical question, it is imminent to examine how consumers would respond to designs by AI. The purpose of this study is to explore consumers' perceptions toward a fashion product labeled as generated by an AI system, comparing it to the same product labeled as designed by a human designer. Specifically, drawing from existing literature, we examine if the design source affects consumers' perceptions of a product to be more hedonic or utilitarian, with perceived warmth as a mediating factor.

Literature Review

There is more studies on the usages of AI as voice assistance and chatbot services compared to design assistance. Nevertheless, the evidence from these studies consistently revolves around the association of AI with the cognitive, utilitarian, and functional aspects of products or services, while human with creative, experiential, and hedonic aspects. For example, a study on consumers acceptance of an AI-driven product recommendation service by Wein and Peluso (2021) showed that when the recommended products were hedonic products, consumers preferred recommendation by humans. In contrast, when the recommended products were utilitarian, the preference for human recommenders disappeared. Similarly, Longoni and Cian (2022) explored the lay belief that AI recommenders exhibit greater competence than human recommenders in utilitarian contexts and less competent in hedonic contexts, and they found ample evidence to support these associations. Zhu et al. (2022) also discovered that consumers preferred receiving assistance from AI chatbots over humans when the task involved objective criteria for searching products, while human assistance was preferred when looking for experiential products. Im et al. (2023) conducted a comparison of the voices of AI assistants and found that consumers favored a synthetic voice when they engaged in functional tasks.

Similar findings emerged in the studies related to design. Xu and Mehta (2022) explored the impact of AI-led design compared to human-led design in different product types. In a situation characterized by high emotional values (i.e., fashion consumption), the utilization of AI as a design source negatively affected consumer outcomes. However, in a situation with high functional values (i.e., cars consumption), the negative impact of AI-led design was reduced. In the design of subscription box services (meal and fashion), Im and Lee (2023) reported that consumers were more inclined to accept recommendations from a human because they perceived a human to be more creative in creating subscription boxes than AI. Likewise, Millet et al. (2023) examined the perceived creativity of an artwork labeled as AI-made versus human-made. Consumers perceived the AI-made labeled artwork to be less creative and preferred it less, while they considered the human-made labeled artwork more creative and preferred it more.

Accordingly, we hypothesize that consumers would perceive a product to be more hedonic if the product is introduced as designed by a human designer, while they would perceive a product to be more utilitarian if introduced as a generated by an AI system. Additionally, this link—the enhanced hedonic (utilitarian) perception driven by a human designer (AI system)—is attributed to the mediator, perceived warmth.

Research Method

Participants were recruited among a panel members of Amazon Mechanical Turk and randomly assigned to one of the two stimuli conditions. In both conditions, participants were presented with the same image of a

black dress that selected from a pre-test. In one condition, the dress was attributed to being designed by a human fashion designer, while in the other, it was stated to be generated by an AI system. Then, participants were asked to respond to bipolar questions assessing the perceived utilitarian or hedonic aspects of the dress, as well as other aspects (i.e., simple-complex, familiar-novel, and plain-creative) for reference. The survey also included questions about perceived warmth and purchase intention of the dress. All items were measured using a seven-point Likert scale. Additionally, an attention check question was incorporated to ensure data quality, and responses that failed to correctly answer the question were excluded. Combining both the human designer condition (n=65) and the AI generated condition (n=65), a total of 130 usable responses were collected. The data was analyzed using SPSS 26.0 for the analysis of variance (ANOVA) and PROCESS procedure for the mediation analysis.

Results & Discussion

ANOVA was conducted with the design source type (Human vs. AI) as an independent variable and utilitarian-hedonic perception of the dress as a dependent variable. The result showed a significant main effect of the design source type ($F(1,133)=10.641$, $p <.01$), indicating that participants perceived a greater hedonic (utilitarian) aspect for the dress designed by human (generated by AI). However, the other perceptions (i.e., simple-complex, familiar-novel, plain-creative) did not differ significantly across the design source types. Next, to investigate the mechanism behind why participants perceived the dress to be more hedonic (utilitarian) for the human-designed (AI-generated) one, a bootstrapping analysis using the PROCESS macro (Model 4, n = 5,000 bootstrap samples) was conducted. The design source type was set as an independent variable (coded 0 for AI, 1 for human), utilitarian-hedonic perception as a dependent variable, and perceived warmth as a mediator. The results revealed that both direct (Effect= .3570, 95% CI = .0073: .7067) and indirect (Effect= .1353, 95% CI = .0140: .2781) effects were significant. When the dress was presented as designed by a human designer (AI system), the more (less) warmth it was perceived, increasing hedonic (utilitarian) perception. These findings suggest that clothing designed by human designers can be perceived as more hedonic compared to those generated by AI, mainly because it was associated with warmth—an aspect of human touch.

Conclusion

These findings contribute to the ongoing discourse on the role of technology in shaping consumer behavior. The observed links between human-designed (AI-generated) products and hedonic (utilitarian) aspects, along with their mediator, perceived warmth, also hold managerial implications. Brands considering the adoption of AI in product design can leverage these findings to identify potential challenges. Strengthening the human touch for hedonic items or emphasizing technological aspects for utilitarian items can be a strategic approach. This strategy can guide risk mitigation strategies and ensure a smoother integration of AI technologies into the market. While this study explored the mediation effect of perceived warmth, future research can investigate other mechanisms driven by AI-generated clothing related to utilitarian aspects such as competence or enhanced technological quality of a product.

References

Im, H., Sung, B., Lee, G., & Kok, K. Q. X. (2023). Let voice assistants sound like a machine: Voice and task type effects on perceived fluency, competence, and consumer attitude. *Computers in Human Behavior, 145*, 107791.

Im, H., & Lee, G. (2023). Do consumers always believe humans create better boxes than AI? The context-dependent role of recommender creativity. *International Journal of Retail & Distribution Management, 51*(8), 1045-1060

Longoni, C., & Cian, L. (2022). Artificial intelligence in utilitarian vs. hedonic contexts: The "word-of-machine" effect. *Journal of Marketing, 86*(1), 91-108.

Millet, K., Buehler, F., Du, G., & Kokkoris, M. D. (2023). Defending humankind: Anthropocentric bias in the appreciation of AI art. *Computers in Human Behavior, 143*, 107707.

Wien, A. H., & Peluso, A. M. (2021). Influence of human versus AI recommenders: The roles of product type and cognitive processes. *Journal of Business Research, 137*, 13-27.

Xu, L., & Mehta, R. (2022). Technology devalues luxury? Exploring consumer responses to AI-designed luxury products. *Journal of the Academy of Marketing Science, 50*(6), 1135-1152.

Zhu, Y., Zhang, J., Wu, J., & Liu, Y. (2022). AI is better when I'm sure: The influence of certainty of needs on consumers' acceptance of AI chatbots. *Journal of Business Research, 150*, 642-652.

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EXPLORING CONSUMER PROFILES IN SOCIAL FASHION RESALE: UNDERSTANDING ENGAGEMENT BEHAVIORS, MOTIVATIONAL DRIVERS AND INNOVATIVENESS IN CIRCULAR AND GENERAL FASHION

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Introduction

The integration of social networking features (e.g., likes, comments, uploads) into fashion resale platforms is reshaping consumer interactions, transforming mere transactions into active engagement and blending commerce with social networking. Despite the need to explore these varied behaviors, research often overlooks this nuanced landscape. Our study aims to bridge this gap by examining consumer profiles in Social Fashion Resale Marketplaces (SFRMs), with a focus on consumer engagement (CE), motivational drivers, and fashion innovativeness in both circular and general contexts. Identifying the key determinants of high engagement, we offer academic and strategic insights to bolster user participation.

Literature Review

This study considered content consumption and creation as key CE dimensions, per Puligadda et al. (2021). We further integrated advocacy (Dessart et al., 2016), social connection (Vivek et al., 2014), and purchase engagement (Kumar & Pansari, 2016) to highlight the roles of endorsing secondhand fashion transactions and user interactions. Motivations guide user behaviors, with SFRM motivations covering financial gains, recognition (Hamari et al., 2016), learning, and altruism (Abhari et al., 2019). Circular Fashion Innovativeness (CFI) and Fashion Innovativeness (FI) were integrated into consumer profiling, where CFI addresses circular practices in fashion lifecycles, and FI the early adoption of new trends (Goldsmith & Hofacker, 1991), emphasizing the significant influence of a consumer's circular practices and trend adoption.

Research Method

A survey was conducted via Dynata, targeting 406 American adults, both men and women, who had experience participating in SFRMs (e.g., Depop). We measured CE (Van der Shee et al., 2020), participation motivations (Abhari et al., 2019), FI (Goldsmith & Hofacker, 1991), CFI (Maitre-Ekern & Dalhammar, 2019), and demographic characteristics. Items were modified by researchers as necessary and measured using a seven-point Likert scale (1: strongly disagree, 7: strongly agree). The analysis utilized data from 406 responses after the removal of insincere answers.

Results & Discussion

Cluster analysis of CE dimensions—advocacy, purchase engagement, content creation and consumption, social connection—revealed four user groups: 'Circular Fashion Advocators,' 'Circular Fashion Networkers,' 'Dedicated Influencers,' and 'Detachers.' 'Circular Fashion Advocators' prioritize financial benefits and altruism, focusing on trading products with minimal content interaction and practicing innovative disposal. 'Circular Fashion Networkers,' driven by altruism and recognition, engage actively in content dynamics but less in circular fashion practices, favoring networking over trendsetting. 'Dedicated Influencers' are highly engaged across all dimensions of CE, leading in trends and circular practices through a blend of financial motivation, learning, recognition, and altruism, significantly enriching SFRMs. 'Detachers' display minimal engagement, with the lowest scores in both circular and fashion innovativeness.

Table 1. Cluster analysis

Variables		Group 1 (n=77)	Group2 (n=115)	Group3 (n=60)	Group4 (n=154)	F value
		Detacher	Dedicated Influencer	Circular Fashion Advocator	Circular Fashion Networker	
Advocating		3.126C	6.087A	5.989A	4.678B	182.117***
Purchase engagement		2.442D	6.058A	5.092B	4.183C	241.149***
Content Creation		1.528D	5.976A	2.311C	4.180B	599.820***
Content consumption		2.117D	6.089A	4.261C	4.594B	293.271***
Social connection		1.812C	5.945A	3.958B	4.065B	299.688***
Platform usage motivation	Financial Gain	5.221B	6.067A	6.050A	4.913B	25.916***
	Learning	5.182B	6.146A	6.000A	4.904B	25.772***
	Recognition	1.675D	5.623A	2.975C	4.026B	175.453***
	Altruism	3.221C	5.963A	4.472B	4.359B	92.285***
FI		3.179C	5.696A	4.207B	4.459B	92.276***
CFI	Disposal	4.273B	5.854A	5.483A	4.613B	35.274***
	Purchase	2.974C	5.711A	4.158B	4.304B	85.149***
	Use	3.909D	5.770A	5.175B	4.557C	40.487***

***p<.001

Conclusion

This study segmented SFRM users into four groups based on their CE, highlighting diverse motivations and fashion tendencies. Contrast with Detachers, Dedicated Influencers, as trendsetters, are highly engaged in circular fashion consumption. Circular Fashion Advocates emphasize trading for financial and altruistic reasons, using innovative disposal. Circular Fashion Networkers, motivated by recognition and altruism, are active in content but less so in innovation. Recognition and altruism are key differentiators among these groups, shedding light on the intricate relationship between CE, CFI, and FI in SFRMs. These findings inform targeted strategies to boost engagement and support circular fashion.

References

Abhari, K., Davidson, E. J., & Xiao, B. (2020). Modeling social product development process, technology, and governance. *IEEE Transactions on Engineering Management, 69*(2), 409-422.

Dessart, L., Veloutsou, C., & Morgan-Thomas, A. (2016). Capturing consumer engagement: duality, dimensionality and measurement. *Journal of Marketing Management, 32*(5-6), 399-426.

Goldsmith, R. E., & Hofacker, C. F. (1991). Measuring consumer innovativeness. *Journal of the Academy of Marketing Science, 19*, 209-221.

Hamari, J., Sjöklint, M., & Ukkonen, A. (2016). The sharing economy: Why people participate in collaborative consumption. *Journal of the Association for Information Science and Technology, 67*(9), 2047-2059.

Kumar, V., & Pansari, A. (2016). Competitive advantage through engagement. *Journal of Marketing Research, 53*(4), 497-514.

Maitre-Ekern, E., & Dalhammar, C. (2019). Towards a hierarchy of consumption behaviour in the circular economy. *Maastricht Journal of European and Comparative Law, 26*(3), 394-420.

Puligadda, S., Coyle, J. R., & Ni, J. (2021). Are you engaged? The influence of brand schematicity on online brand engagement and brand purchase. *Journal of Research in Interactive Marketing, 15*(4), 709-728.

Van Doorn et al. (2010) Van Doorn, J., Lemon, K. N., Mittal, V., Nass, S., Pick, D., Pirner, P., & Verhoef, P. C. (2010). Customer engagement behavior: Theoretical foundations and research directions. *Journal*

of Service Research, 13(3), 253-266.

Vivek, S. D., Beatty, S. E., Dalela, V., & Morgan, R. M. (2014). A generalized multidimensional scale for measuring customer engagement. *Journal of Marketing Theory and Practice, 22*(4), 401-420.

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KOREAN ATHLEISURE BRANDS' INTERNATIONALIZATION: A CASE STUDY OF XEXYMIX, ANDAR, AND MULAWEAR

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Introduction

Athleisure, a blend of "athletic" and leisure", represents a fashion that is equally appropriate for exercise and everyday wear. The Korean athleisure market grew from 1.5 trillion won in 2016 to nearly double by 2020 (Seo, 2023). Grand View Research (2023) forecasts the global athleisure market to expand at a compound annual growth rate of 9.1% from 2023 to 2030. This projection indicates that athleisure is evolving from a fleeting pandemic-driven trend into a consistently growing segment of the fashion industry. The Korean athleisure 'Big 3' brands – Xexymix, Andar, and Mulawear – have expanded their market reach, extending from Asia to Western countries (Seo, 2023). Despite this growth, there is a notable lack of academic research on the internationalization patterns and strategies adopted by these Korean athleisure companies. Therefore, this study aims to analyze and compare three representative Korean athleisure brands' (Xexymix, Andar, and Mulawear) internationalization patterns and foreign market entry strategies, based on internationalization theories. The analysis will include an assessment of the strengths and weaknesses of their strategies. Through this, this study intends to provide strategic insights for other Korean athleisure brands considering entry into international markets.

Theoretical Framework and Research Questions

Johanson & Vahlne's (1977) Stages Theory explains the internationalization patterns of brands as initially entering into countries with geographical and cultural proximity. This allows them to accumulate experiential knowledge before venturing into countries with more pronounced cultural differences. In the Stages Theory, *Risk Management* is considered a key element, as it manages risk under conditions of uncertainty (Clarke & Liesch, 2017). A proper risk management process allows brands to decide with minimized risk, which is their ultimate goal. According to the Stages Theory and Risk Management Theory, therefore, fashion brands often choose close countries that offer minimum risks, and then expand to further countries after building experiential knowledge.

Foreign Market Entry Modes refer to an organizational framework that enables the international transfer of a firm's products, technological capabilities, managerial practices, and additional resources (Robles et al., 1988). Robles et al. (1988) outlined traditional approaches for international market entry, including exporting, licensing, franchising, establishing joint ventures, and creating wholly owned subsidiaries. However, with the rapid global expansion of companies, a trend of entering international markets through online channels has emerged (Jin & Cedrola, 2016). The concept of *Cross Border E-Commerce (CBEC)* explains this digitalized foreign market entry mode.

Dunning's (1980) *Eclectic Theory (or OLI model)* provides a framework for assessing the strengths and weaknesses of multinational brands' internationalization strategies. This theory posits that a firm's entry into a foreign market relies on three key factors. Ownership Advantages (O) refer to a firm's unique competitive strengths, while Locational Advantages (L) encompass the specific attributes of a country relevant to the market entry under consideration. Lastly, Internalization Advantages (I) signify a company's capabilities to internalize strategies within the company (Dunning, 1980).

Based on these, this study explores Korean athleisure brands' (Xexymix, Andar, and Mulawear) internationalization patterns and entry modes, and analyzes the strengths and weaknesses of their strategies via the following research questions: RQ1: Based on the Stages Theory and Risk Management Theory, what are the internationalization patterns of Korean athleisure brands (Xexymix, Andar, and Mulawear)?; RQ2: What are the foreign market entry modes of Korean athleisure brands (Xexymix, Andar, and Mulawear)?; RQ3: Based on the OLI model, what are the strengths and weaknesses of Korean athleisure brands' (Xexymix, Andar, and Mulawear) internationalization strategies?

Research Method

This study adopted a case study method. The three brands (Xexymix, Andar, and Mulawear) were selected by the following procedure. First, industry reports call these brands the top three brands accounting for over 30% of the Korean athleisure market (Seo, 2023). Second, this selection was verified via text mining, gathering data with the keyword 'Korean athleisure brands' from Google and Naver from January 1, 2020, to November 2, 2023, using Textom. The result confirmed that the three brands are the most frequently mentioned Korean athleisure brands. For data analysis, information on each brand's year and location of foreign market entries, entry modes, and strategies were collected from secondary sources such as the brands' official websites and news articles. Data were analyzed by three researchers who independently reviewed the data and then combined the results through interactive discussion, and then the fourth researcher reviewed the results to ensure objectivity.

Results, Discussion, and Conclusion

Figures 1, 2, and 3 present the three brands' internationalization patterns and the year and entry modes for each country. First, regarding RQ1, apart from Andar and Mulawear initially venturing into the American market, all three brands began their internationalization from geographically and culturally proximate Asian countries, consistent with the Stages Theory and Risk Management Theory (Pattern 1). They all used pop-up stores, events, and online platforms to understand new markets with minimized risks, supporting the theories. Xexymix followed the conventional theories more closely in its expansion strategy (Pattern 2-1), whereas Andar and Mulawear initially diverged by targeting the North American market (Pattern 2-2). Following setbacks in North America, they appeared to realign with the traditional theories by expanding into neighboring East Asian countries (Pattern 3).

Figure 1. Xyemix's internationalization Pattern & Entry Mode
The total number of countries where Xyemix has broadened its market reach is 55, however, countries for which the exact year of entry could not be accurately determined have been excluded from this table.
The lightest gray bars in the table represent the initial entry period for each country.
*Wholly owned subsidiary -> Owned   *Cross Border E-Commerce -> CBEC

Figure 2. Andar's internationalization Pattern & Entry Mode
The lightest gray bars in the table represent the initial entry period for each country.
*In early 2022, Andar, which entered the U.S. market, temporarily suspended after just one year.

Figure 3. Mulawear's internationalization Pattern & Entry Mode
The lightest gray bars in the table represent the initial entry period for each country.
*In October 2021, Mulawear, which entered the U.S. market, temporarily suspended after two years.

For RQ2, the three brands utilized a hybrid approach of subsidiaries, exports, and CBEC. Xexymix mainly used subsidiaries and exports, recently incorporating CBEC. In contrast, Andar and Mulawear initially focused on CBEC, later integrating subsidiaries. This strategy reflects a response to the rapid rise in online markets, showing cost-effectiveness and direct consumer reach. They also attempted to create strategic synergy by combining online and offline channels, enhancing customer experiences. For RQ3, Xexymix and Andar took ownership advantages with their parent companies that possess multinational experiences. They also leveraged geographic proximity by focusing on Asian markets, employing locational advantages. All three brands enhanced the stability of product distribution by establishing their own distribution systems, taking internalization advantages. However, Andar and Mulawear's failure in the U.S. market due to their lack of understanding of the market emerged as a weakness.

In conclusion, this study analyzed Korean athleisure brands' (Xexymix, Andar, and Mulawear) internationalization based on the established internationalization theories, by providing useful resources about the common patterns, entry modes, and their success/failure factors to the literature. The findings also offer Korean athleisure brands an understanding of their own patterns and success/failure factors aiding the formulation of effective global market strategies in the future. Additionally, the findings provide practical implications for athleisure and other sportswear brands seeking international expansion. In future research, it is essential to utilize text-mining techniques to convert data obtained

from case studies into organized information. This approach will facilitate the quantitative understanding of patterns and allow the systematic tracking of individual businesses.

References

Clarke, J. E., & Liesch. P. W. (2017). Wait-and-see strategy: Risk management in the internationalization process model. *Journal of International Business Studies, 48*, 923-940.

Dunning, J. H. (198). Toward an eclectic theory of international production: Some empirical tests. *Journal of International Business Studies, 11*(1), 9-31.

Grand View Research. (2023, January 18). Athleisure market size, share, Growth & Trends Report, 2030. *Market Analysis Report.* Retrieved from https://www.grandviewresearch.com/industry-analysisathleisure-market

Jin, B., & Cedrola, E. (2016). Overview of fashion brand internationalization: Theories and trends. Fashion Brand Internationalization, 1-30. https://doi.org/10.1057/978-1-137-52337-2_1

Johanson, J., & Vahlne, J.-E. (1977). The internationalization process of the firm-a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies, 8*(1), 23-32.

Robles, F., El-Ansary, A., & Root, F. R. (1988). Entry strategies for international markets. Journal of Marketing, 52(4), 128. https://doi.org/10.2307/1251639

Seo, B. (2023, July 22). '1,000 cho-won market'…Big 3 athleisure brands looking at foreign markets. E-News Today. Retrieved from https://www.enewstoday.co.kr/news/articleView.html?idxno=2021902

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DEFYING THE DISPOSABLE CULTURE:
THE CASE OF MENSTRUAL UNDERWEAR

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Introduction

In recent years, there has been a growing interest in the market for alternative menstrual hygiene products (e.g., menstrual cups, reusable pads, and menstrual underwear) that provides an innovative and sustainable alternative to the disposable feminine hygiene products (e.g. tampons, pads). The most stylish of emerging reusable products are menstrual underwear, or period-proof underwear, a standalone absorbent or "complementary to tampons, menstrual cups or pads" (VanLeeuwen & Torondel, 2018). The global menstrual underwear market was $241.6 million in 2022 and was valued at $385 million in 2023 (Global Market Insight, 2022). However, while the industry sees growth in consumer acceptance, its impact is still minimal compared to the sales made by conventional disposable feminine hygiene products. Therefore, this study aims to study the consumer perception, acceptance, and adoption of menstrual underwear as it provides a sustainable option to the current feminine hygiene management solutions widely used in the consumer market in the U.S. Employing a longitudinal qualitative research design, researchers explore the social-psychological effect the usage of the underwear will have on consumer adoption, in addition to the functional aspect of the underwear.

Literature Review

Commercially produced disposable pads and tampons have made managing periods easier but have contributed greatly to the global issue of menstrual waste. When improperly disposed of, plastic and chemical makeup in disposable feminine hygiene products can disrupt our ecosystem (Mercola, 2013). Even if disposed in the trash properly, these non-biodegradable, plastic products end up in our landfills requiring about 500-800 years to decompose (Mehrotra, 2018), which contributes to the pollution of the eco-system. Further, embarrassment over having a period leads most women to think less about the environment. While 97% of women expressed concern towards the environment in a U.S. study, 85% admitted to ignoring the harmful environmental repercussions of improperly disposing of sanitary products, flushing them down the toilet so others wouldn't see them in the trash (Siebert, 2018). 38% of women would dispose of their tampons in the toilet if at a partner's house or at work (Siebert, 2018). These issues have received both increased scrutiny and awareness towards the environmental, economic, and social impact of menstruation.

Research Method

This study employed a three-step approach with purposive sampling. At the beginning of the study, 42 participants were enrolled but only 37 were able to fully participate. Initially, a pre-usage, semi-structured interview was conducted to learn the participants' opinions on menstrual management and sustainable living. The purpose of the pre-usage interview was to identify if the participants were aware of the option of the menstrual underwear and if so, how they felt about it. In the second step, participants were sent one menstrual underwear to be used during their period for the following two months. They recorded their experience based on specific guidelines that were later used for qualitative data analysis. The exploratory nature of the second step allowed the researchers to collect information on the immediate thoughts and emotions during usage. This process also lets participants discuss the barriers that may prevent them from buying and using menstrual underwear. The last step was an after-usage interview following up on the overall exposure and experience with the product. Data collected were analyzed through transcribing audio data, memoing, identifying patterns, words, and phrases of commonality amongst the participants. Based on the Grounded Theory approach, the data were coded into themes that emerged.

Results & Discussion

Alternative Hedonism and Female Empowerment Alternative hedonism is the pursuit and enjoyment of pleasures with less emphasis on consumption (Syse & Mueller, 2014). The concept of alternative hedonism identifies self-interested motivations for less environmentally destructive practices, as well as the altruistic motives commonly associated with green and ethical consumption (Soper & Thomas, 2006). Interviewees expressed a conscious concern for the environment mentioning phrases such as "eco-friendly", "unnecessary chemicals", and "help cut down on pollution". Menstrual underwear not only provides an environmentally friendly solution for conscious consumers but can also improve the overall mental and physical health of the user. Participants often noted that they feel different when menstruating such as having low confidence and low self-esteem. Presented in participant journals and their post-usage interviews, while wearing the menstrual underwear, they "felt secure," "protected," and more confident during menstruation. This aspect of menstrual underwear induced more positive attitudes after usage.

Utilitarian Benefit Most participants believed managing periods are expensive. A few participants were unaware of their spending habits and expressed disbelief. More than half of the participants were unaware of the existence of menstrual underwear but keywords common amongst their opinions of perceived benefits were cost savings, reusability, and waste reduction.

Moral Decoupling Overall, the findings revealed contradicting responses between the subject's attitudes and behavior towards the environment. It is interesting to note that behavior was more selective when the action satisfies personal interest, indicating the process of moral decoupling. For example, one participant agreed that there is a concern regarding the disposal method and its impact on the environment but felt it necessary to continue using tampons and pads to manage menstruation. Concurrently, this individual has justified her behavior by buying a tumbler to reduce plastic straw waste that may disrupt the marine environment and harm turtles.

Functional Risk: Responses from the pre-usage and usage stages of the study revealed that the perceived risks of menstrual underwear common amongst participants include functional risks concerning absorbency levels, leakage, the weight of the product, odor, quantity, and hygiene. Further subjects mentioned that the underwear was "weird" and "bulky" which contributed to her negative opinion of the product. This leads to social risk, where participants were concerned with how they would look in the menstrual underwear.

Stigma: Participants also noted that "sitting on their own blood" is not what they'd like to do. The interview further revealed that, the tampon users would rather try menstrual cups than menstrual panties. In addition, the cleaning process also posed a challenge as they noted that "the idea of touching blood is unbearable."

Social Approval: Interestingly, participants repeatedly mention their mothers or sisters as one of the critical influencers of the menstrual hygiene management. The interview results reveal that the choice of the first menstrual product was heavily dependent upon the advice of their female family members and the participants hardly explored other options.

Conclusion

While there is a growing popularity for menstrual underwear in Western industrialized countries, there is a lack of empirical evidence examining the acceptance and potential usage of the product in the U.S. (VanLeeuwen & Torondel, 2018). Further, prior studies on female hygiene management provided limited implication in its research design as they did not allow the participants to fully experience the product. As this study allowed participants to experience the product during their period, the study was able to record the true psychological and physiological responses from the participants. Lastly, this study raises awareness on the impact of disposable feminine hygiene products and how reusable underwear can help reduce cost and waste.

References

Global Market Insight (2022). Period Panties Market Size. Retrieved from https://www.gminsights.com/industry-analysis/period-panties-market

Mehrotra, A. (2018). Sustainable menstruation-The impact of menstrual products on the environment. Retrieved from https://medium.com/one-future/sustainable-menstruation-the-environmental-impact-of-menstrual-products-eba30e095cda

Mercola, J. (2013). Women Beware: Most Feminine Hygiene Products Contain Toxic Ingredients. Retrieved from https://www.huffpost.com/entry/feminine-hygiene-products_b_3359581

Siebert, V. (2018). Nearly half of women have experienced 'period shaming'. Retrieved from https://nypost.com/2018/01/03/nearly-half-of-women-have-experienced-period-shaming/

Soper, K., & Thomas, L. (2006). Alternative Hedonism: a theory and politics of consumption. London. Retrieved from http://www.consume.bbk.ac.uk/researchfindings/althedonism.pdf

Syse, K., & Mueller, M. (2014). Sustainable Consumption and the Good Life: Interdisciplinary Perspectives. New York: Routledge.

VanLeeuwen, C., & Torondel, B. (2018). Exploring menstrual practices and potential acceptability of reusable menstrual underwear among a Middle Eastern population living in a refugee setting. International journal of women's health, 10, 349-360. doi:10.2147/IJWH.S152483

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MATERIAL MATTERS: UNVEILING CONSUMER RESPONSES TO VEGAN FAUX FUR AND LEATHER IN FASHION ADVERTISING

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Introduction

This study examines consumer responses to fashion advertising featuring vegan bags derived from different vegan materials, focusing specifically on faux fur and faux leather. Veganism has emerged as a prominent consumer trend to support environmental sustainability and ethical consumerism, and it advocates animal welfare and rejects items that are generated from or tested on animals (Yoh, 2018). Although previous studies have explored how consumers react to vegan fashion items from comprehensive viewpoints (Gheihman, 2021; Jeong & Chun, 2021; Kim & Kwon, 2016; Yoh, 2018), there is a noticeable dearth of research investigating the influence of certain vegan materials on consumer responses. This oversight is significant considering the crucial role that materials play in the fashion industry. In order to address this gap, we analyze the impact of different vegan material types (faux fur vs. faux leather) and the perceived level of falsity in these materials (low vs. high) on consumer responses by employing an experimental methodology that incorporates four distinct research stimuli. We expect that the findings of this study would provide valuable insights into innovative marketing approaches for promoting sustainable fashion and enhance scholarly discussions in the fashion and textiles discipline, emphasizing the imperative to align with consumer preferences.

Literature Review

In the realm of fashion, vegan consumers, who avoid purchasing and using animal-based materials such as natural fur and leather, are increasingly opting for fashion items that use vegan materials, thanks to advancements in textile technology (Minh & Ngan, 2021). The evolution of textile technologies has ushered in vegan materials that replicate the tactile and visual characteristics of natural substances so closely that they often defy differentiation from their genuine counterparts. Furthermore, the spectrum of vegan materials now spans from fur, directly linked to animal cruelty, to leather, which bears a less direct connection (Heo & Shin, 2020). However, the literature has yet to fully explore consumer reactions to vegan materials according to those types and levels of falsity. Notably, the differential consumer responses to vegan bags—a fashion item with heightened visibility and a significant role in symbolizing the social status of users—contingent upon various vegan materials remain underexplored (Song & Kaijun, 2023). Therefore, this study aims to delve into consumer responses to vegan bags according to the types of materials (faux fur vs. faux leather) and the degrees of falsity (low vs. high). Accordingly, we propose the following hypotheses:

H1a-d: The impact of vegan material type (faux fur, associated with the lower level of social status symbolism, vs. faux leather, associated with the higher level of social status symbolism) in fashion advertising featuring vegan bags on consumer responses—including (a) advertising attitude, (b) product attitude, (c) purchase intention, and (d) word-of-mouth intention—will be influenced by the perceived falsity (low vs. high) of the materials applied in the vegan bags.

H2a-b: The interaction effect between vegan material types (faux fur vs. faux leather) and the perceived falsity (low vs. high) of the materials in fashion advertising featuring vegan bags will impact consumer responses—namely, (a) purchase intention and (b) word-of-mouth intention—through the mediation effects of advertising attitude and product attitude.

Research Method

Data were gathered using a 2x2 between subject design, contrasting two types of vegan materials with distinct social status symbolism (faux fur vs. faux leather) and two levels of perceived falsity (low vs. high), resulting in four research stimuli centered around fashion advertisements for vegan bags. A pretest was conducted with 141 US women (83.7% white) through an online platform, CloudResearch, utilizing a 7-point Likert scale. This test confirmed that leather bags were perceived to carry a higher social status compared to fur bags ($M_{fur\ bag}$=3.655, $SD_{fur\ bag}$=2.042 vs. $M_{leather\ bag}$=4.748, $SD_{leather\ bag}$=1.605, $t(140)$=-8.271, p<.001). In addition, the pretest validated the manipulation of falsity levels (for faux fur bags: $M_{falsity\_low}$=4.761, $SD_{falsity\_low}$=1.767 vs. $M_{falsity\_high}$=5.376, $SD_{falsity\_high}$=1.509, $t(140)$=5.423, p<.001; for faux leather bags: $M_{falsity\_low}$=3.364, $SD_{falsity\_low}$=1.953 vs. $M_{falsity\_high}$=4.787, $SD_{falsity\_high}$=1.730, $t(140)$=9.833, p<.001). Following the verification of the stimuli, hypothesis testing was carried out. An online survey was administered to 487 US women (M_{age}=41.32, SD_{age}=12.452, 80.5% white) via CloudResearch. Participants were randomly assigned to one of the four stimuli ($n_{fur\_low\ falsity}$=113, $n_{fur\_high\ falsity}$=132, $n_{leather\_low\ falsity}$=126, $n_{leather\_high\ falsity}$=116). The collected data were analyzed through ANCOVA and SPSS Process MACRO Model 8, and fashion involvement was applied as a covariate in all analyses.

Results & Discussion

Four series of ANVOVAs were conducted to test hypotheses H1a to Had. For advertising attitude (H1a), a 2×2 between-subjects ANCOVA (F=19.439, p<.001, R^2=.139) revealed a significant interaction effect ($F(1,482)$=12.162, p<.001; $M_{fur\_low\ falsity}$=3.699, $M_{fur\_high\ falsity}$=4.155; $M_{leather\_low\ falsity}$=5.137, $M_{leather\_high\ falsity}$=4.407), after controlling for fashion involvement (p<.001). The main effect of the types of materials was significant ($F(1,482)$ =26.227, p<.001), but not for the perceived level of falsity. Similarly, the ANCOVA for product attitude (H1b; F=18.842, p<.001, R^2=.135; controlling for fashion involvement, p<.001) demonstrated a significant interaction effect ($F(1,482)$=10.152, p<.01), with faux leather bags with low falsity eliciting more favorable product attitude than those with high falsity ($M_{leather\_low\ falsity}$=5.389, $M_{leather\_high\ falsity}$=4.526), whereas faux fur bags showed the opposite results ($M_{fur\_low\ falsity}$=3.971, $M_{fur\_high\ falsity}$=4.227). Regarding purchase intention (H1c), a 2x2 ANCOVA (F=21.085, p<.001, R^2=.149; with fashion involvement being significant; p<.001) indicated a higher purchase intention for faux leather bags compared to faux fur bags ($F(1,482)$ =26.325, p<.001). However, no significant main effect of the level of falsity and the interaction effect were observed. In terms of word-of-mouth intention (H1d), a 2x2 ANCOVA (F=14.372, p<.001, R^2=.107; controlling for fashion involvement, p<.001) confirmed a significant interaction effect ($F(1,482)$=5.342, p<.05; $M_{fur\_low\ falsity}$=3.504, $M_{fur\_high\ falsity}$=3.843; $M_{leather\_low\ falsity}$=4.558, $M_{leather\_high\ falsity}$=4.040), with a significant main effect for the types of material (F(1, 482) = 12.471, p < .001) but not for the levels of falsity. Subsequently, hypothesis 2 was examined using SPSS Process MACRO Model 8, which confirmed that advertising attitude and product attitude fully mediate the relationship between the type of vegan materials applied to vegan bags in fashion advertising and both purchase intention and word-of-mouth intention. Furthermore, the impacts of vegan material types on advertising attitude and product attitude were found to be moderated by the perceived falsity of the materials. Specifically, for faux fur bags, an increase in perceived falsity significantly enhanced advertising attitude and product attitude, whereas for faux leather bags, a higher level of perceived falsity led to reduced increases in these aptitudes.

Conclusion

This study verified distinct consumer responses towards vegan faux fur and leather, influenced by their associated social status symbolism and levels of perceived material falsity. Notably, vegan faux leather's appeal diminishes with increased perceived falsity, unlike vegan faux fur, where higher falsity enhances favorable consumer responses. These insights highlight the complex interplay between ethical considerations and social perceptions in consumer decision-making. The study's mediation analysis further underscores the pivotal role of advertising and product attitudes in driving purchase intentions and word-of-mouth intention, with material authenticity emerging as a critical factor. These results offer valuable implications for sustainable fashion marketing, suggesting that aligning advertising strategies with

consumer expectations of authenticity and ethical values can significantly influence consumer engagement with vegan fashion products.

References
Gheihman, N. (2021). Veganism as a lifestyle movement. *Sociology Compass, 15*(5), 1–14.

Heo, S. M., & Shin, H.-J. (2020). Research trend and product development potential of non-animal leather. *Korean Society for Biotechnology and Bioengineering Journal, 35*(4), 281–287.

Jeong, J., & Chun, J. (2021). Veganism Represented in YouTube Fashion Contents. *Fashion & Textile Research Journal, 23*(1), 44–56.

Kim, Y. J., & Kwon, Y. J. (2016). Is ethical consumption altruistic or egoistic? Consumer culture of wearing faux fur. *Journal of the Korean Society of Costume, 66*(7), 17–33.

Minh, N. T., & Ngan, H. N. (2021). Vegan leather: An eco-friendly material for sustainable fashion towards environmental awareness. *1st Van Lang International Conference on Heritage and Technology Conference Proceeding*, 1–8.

Song, C.-M., & Kaijun, L. (2023). Differentiation strategy of luxury brands through semi-symbolic system composition of materials: Comparative study of Prada and MiuMiu. *Semiotic Inquiry, 74*, 91–117.

Yoh, E. (2018). Determinants of purchase intention for vegan fashion products - Application of the modified planned behavior model. *The Research Journal of Costume Culture, 26*(2), 125–139.

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UNDERSTANDING CHANGES IN US CONSUMERS' APPAREL SHOPPING BEHAVIOR IN THE POST COVID-19 USING SEMANTIC NETWORK ANALYSIS

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Introduction

Over time, the economy of a given country experiences events that can generate structural changes in their economy and in the behaviors of its consumers. The United States (US) has been experiencing economic turbulence from the COVID-19 pandemic, and it appears that the pandemic is causing systemic changes in the US economy, resulting in consumer behavior changes. To develop effective strategies and operations, marketers need to identify and understand when changes occur in consumers' behaviors. Therefore, given the pandemic, it is important for marketers to determine if consumer psychological and sociological changes are occurring that could alter consumers' shopping behaviors. The current research examines potential changes in the US consumers' apparel shopping behaviors resulting from COVID-19 by listening to their own voices and applying semantic network analysis. With the disruptions to the economy generated by the pandemic, research is needed to examine the effects of the pandemic on consumers' behaviors. This study will provide valuable insights for the fashion retailers to formulate strategies not only domestically but also for international markets.

Literature Review

Natural disasters including hurricanes, tornadoes, wildfires, and floods we expect each year, have resulted a recession in economic activity and changes in consumers' utilitarian and hedonic shopping motives both during and after the natural events (Larson & Shin, 2018). Utilitarian consumption reasons include replenishing necessities and replacing items damaged by natural tragedies while hedonic motivations comprise the pursuit of freedom, defying boredom, and celebrating the end of disasters and rekindling with family and friends (Larson & Shin 2018). Research conducted post-Hurricane Katrina (United States 2005) indicates that consumer behaviors changed both during the immediate transition after the storm and years later (Kennett-Hensel et al., 2012). Results suggest that increased buying demonstrated immediately after the event was followed by decreased consumption in the long-term; with some respondents indicating they were no longer less likely to overconsume, and more cautious in their choices. The Great Recession resulted in behavioral and attitudinal changes. Spending was decreased; less expensive brands were acquired; concern for the carbon footprint increased as did environmental consciousness; society had grown intellectually lazy (Etzioni 2011). Studying household food consumption in the United Kingdom post-Great Recession, Griffith, O'Connell, and Smith (2016) stated that households responded to worsening economic conditions by switching to calories that were cheaper, and the nutritional quality of their food baskets did not decline. Essentially, they increased their shopping efforts and changed consumption by adjusting the nature of the shopping basket. Considering societal changes and specifically focusing on the Great Recession, they remarked that consumers price consciousness is more sensitive to changes in the external environment than any other behaviors. Thus, we would suppose consumers to show price sensitivity post Covid-19. Semantic network analysis, which has been widely utilized in earlier studies (An & Park, 2020; Jun, 2019; Lim et al., 2019) on exploring individuals' assessments or perspectives, was applied to examine the textual data. We believe that our work will provide meaningful understandings and implications for the apparel fashion industry, helping them adjust to the needs of US female consumers.

Research Method

Through an unstructured questionnaire, an online survey was conducted targeting female consumers in their 20s to 40s residing in major cities in the United States. Data were collected through Amazon Mechanical Turk, and a total of 500 responses were used for the final analysis. To investigate potential differences in fashion product purchases before and after COVID-19, respondents were asked open-ended questions. Responses to these questions were analyzed using semantic network analysis, examining the results based on the most frequent keywords and meaningful words in the network. The specific research process went as follows. First, 50 noun and adjective keywords related to changes in US consumers' apparel shopping behaviors before and after COVID-19 were derived through frequency analyses. Secondly, Ucinet6 (Borgatti et al., 2002) was utilized for centrality analysis based on the co-occurrence of selected keywords, and then visualized them based on findings using the NetDraw program.

Results & Discussion

Firstly, in response to the question of whether there is a difference in fashion product purchases before and after COVID-19, 70% responded "Yes". Secondly, the analysis of the key words' frequency and the degree centrality concluded 'shop less (0.34%, 0.038)' and 'online buying' (0.27%, 0.019)' were the most relevant changes in US consumers' apparel shopping behaviors before and after COVID-19. Analyzing responses to open-ended questions about changes in fashion product purchases after COVID-19 using semantic network analysis, the predominant themes were: 1) reduced spending or shopping frequency, 2) increased online purchases, and 3) a shift towards wearing comfortable, casual, active wear, or lounge wear. Lastly, examination of consumer perceptions of COVID-19 unveiled two primary topics: 1) exercising restraint in shopping behavior, and 2) concerns or fears related to COVID-19. The results of this study are expected to be utilized as foundational data for understanding consumer fashion purchasing behavior during the pandemic era.

Conclusion

This study aims to identify potential changes in US consumers' apparel shopping behaviors before and after COVID-19 using text responses to open-ended questions. This research investigated changes in clothing shopping among U.S. consumers after the COVID-19 pandemic, with the aim of investigating the conditions required for the sale of clothing products. This includes planning aspects including retail concepts and customer communication strategies. Based on the results of this research, the fashion industry should enhance shopping experiences through consumer-centric product strategies, applying insights from U.S. fashion consumers. Additionally, promotional strategies should be implemented to strengthen attitudes, images, purchasing intentions, and usage preferences related to fashion online distribution. The proposed method, semantic network analysis, enabled us to extract and summarize the changing shopping behaviors. Future exploratory and empirical research is needed to delve into specific purchasing behaviors and psychology of fashion consumers during the pandemic era. Moreover, the semantic network analysis method used in this study will provide new guidelines for text data usage around fashion retailers.

References

An, H., & Park, M. (2020). Approaching fashion design trend applications using text mining and semantic network analysis. *Fashion and Textiles, 7*(1), 34.

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *UCINET 6 for Windows. Harvard: Analytic Technologies*, 185.

Che, S., Nan, D., Kamphuis, P., Jin, X., & Kim, J. H. (2021, January). A cluster analysis of Lotte young plaza using semantic network analysis method. In *2021 15th International Conference on Ubiquitous Information Management and Communication (IMCOM)* (pp. 1-6). IEEE.

Etzioni, A. (2011). The new normal. *Sociological Forum, 26*(4), 779–89.

Griffith, R., O'Connell, M., & Smith, K. (2016). Shopping around: how households adjusted food spending over the great recession. *Economica*, *83*(330), 247-280.

Jun, Y. (2019). Estimating media environments of fashion contents through semantic network analysis from social network service of global SPA brands. *Journal of the Korean Society of Clothing and Textiles, 43*(3), 427-439.

Kennett-Hensel, P. A., Sneath, J. Z., & Lacey, R. (2012). Liminality and consumption in the aftermath of a natural disaster. *Journal of Consumer Marketing*, *29*(1), 52-63.

Larson, L. R., & Shin, H. (2018). Fear during natural disaster: Its impact on perceptions of shopping convenience and shopping behavior. *Services Marketing Quarterly*, *39*(4), 293-309.

Lim, J. H., Rhie, Y. L., & Park, J. (2019). Applying semantic network analysis to develop user experience assessment model for smart TV. *Applied Sciences, 9*(16), 3307.

Mason, A., Narcum, J., & Mason, K. (2020). Changes in consumer decision-making resulting from the COVID-19 pandemic. *Journal of Customer Behaviour*, *19*(4), 299-321.

Zwanka, R. J., & Buff, C. (2021). COVID-19 generation: A conceptual framework of the consumer behavioral shifts to be caused by the COVID-19 pandemic. *Journal of International Consumer Marketing*, *33*(1), 58-67.

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THE IMPACT OF INFORMATION SOURCE CHARACTERISTICS ON CONSUMER BEHAVIOR IN LUXURY FASHION PRICE INCREASES

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Introduction

Amid the pandemic, the domestic luxury market has seen a surge, prompting luxury brands to increase prices more frequently. Despite the usual effect of higher prices leading to decreased demand, certain luxury fashion brands continue to achieve strong sales figures even after raising prices. These brands typically inform select in-store customers about price increases through sales representatives while also spreading the news to a wider audience via online luxury communities or news platforms. Recent industry trends suggest that disseminating price increase information through online word of mouth tends to enhance consumers' purchasing desires. While the impact of price increases on luxury brands is recognized, research on how consumers react to different sources delivering the same information is limited. Thus, this study aims to investigate consumers' reactions and behaviors based on the type of information source when conveying identical price increase information.

Literature Review

We utilized Shannon & Weaver's communication model to analyze how luxury fashion brands communicate price increase information across different platforms and study consumer reactions. By applying this model, we can understand how consumers perceive the credibility of information sources differently depending on the medium, leading to varied effects on their attitudes and behavioral intentions. Information source credibility refers to whether the source is knowledgeable, unbiased, and appealing to consumers (Ohanian, 1990). Information source credibility encompasses attributes like trustworthiness, expertise, and attractiveness (Dholakia & Sternthal, 1977; McCracken, 1989). Attitudes toward price increase information refer to consumers' favorable appraisals of such information, while behavioral intentions include actions like purchase, visit, and word-of-mouth recommendations. This study aims to explore these behavioral intentions, building upon previous research.

Research Method

The study employed a between-group design to investigate differences in consumers' perception, attitude, and behavioral intentions based on three types of luxury fashion price increase information sources: sales representatives, online communities, and online news. The research questions included exploring the influence of information sources on credibility, examining how consumer attributes moderate this relationship, investigating the impact of information source credibility on message attitude, and understanding the influence of credibility and attitude on behavioral intentions. Conducted in South Korea, the survey targeted residents aged 2030s and 4050s. Participants were randomly assigned to one of the three information sources and provided with specific explanations and scenario stimuli. After excluding dishonest responses, the final dataset comprised 440 responses for analysis. Statistical analyses in SPSS 26.0 included descriptive statistics, frequency analysis, factor analysis, reliability analysis, analysis of variance, and regression analysis.

Results & Discussion

The study's results are as follows: To explore differences in consumers' perception of information source credibility based on the type of luxury fashion price increase information source, one-way ANOVA with Duncan's post hoc test was conducted. Consumers perceive higher levels of trustworthiness and expertise when receiving luxury fashion price increase information through sales representatives or online news compared to online communities. However, attractiveness did not show significant differences among the

three groups. This suggests that in the context of price increases in luxury fashion brands, consumers trust and perceive information delivered directly by a company's sales representatives or provided by neutral media more than information obtained through word of mouth in online communities.

Secondly, a two-way ANOVA was conducted to investigate the interaction between luxury fashion price increase information sources and receiver characteristics (purchase experience, age). Findings revealed that in the low luxury purchase experience subgroup, credibility's impact was more significant when information came from sales representatives, while expertise had a greater impact when from online news, particularly in the high purchase experience subgroup. The influence of information sources on credibility and expertise varied based on age (20-30 vs. 40-50), but attractiveness showed no significant age-based differences. Notably, for the 40-50 age group, credibility and expertise were more affected by online community information.

Thirdly, a multiple regression analysis was conducted for the entire group to assess the influence of information source credibility on attitude toward the price increase message. Results showed that all three sub-dimensions of information source credibility significantly affected the message attitude. Specifically, in the sales representative group, only attractiveness significantly impacted the message attitude. Conversely, in the online community group, all credibility dimensions affected the message attitude significantly. For the online news group, expertise and attractiveness of the information source significantly influenced the message attitude.

Fourthly, A multiple regression analysis was conducted to assess the impact of information source credibility and attitude toward price increase messages on behavioral intentions across the entire group. The results showed that attitude toward the message significantly influenced all behavioral intentions. Among the credibility dimensions, only attractiveness had a significant effect on word-of-mouth intention. Path analysis for each information source revealed that message attitude significantly influenced all behavioral intentions across all sources. However, credibility dimensions didn't significantly impact intentions in the sales representative and online news groups. In the online community group, only attractiveness significantly influenced purchase intention. Overall, the study underscores the importance of a positive attitude toward price increases in influencing consumer behavior across all information sources. It suggests strategies to enhance positive attitudes toward price increase messages for luxury fashion companies based on information source credibility attributes.

Conclusion

This study, viewing the price increase in luxury fashion brands as a strategic marketing tool for companies, categorizes information sources delivering price increase information in consumer luxury shopping situations into sales representatives, online communities, and online news. It holds academic significance as an inaugural study that verifies credibility, message attitude, and behavioral intentions based on information source types. Furthermore, it carries practical significance by proposing approaches to cultivate positive attitudes and evoke behavioral intentions toward price increases, considering the characteristics of luxury consumers and information source types.

References

McCracken, G. (1989). Who is the celebrity endorser? Cultural foundations of the endorsement process. *Journal of Consumer Research*, 16(3), 310- 321.

Ohanian, R. (1990). Construction and validation of a scale to measure celebrity endorsers' perceived expertise, trustworthiness, and attractiveness. *Journal of Advertising*, 19(3), 39-52.

Roy Dholakia, R., & Sternthal, B. (1977). Highly credible sources: persuasive facilitators or persuasive liabilities?. *Journal of Consumer Research*, 3(4), 223-232.

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A STUDY OF FASHION LIFELOGGING APP ADOPTION: APPLICATION OF THE UTAUT2 MODEL

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Introduction

The rise of wearable technology in conjunction with smart devices has sparked an increased fascination with lifelogging as a convenient method for documenting daily activities (Ristić & Marinković, 2019). Lifelogging technology and its concepts have found success primarily in personalized healthcare or wellness applications, with limited exploration in fashion-related areas. There is a noticeable absence of empirical studies examining user interactions and behaviors with fashion lifelogging apps(FLA) despite the companionship of fashion in our daily lives. This study aims to investigate the intention to adopt FLA from a consumer perspective and utilizes the UTAUT 2 (Unified Theory of Acceptance and Use of Technology 2) model, considering a comprehensive intention to use technology. We seek to understand the effects of the core functions of FLA, which enable individuals to record and explore their fashion lifestyles in various ways, on the intention to adopt the app.

Literature Review

Lifelogging. Lifelogging, which means "life record," involves digitally recording daily experiences, encompassing hobbies and health (Gurrin et al., 2014). Dodge and Kitchin (2007) defined lifelogging as a comprehensive digital record of an individual's experiences, captured through digital sensors and stored permanently as a multimedia archive. We specifically define fashion lifelogging as the subset of lifelogging activities related to fashion within an individual's overall life records. Lifelogging apps enable users to document and monitor their daily lives using smartphones, promoting self-tracking. Prior research highlighted the goal of lifelogging to monitor, analyze, and share personal data for self-awareness and a healthier lifestyle, while identifying four primary functions of lifelogging apps: record, report, search, and share (Ristić & Marinković, 2019). Consequently, we aim to examine the impact of these functional attributes on the adoption of FLA.

UTAUT2 Model. Understanding the factors influencing IT adoption is crucial in Information System (IS) research. The UTAUT2 model, focusing on consumer perspectives, incorporates factors like Performance Expectation, Effort Expectation, Social Influence, Hedonic Motivation, Price Value, and Habit, moderated by gender, age, and experience (Venkatesh et al., 2012). In this study, UTAUT2 was chosen for examining consumers' intention and behavior toward fashion lifelogging apps. Notably, the Price Value component was omitted due to the prevalent free nature of available apps.

Research Question 1. To examine the influence of the use of fashion lifelogging app features on.integrated technology acceptance factors.

Research Question 2. To examine the influence of integrated technology acceptance factors on consumers' adoption and use of fashion lifelogging apps.

Research Method

To empirically investigate our research questions, an online survey was undertaken.Participants experienced in using FLA were recruited, specifically users of 'Clothbox,' a platform for recording and sharing daily clothing styles. The reasons for selecting Clothbox as the FLA are as follows: First, Clothbox allows users not only to record their clothes and styles but also to report and search for meaningful information from accumulated fashion lifelogging data. Second, Clothbox provides features to analyze one's fashion

lifelogging data, monitor frequently worn clothes, unworn clothes, favorite brand preferences, personal style, and share them. Third, after reviewing other apps providing fashion lifelogging services in Korea such as Acloset, Lonely Closet, onthelook, ootd, Musinsa Snap, SSF SHOP diver, we found that Clothbox was the only app offering all four key functions of lifelogging apps as suggested in previous studies: recording, reporting, sharing, and searching. The survey included questions about the use of fashion lifestyle app features, UTAUT2 factors, and use intentions. All responses were measured on a 7-point Likert scale ranging from 'strongly disagree' (1) to 'strongly agree' (7). After excluding 25 non-responses, 101 responses were used for analysis with SPSS 26.0.

Results & Discussion

The analysis revealed that utilizing the record feature significantly impacted performance expectancy, effort expectancy, hedonic motivation, and habits. Conversely, the report feature had a significant positive effect only on performance expectancy. The share feature demonstrated a statistically significant impact on social influence, while the search feature affected performance expectations, habits, and social influence. These findings indicate that offering lifelogging functions, particularly recording and search services, can motivate users to adopt and sustain app usage. Second, performance expectancy, effort expectancy, and habit were identified as significant factors influencing the intention to use fashion lifelogging apps. In contrast, hedonic motivation, social influence, and facilitating conditions showed no significant impact on usage intention. This suggests that the adoption of fashion lifelogging apps is driven by users perceiving them as useful and convenient, coupled with the formation of usage habits.Thirdly, in FLA, the use of the record feature significantly positively influences performance expectancy, effort expectancy, hedonic motivation, and habit. This confirms that the record feature for lifelogging apps are key factors in the successful adoption and use of the apps. Moreover, the use of search features significantly impacts all three components (performance expectations, habits, and social influence) for fashion lifelogging apps. Additionally, share feature shows a significant positive effect on social influence. Fourth, performance expectancy and effort expectancy significantly positively influence usage intention. This aligns with prior research emphasizing the significance of these factors as key determinants in the behavioral intention of mobile app adoption (Palos-Sanchez et al., 2019; Yuan et al., 2015), and confirms that regardless of the type of lifelogging app, the usability and convenience of the app are essentially important factors. Furthermore, habits significantly enhance usage intention. Thus, utilizing fashion lifelogging apps rooted in habit-forming elements can enhance overall app usage for users.

Conclusion

This research holds significance as it marks the inaugural comprehensive examination of the UTAUT2 model's influence on consumers' adoption of FLA. While prior lifelogging studies have covered diverse domains like technology, wellness, entertainment, medical systems, and intelligent environments, this study extends the lifelogging literature into the realm of fashion. Ultimately, this study serves as a valuable resource for mobile app developers, planners, and marketers, offering insights to craft successful apps that enhance fashion lifelogging experiences for smartphone users.

References

Dodge, M., & Kitchin, R. (2007). Outlines of a world coming into existence: pervasive computing and the ethics of forgetting. *Environment and planning B: planning and design, 34*(3), 431-445.

Gurrin, C., Smeaton, A. F., & Doherty, A. R. (2014). Lifelogging: Personal big data. *Foundations and Trends in Information Retrieval, 8*(1), 1-125.

Palos-Sanchez, P. R., Correia, M. B., & Saura, J. R. (2019). An empirical examination of adoption of mobile applications in Spain and Portugal, based in UTAUT. *International Journal of Mobile Communications, 17*(5), 579-603.

Ristić, D., & Marinković, D. (2019). Lifelogging: Digital technologies of the self as the practices of contemporary biopolitics. *Sociologija, 61*(4), 535-549.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, 157-178.

Yuan, S., Ma, W., Kanthawala, S., & Peng, W. (2015). Keep using my health apps: Discover users' perception of health and fitness apps with the UTAUT2 model. *Telemedicine and e-Health, 21*(9), 735-741.

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METAVERSE AS ARTISTIC SPACE: THE IMPACT OF GENERATIVE ART IN VIRTUAL RETAIL STORES
–THE MODERATING EFFECT OF BRAND TYPE–

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Introduction

Amid the global pandemic, there has been a surge in demand for alternative virtual environments (Herrman & Browning, 2021), leading to a rapid transition from traditional in-store experiences to the metaverse. This experience-oriented retail platform allows individuals to immerse themselves in creative and aesthetic activities using avatars. From the perspective of retailing entertainment, art plays a crucial role in providing unique in-store experiences through a concept termed as 'art infusion', which involves integrating masterful imagery into product design, advertisements, or retail environments (Park et al., 2023). The 'spillover effect' further elucidates art infusion, indicating the positive impact of artwork on consumer perceptions and evaluations of associated objects (e.g., products, brands) (Hagtvedt & Patrick, 2008). Although art infusion is often associated with luxury consumption due to the exclusivity of artworks, previous studies have yielded mixed results influenced by factors such as art type, familiarity, genre, or the object to which art is infused (Hagtvedt & Patrick, 2008; Peluso et al., 2017; Park et al., 2023). Furthermore, despite the proliferation of 3D virtual environments for art consumption, research on the art infusion effect has predominantly focused on physical retail stores.

To expand on existing research, this study aims to investigate the interaction effect of generative art (No-art vs. Art) and brand type (Mass vs. Luxury) on store evaluations and approach intentions within the metaverse retailing context. Specifically, this examination will explore two sequential perception routes: perceived exclusivity and aesthetic pleasure toward the store, serving as mediators.

Literature Review

Generative art, a novel form of technology-driven art, utilizes computer algorithms to create unique, intricate, and evolving creations within the realm of AI technology. It serves as a valuable tool for retailers, brands, and artists, offering consumers innovative and immersive experiences in retail spaces (Peralta, 2023). Prior studies in marketing and retailing, which applied the art infusion theory, indicate that the presence of art is predominantly effective in eliciting consumers' positive emotions, attitudes, or behavioral intentions toward the infused object (Naletelich & Paswan, 2018; Park et al., 2023). Accordingly, like other traditional retail formats, the experience of a metaverse store infused with generative art imagery can serve as a stimulating facilitator, enhancing consumer-store experience. Interestingly, while art has traditionally been associated with luxury items due to its inherent originality, such pairing does not consistently deliver positive spillover effects to consumers (Wang et al., 2023).

Therefore, this study explores how generative art experiences in a metaverse retail space positively impact store evaluations, ultimately resulting in increased approach intentions. Furthermore, we examing the boundary conditions of generative art effect by comparing brand types.
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Research Method

The online-based experiment was conducted using a 2 (generative art; No-art vs. Art) × 2 (brand type; Mass vs. Luxury) between-subjects design. To achieve the research objective, 3D retail environments were designed and replicated on the Spatial.io metaverse platform. Using a projection mapping technique, generative art imagery adorned a large feature wall in a metaverse retail store. Brand type manipulation was implemented through a scenario. A total of 130 female consumers were recruited from Amazon Mturk, considering the congruency between displayed products and shoppers' general needs. Each participant was

required to navigate the 3D virtual store for a minimum of 3 minutes. After experiencing the store, they were asked to complete a survey comprising of question items related to perceived exclusivity, perceived aesthetic pleasure, approach behavioral intention, along with consumers' individual characteristics and manipulation items. All measures used in this study were adopted from reliable sources in previous studies and were measured using a five-point Likert scale. After excluding responses that failed to pass attention check items, a total of 122 available data points (Mage=28.56; Caucasian=96.7%) were analyzed using SPSS 26.0 and PROCESS Macro.

Results & Discussion

Regarding the manipulation check, an independent t-test revealed that participants who experienced generative art perceived a higher level of art presence (M=4.24, SD=0.44) compared to the non-art group (M=3.92, SD=0.59, t=-3.372, p <.01). Sequential mediation analysis was conducted using the PROCESS Macro model 6 to confirm the indirect effect of generative art experience on approach intention through store evaluations. The results indicated that the presence of generative art significantly increases consumers' perceptions of exclusivity and aesthetic pleasure toward the store, subsequently leading to enhanced approach intention (effect=0.265, BootSE=0.105, BootCI [0.067, 0.478]). The direct effect of generative art experience on approach intention was insignificant, suggesting a full-mediation model.

Additionally, to explore the moderating effect of brand type, additional analysis was conducted using PROCESS Macro model 83 (Mass=0, Luxury=1). The results revealed a negatively significant interaction effect of generative art × brand type on perceived exclusivity. This indicates that the influence of generative art experience on perceived exclusivity is more pronounced for mass brands compared to luxury brands. Moreover, the conditional indirect effect of generative art on approach intention through store evaluations was significant for mass brands (effect=0.120, BootSE=0.047, BootCI [0.039, 0.221]), but not for luxury brands (effect=0.014, BootSE=0.031, BootCI [-0.046, 0.079]). These findings indicate that while generative art in virtual spaces doesn't inherently boost the exclusivity of luxury brands, it significantly enhances consumers' perceived exclusivity of the store for mass brands.

Conclusion

This study initially explores the impact of generative art as an experiential stimulus within a virtual retail environment, with potential applications extending to real-world contexts. Theoretical implications of this research lie in its interdisciplinary nature, offering valuable insights for researchers in fashion, retailing, and spatial design. On a practical level, our findings suggest the broad applications of generative art as a distinctive atmospheric element to enhance consumers' shopping experiences. Considering the capacity of generative art to produce an infinite variety of artworks using AI technology, its integration into retail spaces can serve as an effective tool for various brands, particularly mass brands, to elevate their brand image while offering both aesthetic and cost-effective advantages.

References

Hagtvedt, H., & Patrick, V. M. (2008). Art infusion: The influence of visual art on the perception and evaluation of consumer products. *Journal of Marketing Research, 45*(3), 379-389.

Herrman, J., & Browning, K. (2021). Are we in the metaverse yet? New York Times. Retrieved from https://www.nytimes.com/2021/07/10/style/metaversevirtual-worlds.html

Naletelich, K., & Paswan, A. K. (2018). Art infusion in retailing: The effect of art genres. *Journal of Business Research, 85*, 514-522.

Park, S., Kim, S., & Ahn, S. (2023). Understanding the effect of art infusion type on retail product shopping: An attention to the intervening role of customers' financial wealth. *Journal of Retailing and Consumer Services, 70*, 103154.

Peluso, A. M., Pino, G., Amatulli, C., & Guido, G. (2017). Luxury advertising and recognizable artworks: New insights on the "art infusion" effect. *European Journal of Marketing, 51*(11/12), 2192-2206.

Peralta, A. (2023). Generative Art is Helping (re)Humanize the Retail Experience. Arigami. Retrieved from https://www.retailtouchpoints.com/topics/retail-store-design/in-store-innovation/generative-art-is-helping-rehumanize-the-retail-experience

Wang, Y., Xu, A. J., & Zhang, Y. (2023). L'Art Pour l'Art: experiencing art reduces the desire for luxury goods. *Journal of Consumer Research, 49*(5), 786-810.

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A DEEP DIVE INTO PREEMPTIVE RETURN CONSIDERATION PURCHASING IN ONLINE FASHION SHOPPING

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Introduction

With the development of online shopping channels, consumers engage in multi-channel shopping such as webrooming and showrooming, utilizing various channels for fashion shopping. This mixed-channel behavior stems from consumers deeming it crucial to physically check and try on products during the decision-making process for fashion items. However, the nature of online shopping restricts the ability to try items before purchasing, which leads to decision-making difficulties due to perceived risks and uncertainties. These challenges may result in non-buying behaviors such as abandonment and delayed purchases, impacting overall satisfaction and influencing return behavior. As online purchases continue to surge, so does consumers' return behavior. According to Narvar(2022), consumers returned $761 billion in online shopping in 2021, a 78% increase from 2020. It explored consumer bracketing behavior and its impact on return patterns. Bracketing behavior is characterized by consumers acquiring multiple items with the intention of potential returns, subsequently returning some or all of them. This behavior was also found in the study of Lee (2015). He stated that one reason for the increasing return rates is that consumers purchase multiple products with the intention of keeping only one.

In this study, we focus on bracketing behavior and operationally define "Preemptive return consideration purchasing" as the behavior of ordering a product with the possibility of returning it in mind during the decision-making process on an online fashion platform. Although this behavior is frequently mentioned in marketing reports, academic research on the subject remains scarce. Therefore, this study aims to increase our understanding of Preemptive return consideration purchasing through in-depth interviews and to identify its various driving factors and consequences.

Literature Review

The concept of preemptive return consideration purchasing originated with the term "bracketing" introduced by Narvar(2017) and refers to the behavior of buying multiple versions of a product to return at least some of the items. Interest in bracketing behavior began with research on consumer return behavior. Lee(2015) was one of the first to focus on consumer bracketing behavior. Although he did not use the term bracketing, he focused on the phenomenon of bracketing in marketing. Lee(2015) questioned why returns are increasing even though the overall quality of products is improving due to technological advancements and sought to explore the unexplored reasons for consumer returns. He found that the following factors were not reported in previous studies: "Purchase with incomplete product knowledge", "Carelessness/rush purchase", "Obtaining additional information after purchase", "Change of mind after using the product", "No longer needed", and "Multiple item purchase". Of these, "multi-item purchase" was defined as buying two or more items of the same product (size, style, or color) with the intention of keeping only one. In other words, it can be seen as a bracketing behavior. Lee(2015) explained that most consumers who engage in bracketing behavior can adapt to the changing environment and accept bracketing behavior from an ecological perspective.

Asdecker, Karl, and Sucky(2017) analyzed real-world data from a German online fashion retailer on the effect of multiple purchases on the return rate. The results showed that buying multiple items related to size and buying multiple items related to style had a significant positive effect on return rates.

Lochner (2017) explored reasons for purchasing and returning items, finding that respondents purchased fashion items with the intention of returning them to compare products at home, shedding light on the motivations behind bracketing behavior.

Research Method

In this qualitative study, we conducted interviews with 10 consumers who regularly purchase fashion products online and have experience with returns. The consumers' purchasing decision-making processes were thoroughly examined. The interviews' contents were analyzed using grounded theory research methods, particularly focusing on open and axial coding techniques. Through open coding, the shopping behavior of fashion product consumers was categorized based on the process from purchase to return. Axial coding was then applied to derive and interpret a paradigmatic model of consumers' preemptive return consideration purchasing.

Results & Discussion

The open coding process yielded 46 concepts related to fashion product purchase and return behavior in online shopping malls, organized into 24 subcategories and 11 categories. The 11 categories were: online shopping difficulties, online consumer identity, perceived return policy benefits, purchase uncertainty, preemptive return consideration purchasing, subjective norms of return behavior, acceptability of return procedures, proceeding to return non-selected items, abandoning non-selected items, post-purchase consumer satisfaction, and habituation to the online purchase decision-making process.

Paradigm analysis, conducted through axial coding, identified 'preemptive return consideration purchasing' as the main phenomenon in the online purchase process. Causal conditions such as "difficulty of online shopping," "online consumer identity," and "perception of return policy benefits" were identified. The contextual condition of "purchase uncertainty" was observed. Strategies for action/interaction included "progress of returning non-selected products" and "abandonment of returning non-selected products." "Subjective norms of return behavior" and "acceptability of return procedures" served as intervening conditions influencing the action/interaction of "progress of non-selective returns" or "abandonment of non-selective returns." Ultimately, "consumer satisfaction after purchase" and "habituation of the online purchase decision-making process" resulted from the consequence of preemptive return consideration purchasing.

Conclusion

In the purchase of fashion products through online channels, consumers exhibit return consideration purchase behavior due to limitations in the online shopping environment. This behavior arises from difficulties in decision-making, and seller-provided return policies enable consumers to delay purchase decisions until after delivery instead of at the time of purchase. Consumer characteristics, such as purchase impulsivity and best choice orientation, influence preemptive return consideration purchasing. Similar to the findings of Wachter et al.(2012), a positive correlation exists between planned return purchase behavior and impulse buying tendency. Additionally, choice difficulty, as supported by Cheek and Goebel(2020), impacts preemptive return consideration purchasing. The consequent return consideration behavior leads to a final purchase decision, resulting in either the initiation or abandonment of returns for non-selected products. This behavior contributes to consumer satisfaction and shapes future online purchase decision-making processes, eventually becoming habitual.

This study addresses a gap in academic research by exploring return-conscious purchasing behavior through qualitative analysis of real consumer experiences in the online shopping context. It is anticipated that the findings will assist merchants in formulating effective return policies and strategies for managing online shopping malls by understanding consumers' preemptive return consideration purchasing.

References

Asdecker, B., Karl, D., & Sucky, E. (2017). Examining Drivers of Consumer Returns in E-Tailing with Real Shop Data. Paper presented at the Proceedings of the 50th HICSS.

Cheek, N. N., & Goebel, J. (2020). What does it mean to maximize? Decision difficulty, indecisiveness, and the jingle-jangle fallacies in the measurement of maximizing. Judgment Decision Making, 15(1), 7-24.

Lee. (2015). An alternative explanation of consumer product returns from the postpurchase dissonance and

ecological marketing perspectives. Psychology & Marketing, 32(1), 49-64.

Lochner, J. K. (2017). Morally Questionable, Opportunistic Product Returns. Paper presented at the Conference Proceedings Trends in Business Communication 2016. 171-178.

Narvar. (2017). The Essential Guide to Retail Returns. Retrieved January 31, 2024, from https://corp.narvar.com/resources/essential-guide-retail-returns-ebook

Narvar. (2022). State of returns: The end of one-size-fits-all returns. Retrieved January 31, 2024, from https://corp.narvar.com/resources/2022-the-state-of-returns

Wachter, K., Vitell, S. J., Shelton, R. K., & Park, K. (2012). Exploring consumer orientation toward returns: unethical dimensions. Business Ethics: A European Review, 21(1), 115-128.

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NAVIGATINIG SUSTAINABILITY: THE IMPACT OF ECO-LABELS ON CONSUMER DECISION-MAKING AND TRUST

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Introduction

In an era where environmental sustainability is becoming a pivotal concern for consumers, businesses are increasingly leveraging eco-labels as a means to signify their commitment to environmental stewardship. These labels not only serve as indicators of a product's environmental impact, but also as strategies tools that may influence consumer purchasing behavior. Eco-labels have demonstrated the potential to proficiently steer consumers' decision-making processes (Potter et al., 2021). This study explores the interplay between eco-labels and purchase intention, emphasizing the mediating role of brand trust and the moderating effect of product competence. Eco-labels serve not only as markers of environmental friendliness but also as influencers of consumer perception, potentially enhancing brand trust, which in turn affects purchase intention. However, the impact of eco-labels is nuanced, being moderated by the product's perceived competence, or its ability to fulfill its intended function. This study seeks to unravel how eco-labels, brand trust, and product competence collectively shape consumer behavior, offering insights into the intricate dynamics at play. The research contributes to the discourse on sustainable consumer behavior, providing a nuanced understanding of the mechanisms through which eco-labels influence purchase decisions, and underscores the importance of product competence in this context, offering valuable perspectives for marketers and policymakers in the realm of green marketing.

Literature Review

Eco-labels serve as a pivotal communication channel between consumers and companies, fostering trust and showcasing the company's commitment to environmental friendliness. They are especially crucial in contexts like e-commerce, where the scarcity of direct product experience heightens consumers' reliance on extrinsic cues like eco-labels to navigate their uncertainty and decision-making process (Zeithaml, 1988). This dynamic is underscored by the Elaboration Likelihood Model (ELM), which suggests that eco-labels can influence purchase intentions through both central and peripheral processing routes, depending on consumers' involvement level and ability to evaluate the information (Chekima et al., 2016). Trust, defined as confidence in the trustworthiness and sincerity of the counterparty (Morgan & Hunt, 1994), is a key factor that eco-labels can enhance, directly influencing brand attitudes and purchase intentions. Furthermore, the concept of product competence—reflecting a brand's perceived efficacy and intelligence (Fiske et al., 2007)—moderates how eco-labels impact consumer behavior. This integrated framework elucidates how eco-labels, through the lens of ELM, bolster brand trust and, along with product competence, shape consumer perceptions and purchase behaviors, offering companies a strategic tool to differentiate themselves in the marketplace and align with consumers' environmental values (Iraldo et al., 2020).

Research Method

The study's primary aim was to explore the effect of eco-labels on consumer purchase intention in an online shopping setting. Participants were presented with a scenario in which they were considering the purchase of a bag online. They were instructed to read consumer reviews about the bag to simulate a realistic online shopping experience. After reviewing the information, participants were asked to answer questions related to their trust in the brand and their intention to purchase the product. The experiment was designed to isolate the impact of eco-labels by using product images of a bag, where the only difference was the presence or absence of an eco-label. To gauge the bag's perceived competence, participants referred to its star rating, which served as an indicator of the bag's durability and storage capacity: a 5-star

rating signified excellent sturdiness and ample storage, whereas a 1-star rating suggested poor durability and limited storage. Participants, who were adults aged between their 20s and 50s, completed an online survey. Data were analyzed using SPSS 27.0 and the PROCESS MACRO version 4.2, employing ANOVA to detect any significant differences in means between groups, and the PROCESS MACRO to delve into the mediating influence of brand trust on the relationship between eco-labels and purchase intention across different levels of product competence.

Results & Discussion

A 2 (eco-label: with vs. without) x 2 (competence: high vs. low) ANOVA on brand trust revealed a significant interaction effect of eco-label attachment and competence (F = 4.470, p = .036). When competence (high reviews) was high, there was no difference in the mean value for trust, regardless of the presence or absence of labels. However, when competence (low reviews) was low, there was a difference in the group means. Trust was lower when the label was absent (with label M = 3.04, without label M = 2.53). The interaction effect was also observed for purchase intention (F = 11.141, p = .001). Similar to 'trust', when competence was low, differences between groups emerged (with label M = 2.89, without label M = 2.19). To verify the mediating effect of trust, the analysis employed the SPSS PROCESS macro model 7. The direct effects of labeling on purchase intent were found to be insignificant because the confidence interval (95%) included 0 (Effect = -.008, LLCI = -.231, ULCI = .214). However, the indirect effect mediated by trust was significant because the confidence interval (95%) did not contain 0 (Effect = -.4655, LLCI = -.908, ULCI = -.038). In other words, the mediating effect of trust was confirmed.

Conclusion

This study explored the impact of eco-labels on consumer purchase intentions, revealing that eco-labels significantly enhance consumers' likelihood to buy, particularly when they trust the brand and perceive the product as competent. Brand trust emerged as a crucial mediator, indicating that eco-labels can bolster consumer confidence in a brand, thus influencing their purchasing decisions in an online context. Additionally, the effect of eco-labels was found to be stronger when the product competence, as indicated by consumer reviews, was high. These findings underscore the importance of eco-labels in marketing strategies, especially for appealing to environmentally conscious consumers. While offering valuable insights, the research invites further exploration across various product categories and consumer demographics to deepen the understanding of eco-labels' role in sustainable consumer behavior. In essence, this study highlights the critical interplay between eco-labels, brand trust, and product competence in shaping consumer purchase intentions in the digital marketplace.

References

Chekima, B., Wafa, S. A. W. S. K., Igau, O. A., Chekima, S., & Sondoh, S. L. Jr. (2016). Examining green consumerism motivational drivers: Does premium price and demographics matter to green purchasing? *Journal of Cleaner Production, 112*, 3436-3450.

Fiske, S. T., Cuddy, A. J., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences, 11*(2), 77-83.

Iraldo, F., Griesshammer, R., & Kahlenborn, W. (2020). The future of ecolabels. *The International Journal of Life Cycle Assessment, 25*(5), 833-839.

Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing, 58*(3), 20-38.

Potter, C., Bastounis, A., Hartmann-Boyce, J., Stewart, C., Frie, K., Tudor, K., Bianchi, F., Cartwright, E., Cook, B., Rayner, M., Jebb, S.A. (2021). The effects of environmental sustainability labels on selection, purchase, and consumption of food and drink products: A systematic review. *Environment and Behavior, 53*(8), 891-925.

Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence. *Journal of Marketing, 52*(3), 2-22.

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AM I A GOOD DESIGNER?: THE EFFECTS OF PERCEIVED INNOVATIVENESS ON PLEASURE AND SELF-EXPANSION IN THE AI-DRIVEN DESIGN PROCESS

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Introduction

The fashion industry has integrated IT technologies such as the Internet of Things, augmented reality, virtual reality, and artificial intelligence (AI). In particular, AI has increasingly penetrated every aspect of people's lives due to its sustainable work, fast computing speed, and intelligence. The integration of design with AI technology is essential to address the existing shortage of demand and productivity in visual design. Such integration also serves to relieve the burden on designers who are dealing with the high demand for designs that may be of relatively lower quality. The development of fashion design systems using generative AI-driven technology has led to multiple applications in the fashion industry that empower each customer to craft their unique designs. Individuals now have the opportunity to participate in the design process, collaborate with brands, and anticipate novel ways to express their creativity through AI-driven design applications. Surprisingly, despite the evident impact, no studies have been conducted in this domain. Therefore, this study aims to investigate the perceived innovativeness of design output in the AI-driven design process and its impact on self-expansion through pleasure. Furthermore, we explore whether individuals' creative consumer efficacy moderates the effect of perceived innovativeness on pleasure and self-expansion.

Literature Review

According to the self-expansion model, individuals are driven to broaden their self-concept by acquiring new identities, cultivating fresh perspectives, improving their skills, and acquiring resources from others (Mattingly & Lewandowski, 2014). The expansion of self-definition and the embrace of new perspectives are encouraged by novel and exciting experiences (Reimann & Aron, 2009). Self-expansion can be triggered through access to affective, sensorial, social, and intellectual brand experience dimensions (de Kerviler & Rodriguez, 2019). Specifically. positive emotions, such as pleasure and enthusiasm, play a crucial role in fostering an open and receptive mindset, encouraging individuals to explore new possibilities, relationships, and experiences (Mattingly et al., 2012). Schindler et al. (2013) also examined that positive emotions, such as admiration and adoration, were associated with an increased potential efficacy to accomplish goals, such as self-expansion. Thus, this study hypothesizes that participants in the AI-driven design process will induce pleasure, leading to self-expansion. This effect will occur when the innovativeness of the output from the AI-driven design process is highly valued. In terms of AI and human co-creation, innovativeness can be appraised differently based on an individual's effort or ability to navigate the AI. Therefore, we anticipate that the higher the perceived innovativeness of the design output, the greater the pleasure and self-expansion experienced.

Furthermore, the effect of the perceived innovativeness on pleasure and self-expansion will depend on one's level of creative consumer efficacy. Individuals with high creative consumer efficacy are likely to be less influenced by the perceived innovativeness because they directly attribute their ability to succeed to their own capabilities. However, those with low creative consumer efficacy will experience pleasure when the design outcomes are perceived as innovative.

Research Method

To gather data, volunteers engaged in a design process using a generative AI program within an experimental setting. Participants were provided with instructions on how to utilize the generative AI program, which promptly combines images and words to generate a new image. Subsequently, they input two types of data (the digital image they wished to present and a keyword) into the program. Participants

could instantly view the newly generated image and repeat this process until achieving the final desired image. Finally, participants were instructed to upload the final image to create virtual clothing for an avatar in a metaverse creation program, such as Zepeto Studio. This experience equipped participants with skills in crafting new images and designing fashion items in the digital realm. A total of 77 complete responses were collected. The data was analyzed using SPSS 26.0 for the descriptive statistics, reliability analysis, exploratory factor analysis, and PROCESS macro for the mediation analysis.

Results & Discussion

To examine the impact of perceived innovativeness on self-expansion mediated by pleasure and the moderating effect of creative consumer efficacy, bootstrapping analysis using the PROCESS macro (Model 8, with a sample size of n=5,000 bootstrap samples) was conducted. The result revealed that perceived innovativeness increased self-expansion, and this effect was mediated by pleasure. The effect of perceived innovativeness on pleasure was moderated by creative consumer efficacy (index of moderated mediation = −.1116). Specifically, individuals with low creative consumer efficacy showed a more pronounced positive relationship between perceived innovativeness and pleasure. This implies that individuals who feel less confident in their creative abilities may experience greater pleasure when the design output from themselves-AI collaboration is perceived as innovative. However, creative consumer efficacy did not emerge as a significant moderator in the relationship between perceived innovativeness and self-expansion. This suggests that while creative consumer efficacy influences the immediate emotional response to perceived innovativeness, it may not significantly alter the overall impact on individuals' self-expansion.

Conclusion

This study contributes to the theoretical understanding of the dynamics involved in the AI-driven design process. It sheds light on the interplay between perceived innovativeness, pleasure, and self-expansion, providing a deeper understanding of how these factors are interconnected. By identifying pleasure as a mediator between perceived innovativeness and self-expansion, the study extends existing theories on the emotional aspects of innovation processes. Furthermore, the exploration of creative consumer efficacy as a moderator enriches theoretical frameworks by acknowledging the role of individual differences. This highlights that not all individuals respond similarly to the relationship between perceived innovativeness and pleasure, emphasizing the need to consider personal factors in understanding this dynamic. By considering the emotional and individual aspects, companies and brands can enhance user experiences and foster positive perceptions in the process of co-creation.

References

de Kerviler, G., & Rodriguez, C. M. (2019). Luxury brand experiences and relationship quality for Millennials: The role of self-expansion. *Journal of Business Research, 102*, 250-262.

Mattingly, B. A., & Lewandowski Jr, G. W. (2014). Expanding the self-brick by brick: Nonrelational self-expansion and self-concept size. *Social Psychological and Personality Science, 5*(4), 484-490.

Mattingly, B. A., Mcintyre, K. P., & Lewandowski Jr, G. W. (2012). Approach motivation and the expansion of self in close relationships. *Personal Relationships, 19*(1), 113-127.

Reimann, M., & Aron, A. (2014). Self-expansion motivation and inclusion of brands in self: Toward a theory of brand relationships. *In Handbook of brand relationships* (pp. 87-103). Routledge.

Schindler, I., Paech, J., & Löwenbrück, F. (2015). Linking admiration and adoration to self-expansion: Different ways to enhance one's potential. *Cognition and Emotion, 29*(2), 292-310.

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EXPLORING MEDIA RICHNESS IN THE METAVERSE: THE ROLE OF RENDERING QUALITY AND AVATAR REALISM IN USER EXPERIENCE AND ENGAGEMENT

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Introduction

The "metaverse" refers to a three-dimensional (3D) virtual realm that provides users with immersive experiences through their avatars. In a metaverse, consumers can interact with other users and engage in real-life activities using their avatars, which can be visually depicted with realistic or abstract animated features. The rendering quality of virtual space and the visual presentation of avatars, elements of metaverse environments, can shape users' embodied presence, which refers to the sense of actually existing within the virtual world. This study aims to investigate how the rendering quality of virtual stores in a metaverse, serially mediated by embodied presence and enjoyment, can increase shopping intention. In addition, this study explores how avatar realism moderates the relations between the rendering quality and embodied presence. This approach is grounded in the concept of media richness within the metaverse environment.

Literature Review

Media richness theory emphasizes the dominant role of media richness in determining and using different forms of media (Daft & Lengel, 1986). The representational richness of a mediated environment contributes to a user's sensory experience. In richer media, the presented information is perceived more vividly, and the higher quality of the visual image evokes a greater intensity of emotion from users (Jiang & Benbasat, 2007; Sreejech et al., 2021). In a metaverse, users interact with environments mediated by avatars. Based on media richness theory, it is assumed that the high rendering quality of a metaverse platform and the realistic visual representations of avatars enable consumers to perceive the richness of metaverse environments. Additionally, users would experience a great sense of embodied presence and enjoyment in a virtual store when they engage in a richer environment. Thus, the rendering quality of metaverse platform with a realistic avatar (vs. abstract avatar) would be more influential on users' shopping intention in a virtual store, and such experience is serially mediated by embodied presence and enjoyment.

Research Method

An experimental study was conducted using a between-subjects design to investigate the effect of metaverse media richness through avatar realism (realistic vs. abstract). Avatar realism operates based on the level of an avatar's visual realism, which refers to the anthropomorphism of an avatar's appearance (Gong & Nass, 2007). In a realistic setting, avatars are represented to be humanlike with proportions similar to those of real people, whereas abstract avatars are 3D animated with unrealistic proportions. In this study, participants were randomly allocated to view a stimulus, which consisted of a short video clip showing an avatar browsing a virtual store and interacting with other avatars. The stimuli were developed to depict a virtual fashion store in the metaverse. The contents of virtual space and the motion of avatars were controlled, except for the 3D animated avatar' realism. Following the viewing of a video, the participants were asked to respond to items about the perceived rendering quality, embodied presence, enjoyment, and shopping intention in the metaverse store using multiple items from previous studies (Pillai et al., 2023; Zhang et al., 2022; Zhang et al., 2023) on a five-point Likert scale. Data were collected through an online survey using US consumer panels. The participants were metaverse users aged 18 or older. A total of 206 valid responses were analyzed. The manipulation of stimuli was confirmed by testing the level of avatar visual realism.

Results and Discussion

To test the hypotheses, a serial mediating model of embodied presence and enjoyment between rendering quality and shopping intention in the metaverse store was analyzed using bias-corrected bootstrapping. The

respondents' age, gender, and metaverse usage time were inputted as covariates. The results revealed that the direct and indirect effects of rendering quality on shopping intention were significant. In addition, the moderated mediation effect of avatar realism in the indirect path was significant, which was mediated by embodied presence and enjoyment. Specifically, the moderation effect of avatar realism (realistic vs. abstract) between rendering quality and embodied presence was statistically significant. Furthermore, the results showed that, in case of a realistic avatar, the effect of rendering quality on embodied presence was higher than that in the case of an abstract avatar. Consequently, compared with the metaverse with abstract avatars, rendering quality in the metaverse with realistic avatars has a greater influence on shopping intention, and this experience is serially mediated by embodied presence and enjoyment.

Conclusion

The results suggest that the rendering quality of a metaverse environment has a greater impact on embodied presence, particularly when consumers experience environments featuring realistic avatars. Avatar realism is a pivotal feature within the metaverse space. High rendering quality, particularly when combined with realistic avatars, evokes more intense embodied presence from consumers and elicits stronger positive feelings. Consequently, the experience within the metaverse space characterized by high rendering quality and realistic avatars enables consumers to more actively engage with metaverse environment and visit the virtual store.

References

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. *Management Science, 32*(5), 554–571. https://doi.org/10.1287/mnsc.32.5.554

Gong, L., & Nass, C. (2007). When a talking-face computer agent is half-human and half-humanoid: Human identity and consistency preference. *Human Communication Research, 33*(2), 163–193. https://doi.org/10.1111/j.1468-2958.2007.00295.x

Jiang, Z., & Benbasat, I. (2007). The effects of presentation formats and task complexity on online consumers' product understanding. *MIS Quarterly, 31*(3), 475–500. https://doi.org/10.2307/25148804

Pillai, R., Sivathanu, B., Rana, N. P., Preet, R., & Mishra, A. (2023) Factors influencing customers' apparel shopping intention in metaverse. *Journal of Computer Information Systems*. https://doi.org/10.1080/08874417.2023.2280842

Sreejesh, S., Ghosh, T., Dwivedi, Y. K. (2021). Moving beyond the content: The role of contextual cues in the effectiveness of gamification of advertising. *Journal of Business Research, 132*, 88-101. https://doi.org/10.1016/j.jbusres.2021.04.007

Zhang, G., Cao, J., Liu, D., & Qi, J. (2022). Popularity of the metaverse: Embodied social presence theory perspective. *Frontiers in Psychology, 13:* 997751. https://doi.org/10.3389/fpsyg.2022.997751

Zhang, L., Anjum, M. A., & Wang, Y. (2023). The impact of trust-building mechanisms on purchase intention towards metaverse shopping: The moderating role of age. *International Journal of Human–Computer Interaction*. https://doi.org/10.1080/10447318.2023.2184594

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TO CLOSE THE LOOP: CASE ANALYSIS OF CIRCULAR ECONOMY ACTIVITIES IN THE FASHION INDUSTRY

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Introduction

As fast fashion has become a major business model in the fashion industry which has promoted overproduction and overconsumption, generating high levels of clothing and textile waste by consuming substantial amounts of natural resources, accelerating serious environmental impacts(Brydges, 2021). As a result, this industry has faced pressure to transition from the traditional production cycle toward a Circular Economy(CE) by slowing, narrowing, and closing the resource loop strategies (Dissanayake & Weerasinghe, 2021). With respect to closing the loops, the role of retailers is considerable on account of connecting the business sectors to consumers at the post-consumption stage. However, research on what strategic activities fashion industry has been implementing for CE is limited. Therefore, the objectives of this study are to explore the trends of CE within two years, to examine the types of CE practices and promotion formats to increase consumer participation, and to investigate the other eco-friendly activities.

Literature Review

The aim of CE is to optimize resource efficiency and minimize waste generation by extending product's life cycle, reducing the resource use, or reusing the discarded material to promote sustainable supply chain(de Aguiar Hugo, de Nadae, & da Silva Lima, 2021). Jia et al.(2020) suggested four types of sustainable practices in the supply chain, e.g. product design, product stewardship, pollution prevention system, and closing the loop. To close the loop, the authors emphasized to circulate the used goods or waste residuals as a resource as well as consumers' participation in the circular system, which allowed reuse, recycle, redesign, remanufacturing and/or repair approaches. Based on the systematic literature review, Dissanayake and Weerasinghe (2021) analyzed crucial strategies for four phases(materials, design, consumption, and end-of-life) of a circular fashion system, and repairing service, rental platform, swapping shops, and secondhand clothing markets offered by retailers were promising to extend the lifespan of clothing and to reduce the use of raw materials. Kim et al.(2021) also indicated that take-back, recycle, repair, and remanufacturing services, sharing platforms, and circular supply were the recommendable business models of circular economy. Fashion companies in Brydges' study(2021) operated clothing repair services, take-back programs, second-hand transactions, and/or rental businesses for a circular fashion system. However, research in the area of circular fashion business has given attention predominantly to consumers' attitudes or behaviors, and little is known about what activities the fashion companies are actually doing at the retail level as a part of sustainable supply chain.

Research Method

In order to focus on the major strategies at the retail level for a circular fashion business, keywords such as 'repair,' 'take-back,' 'secondhand transactions,' 'rental,' 'eco-friendly activity' AND 'fashion' OR 'clothing' were used. The articles between 2022 and 2023 were collected from Korean major newspapers and fashion-related magazines through NAVER portal site. If the same activity of a specific brand appeared across multiple seasons in the collected articles, only the case of the different seasons was included as an ongoing implementation. Those where company's activity information was insufficient or ambiguous were excluded. As a result, out of 482 cases, a total of 400 cases were used for the final analysis. Cases were analyzed according to types of industry(fashion brands, retailers, NGO, etc.), and type of fashion brand categories (luxury, men's, women's, children's, casual, sports, outdoor, accessories and others) by four seasons. The CE activities were categorized into take-back, repair, secondhand transactions, and rental services based on the previous research, and type of operation, and promotion formats were also analyzed.

Results & Discussion

First, the CE cases have consistently increased over time, 56 cases(14.0%) in S/S 2022, 96 cases(24%) in F/W 2022, 123 cases(30.8%) in S/S 2023, and 125 cases(31.3%) in F/W 2023. The total number of companies for this analysis was 259 brands, and H&M showed the highest frequency(n=10), followed by Uniqlo(n=8), Patagonia and Nike(n=7). Brands with one or two cases accounted for 90.3%, indicating that several brands were at the initial stage to implement CE activities. Regarding the type of fashion industry and fashion brand categories, retailers (department stores, online shopping malls, vertical platforms, SPA etc.) took more than 58%, while fashion brands and NGOs accounted for 35.5%, 6.4% respectively. Regarding type of retailers, platform format presented the highest proportion(66%) and 56.1% of them were engaged in second-hand transaction. About fashion brands, casual(20.3%), luxury(18.1%), and outdoor (12.3%) brands ranked higher in that order. In contrast, there were relatively few examples of CE practices in men's, women's, and children's wear. Second, when analyzing types of CE activities, secondhand transactions accounted for 41.7%, followed by take-back(26.9%), repair(20.9%), and rental(10.6%) services, presenting the active implementation of various CE strategies within the fashion industry. Many of CE activities were operated by the company independently(79.3%) rather than collaboration with professionals (20.8%). Among a total CE activities, only 35.7%(n=142) cases provided incentives to consumers, such as point/cash rewards(47.9%), coupons(21.8%), and giveaways(14.1%). Finally, regarding eco-friendly campaigns(n=109), campaign toward internal stakeholders took 42.3%, while cases of external stakeholders, mainly consumers to encourage participation accounted for 58.7%.

Conclusion

This study aimed to explore the tendency of CE initiatives within the fashion industry and analyzed a total of 400 cases over the last two years. Continuously increased number of cases were found over the four seasons, with 90% of the companies showing only 1 or 2 times for CE activities, indicating that the fashion industry has recognized the importance of circular fashion system and just tried to adopt the system as an initial stage. If these early-stage brands have continued to execute and expand their CE activities, it would be expected to shift to CE business system more soundly and promptly by enhancing resource efficiency. The types of CE activities revealed secondhand transactions, take-back, repair, and rental services in order, and about 36% of cases provided incentives to consumers when participating in these activities. To close the loops for CE, since the role of consumers in the supply chain is extremely important, distinctive promotion strategies and communication messages are required to increase consumer awareness as well as participation. Analyzing a gap between fashion company's CE efforts and consumer's intention to participate with empirical research would be valuable for the future study.

References

Brydges, T. (2021). Closing the loop on take, make, waste: Investigating circular economy practices in the Swedish fashion industry, *Journal of Cleaner Production, 293,* 126245.

de Aguiar Hugo, A., de Nadae, J., & da Silva Lima, R. (2021). Can fashion be circular? A literature review on circular economy barriers, drivers, and practices in the fashion industry's productive chain. *Sustainability, 3,* 12246. https://doi.org/10.3390/su132112246

Dissanayake, D.G.K. & Weerasinghe, D. (2022). Towards circular economy in fashion: Review of strategies, barriers and enablers, *Circular Economy and Sustainability, 2,* 25-45. https://doi.org/10.1007/s43615-021-00090-5

Jia, F., Yin, S., Chen, L., & Chen, X. (2020). The circular economy in the textile and apparel industry: A systematic literature review, *Journal of Cleaner Production, 259,* 1-20.

Kim, H. S., Jun, Y-S., Jun, J. H., & Cho, J. Y. (2021). Transition from linear economy to circular economy, *Resources Recycling, 30*(3), 3-17.

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AMPLIFYING CONSUMER–BRAND CONNECTIONS: EXPLORING STRATEGIC SERIES BRANDING IN THE FASHION INDUSTRY

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Introduction

Series strategies have recently attained increased popularity among consumers. For example, a representative case would be the continuous release of similar-concept fashion products with changes in animation character based on character intellectual property. Although the series strategy may have only limited impact during the early stages of marketing, the series' effectiveness will likely increase proportionally as it progresses (Yoo & Park, 2006). Consequently, many brands are gradually expanding their efforts to utilize the series strategy as a key tool for enhancing branding impact. Series strategies have recently gained traction not only in advertising but also in the area of product production, highlighting the need for a broader examination of this approach. Therefore, the aim of the present study is to explore the series strategy's impact on fashion branding by focusing on series product production and release. In particular, given that series strategies are associated with frequent consumer exposure by virtue of their continuity, they are likely to be closely related to brand relationship enhancement. To appreciate the relationship between fashion branding and series strategies, we assume brand authenticity, brand commitment, and product attitude as dependent variables and aim to examine their causality. Based on previous research, brand authenticity was classified into originality and honesty. In the fashion industry, factors such as originality, which differentiate it from other brands, and honesty derived from a consistent brand image and quality, can play a crucial role in maintaining the brand's value and connecting with consumers. Therefore, we would like to pay attention to the mediating role of brand authenticity that connects series marketing perception and brand commitment. We anticipate that this study will not only confirm the role of the series strategy in enhancing fashion branding effects but will also expand the theoretical foundation of series marketing strategies.

Literature Review

The series strategy is a marketing communication and product promotion tool that entails the continuous unfolding of advertisements and products that cohere around a single theme over a given period. Yoo and Park (2006) verified the extent to which the effect improves when the main selling idea of a series advertisement is consistent, they confirmed that consumers who were exposed to consistent advertisement series developed a stronger brand personality and brand attitude compared to those who were not. However, the impact of repetitive marketing strategies of this nature may not always be positive but may in fact yield negative effects. Previous studies have indicated that repetitive consumer experiences may contribute to fatigue and boredom, resulting in adverse effects (Chen et al., 2016). Repetitive exposure may produce negative perceptions of the advertisement's message and product information, highlighting the need to examine its relationship with brand authenticity. Brand authenticity encompasses the clarity of a brand's identity and its honesty in conveying this identity to consumers. In particular, a study by You and Choi (2019) showed that brand authenticity has a mediating effect on the interaction between consumer brands and the relationship between consumer brands. It means that brand authenticity is a valuable parameter for enhancing consumer-brand connections. Therefore, this study aims to identify the factors that have a more significant mediating effect on amplifying consumer-brand connections by categorizing the sub-factors of brand authenticity into honesty and originality, as indicated by previous studies. In this study, brand commitment was considered a variable representing the consumer-brand connections. Brand commitment is a behavioral association that promotes long-term relationship with a

brand, and strong commitment leads to the determination to maintain the relationship with the brand. Seo and Lee (2013) reported that for brand authenticity to contribute to a sense of community and behavioral intention, the relevant attributes must be consistently expressed over the long term. Series marketing strategies are characterized by long-term presentation and continuity using a similar concept and may thus be associated with perceptions of greater brand authenticity and commitment compared with one-time marketing campaigns.

Research Method

The aim of this study was to confirm the branding effects of the series marketing strategy, which has recently garnered attention as an effective marketing technique. The research subjects were male and female consumers aged between 20s and 50s. The survey was conducted through an online survey agency, and a virtual scenario was provided to evoke the experience of shopping for series products repeatedly released by a fashion brand. The measurement tool was constructed by extracting items from previous studies and modifying and supplementing them to fit the research purpose. PLS-SEM analysis was attempted to observe the strengthening of the connections between consumers and brands stemming from branding effects. The analysis was conducted using SmartPLS 4 to perform confirmatory factor analysis and hypothesis testing for direct paths, and PROCESS Macro 4.2 was used to verify mediating effects. For the confirmatory factor analysis, internal consistency, convergent validity, and discriminant validity were confirmed. First, for internal consistency, all measurement items showed factor loadings above the threshold, and the Cronbach's α values were also above the threshold. Additionally, the composite reliability values ranged from .765 to .862, indicating that internal consistency was achieved. Convergent validity was considered desirable as the average variance extracted (AVE) values ranged from .681 to .822, exceeding the threshold, and discriminant validity was also confirmed as the values met the criteria (Fornell & Larcker, 1981).

Results & Discussion

Evaluation of the structural model revealed that the R^2 values of the endogenous variables generally exhibited acceptable figures, and the Q^2 value of PLSpredict for assessing predictive relevance exceeded the standard value of 0, indicating the structural model's adequacy. According to the results of the direct path validation, consumer perception of continuous series marketing had a significant positive static impact on brand honesty ($\beta = .491$, $p < .001$) and originality ($\beta = .444$, $p < .001$), which are sub-factors of brand authenticity. It also had a significant positive static impact on brand commitment ($\beta = .234$, $p < .001$). Brand honesty also had a significant positive static impact on brand commitment ($\beta = .402$, $p < .001$), and although the value for originality was lower than that of honesty, it still had a significant positive static impact on brand commitment ($\beta = .194$, $p < .001$). Finally, brand commitment had a significant positive static impact on product attitude ($\beta = .679$, $p < .001$). The results of the mediating role of brand authenticity verified through bootstrapping showed that consumer perception of series marketing had an indirect effect on brand commitment through brand honesty, with a value of .061 and a confidence interval (CI) index of .035 – .089, indicating a significant partial mediating effect. Meanwhile, originality showed CI values of -.007 – .007, including 0, suggesting no significant mediating effect.

Conclusion

The study's findings suggest that consumers' perceptions of a continuous series marketing strategy is positively related to brand authenticity and brand commitment and that brand commitment is directly related to product attitude and positive relationships. In refer to the results reported by previous studies (e.g., Chen et al., 2016; Yoo & Park, 2006), we found that series marketing differs from single marketing in that it has a distinct marketing concept and presents products and advertisements that cohere around a consistent theme, which makes it easier for consumers to understand the purpose and concept of the marketing strategy, thus positively influencing their perception of brand authenticity. Furthermore, brand authenticity leads to brand commitment and product attitude, and the perception of series marketing has a more efficient effect on brand commitment through honesty as a mediator rather than a direct path. These

results attest that a series marketing strategy can be effective in strengthening the connections between consumers and brands. However, since repetitive exposure to advertisements not only affects brand authenticity but also impacts factors such as brand intimacy, familiarity, and attachment, further detailed verification is deemed necessary. This study highlights practical implications whereby repetitive marketing efforts can effectively enhance the consumer–brand connections. Moreover, the study's academic significance lies in its confirmation of the relationship between brand authenticity and brand commitment, product attitude through a series marketing strategy, shedding light on the mechanism through which it positively influences consumer-brand connections.

References

Chen, J., Yang, X., & Smith, R. E. (2016). The effects of creativity on advertising wear in and wear out. *Journal of the Academy of Marketing Science, 44*, 334-349.

Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research, 18*, 382-388.

Seo, S., & Lee, Y. (2013). Quantitative research for investigating internal structure and the influence on brand attachment, commitment, loyalty of fashion brand authenticity. *Journal of the Korean Society of Costume, 63*(7), 148-163.

Yoo, C., & Park, C. (2006). Study on consistency effects of Ad series. *Broadcasting & Communication, 7*(1), 157-184.

You, S. S., & Choi, Y. J. (2019). Effects of consumer-brand interaction on brand attitudes in brand SNS: The mediated effect of brand authenticity and consumer-brand relationship. *Advertising Research,* (123), 68-109.

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WHAT DEFINES DIGITAL FASHION?
UNVEILING INSIGHTS THROUGH INSTAGRAM DATA ANALYSIS

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Introduction

In the dynamic landscape of fashion, the emergence of digital fashion is a remarkable innovation, redefining the boundaries of style and creativity. Digital fashion is a 3D virtual representation of clothing that is made with computers and 3D software, instead of textiles or fabrics (Ginsburg, 2022). Digital fashion not only presents an opportunity for creative expression but also catalyzes sustainable practices in the fashion industry. Amidst this digital fashion wave, one lingering question is its tangible significance. Consumers, while intrigued, are often unclear about the actual value and utility of digital fashion items. This study delves into the realm of digital fashion, analyzing digital fashion brands' posts on social media platforms to understand how the brands engage and resonate with consumers. The following exploratory research questions are analyzed in exploring digital fashion narratives on social media platforms through text mining: RQ1: Which keywords are most prevalent in the digital fashion narrative on social media platforms? RQ2: What central themes emerge in the social media discourse of digital fashion?

Literature Review

The emergence of digital fashion has marked a transformative shift in the apparel industry, garnering increasing consumer interest (Van Rijmenam, 2022). Digital fashion brands are characterized by their unique identities, similar to traditional fashion brands. Two leading digital fashion brands, The Fabricant and Tribute Brand, identify themselves as digital tailoring couture. In contrast, Dress X aims to become a multi-brand that introduces various brands and designer products on a platform. Price points within digital fashion can vary dramatically, with the Tribute Brand's lace and latex shirt being noted as one of the most expensive digital fashion pieces. Since digital fashion is not a physical form, brands offer services, such as augmented reality (AR) and digital photo services, to help consumers experience wearing the product. AR services allow consumers to vividly see themselves wearing virtual items, and digital photo services enable consumers to upload their photos. It makes the inserted virtual item appear as if they are actually wearing it.

Digital fashion, while allowing creative expression, also plays a crucial role in promoting sustainability. Unlike traditional fashion, digital apparel requires no physical materials, cutting down on production and logistic processes (Saxena, 2022). This not only speeds up the style turnover but also significantly reduces the environmental footprint. Brands like Dress X and Fabricant demonstrate this through their diverse digital collections, offering limitless fashion possibilities without the constraints of material costs and production limitations. Notably, digital fashion reduces carbon emissions by up to 96% and saves substantial amounts of water (Dress X, 2021), underlining its potential as a sustainable choice in the fashion industry.

Research Method

This study used Instagram, recognized as the most widely used social networking service by numerous individuals and corporations, as the primary data source. Utilizing a crawler, we gathered a substantial dataset of 2,560 posts from the most prominent and active digital fashion companies, The Fabricant (@the_fab_ric_ant, 95,000 followers), Dress X (@dressx, 80,000 followers), and Tribute Brand (@tribute_brand, 50,000 followers), from 2018 to February 2024. First, the Textom software was employed to perform text mining, facilitating keyword extraction. Second, a network analysis based on centrality analysis was conducted using Ucinet6 (Borgatti et al., 2002) to identify the key keywords and

their networks. Third, CONCOR analysis, the most effective method to identify clusters in a complex network, was performed to identify structural equivalence.

Results & Discussion

First, keyword frequency analysis revealed as follows: DressX (4.28%), digital (2.71%), fashion (2.31%), digital fashion (1.34%), collection (1.28%), AR (1.19%), NFT (1.07%), look (0.95%), metaverse (0.93%), runway (0.87%), new (0.81%), wear (0.71%), create (0.71%), dress (0.69%), available (0.66%), future of fashion (0.64%), brand (0.59%), fashion tech (0.58%), drop (0.55%), physical (0.49%), app (0.47%), design (0.44%), virtual fashion (0.43%), first (0.40%), designer (0.40%), 3D (0.40%), try (0.38%), meta (0.36%), sustainability (0.35%), outfit (0.35%). Second, a network analysis was conducted. Table 1 presents the results of the degree centrality (DC) analysis, pinpointing the most influential keywords in the network, along with the eigenvector centrality (EC) analysis. This considers both the direct and indirect connections of a keyword and the centrality of the connected keyword. Third, the result of the CONCOR analysis on the top 30 most frequently appearing keywords is shown in Figure 1. Eight clusters were identified, with adjacent grouping in the second dimension of the CONCOR analysis, forming four distinct issues. Issue 1 refers to the keywords about digital couture (Dress X, digital fashion, collection, look, runway, etc.). Issue 2 refers to the keywords about digital innovation (digital, fashion, 3D, new, sustainability, etc.). Issue 3 refers to the keywords about digital fashion technology (NFT, future of fashion, fashion tech, etc.). Issue 4 refers to the keywords about the AR experience (AR, metaverse, app, etc.).

Table 1. Result of Centrality analysis

Keywords	DC	EC
DressX	31.51	0.53
digital	19.73	0.40
fashion	17.98	0.38
digital fashion	9.72	0.21
collection	9.07	0.19
AR	9.35	0.20
NFT	8.17	0.18
look	7.74	0.17
metaverse	7.43	0.16
runway	7.28	0.17
new	6.21	0.13
wear	5.34	0.12
create	5.97	0.13
dress	5.03	0.11
available	5.03	0.12
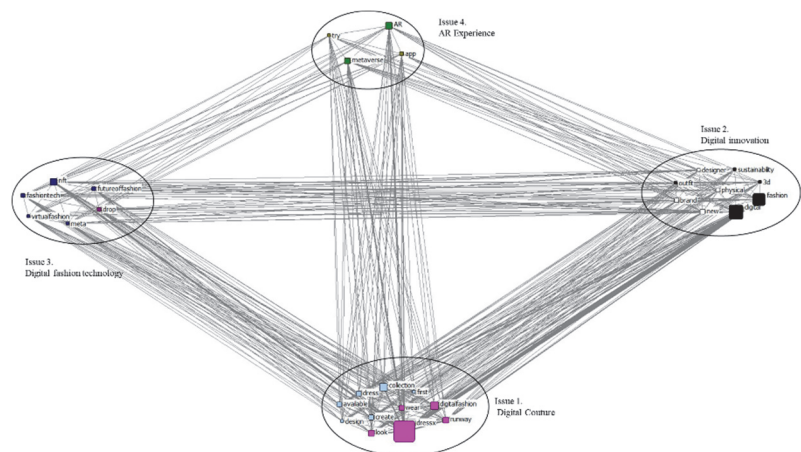
Figure 1. Results of CONCOR analysis

Conclusion

Our findings revealed a diverse array of keywords prevalent in the digital fashion narrative, shedding light on the multifaceted nature of this emerging field. We discovered that digital fashion is characterized by limitless fashion potential and innovation, indicating a future of fashion deeply intertwined with technological advancement. Moreover, our analysis brought the significance of AR experience to the forefront, representing a novel and immersive approach to experiencing and wearing digital fashion.

This study not only deepens the academic understanding of digital fashion but also provides actionable insights for fashion brands exploring this new digital frontier. By highlighting the critical areas of innovation and consumer engagement, our research offers a comprehensive view of the opportunities and challenges for the fashion industry in the digital realm. Additionally, the study highlights a notable communication gap in the industry, especially in terms of sustainability messaging. While brands like Dress X compile detailed sustainability reports, this crucial aspect lacks representation in their social media narratives, suggesting a need for more cohesive and impactful messaging to appeal to environmentally conscious consumers.

References

Borgatti, S. P., Everett, M. G. & Freeman, L. C. (2002). *Ucinet for Windows: Software for Social Network Analysis*. Harvard, MA: Analytic Technologies.

Dress X. (2021). Digital fashion sustainability report 2021.https://docsend.com/view/weyzfyzxqvyapgzn

Ginsburg, R. (2022, July 7). What Is Digital Fashion, And Why Is It Important? *Kiplinger.Com*. https://www.kiplinger.com/investing/cryptocurrency/604900/what-is-digital-fashion

Van Rijmenam, M. (2022, August 15). *Digital Fashion: The Next Frontier in Fashion*. The Digital Speaker. https://www.thedigitalspeaker.com/digital-fashion-next-frontier-fashion/

Saxena, A. (2022, February 22). Digital fashion claims to solve overconsumption and overproduction: how green is it really? *Lampoon*. https://www.lampoonmagazine.com/article/2022/02/22/digital-fashion

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THE EFFECTS OF CUSTOMER ORIENTATION OF FASHION BREND SALESPERSON ON JOB RESULTS: FOCUSING ON THE MEDIATING EFFECT OF CORE SALES TASKS

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Introduction

Salesperson is responsible for improving sales by creating and managing new customers so that the company continues to realize profits(Kim & Oh, 2022). Customer orientation is an attitude or behavior that considers customers to satisfy their desired needs and tries to build trust relationships with customers (Lee, 2014). Customer orientation can be said to be the personal competency that has the greatest influence on salespeople's job activities and results. The relationship between the customer orientation of fashion brand salespeople on core-sales-tasks(sales management and customer management) and job results(job performance and job satisfaction) has been revealed in several previous studies(Ahmad et al., 2021). However, research to explain the difference in the concept of sales management and customer management according to customer orientation or to understand the relationship between job performance and job satisfaction is insufficient. Therefore, the purpose of this study is to first reveal the difference in the influence of fashion brand salesperson's customer orientation on sales management and customer management. Second, it reveals the difference in the influence of salesperson's sales management and customer management on job performance and job satisfaction. Third, it is intended to clarify the mediating role between sales management and customer management in the influence of the customer orientation of fashion brand salespeople on job results

Literature Review

Fashion brand salespeople are in charge of maintaining and improving sales, and this is something that can be done to understand customers and gain customer trust through customer-centered thinking(Oh, 2021). Salesperson's core-sales-tasks can be defined as the brand's sales management and customer management(Kim & Oh, 2019). And salespeople's job results can be revealed as job performance evaluated by companies to achieve a set sales target amount or task(Choi et al., 2014), and job satisfaction evaluated by salespeople as pleasant and positive emotional states they feel in job-related experiences (Rutherford et al, 2009).

Research Method

Data were collected as questionnaires from September to October 2020 from salesperson, who works for a fashion brand in Gwangju. A total of 235 copies were used for data analysis, and factor analysis and regression analysis were conducted using the SPSS 27.0 program. As a result of factor analysis, salesperson's customer orientation consisted of factors such as 'customer understanding' (36.798% variance, Cronbach's α=.875) and 'customer trust' (25.989% variance, Cronbach's α=.725). Core-sales-tasks consisted of 'sales management' (41.070% variance, Cronbach's α=.827) and 'customer management' (28.031% variance, Cronbach's α=.690), and job results consisted of 'job performance' (41.181% variance, Cronbach's α=.868) and 'job satisfaction' (31.283% variance, Cronbach's α=.791).

Results & Discussion

1. Multiple regression analysis analyzed the effect of salesperson's customer orientation on core-sales-tasks. The customer orientation factors 'customer understanding'(β=.339, ρ<.001) and 'customer trust' (β=.198, ρ<.01) had a significant influence on salesperson's 'sales management' work, and 'customer understanding'(β=.406, ρ<.001) and 'customer trust'(β=.284, ρ<.001) also had a significant impact on 'customer management' work. As a result of the analysis, it was found that salesperson with higher

customer orientation had higher awareness of core-sales-tasks. The factor that had a greater influence on salesperson's core-tasks was 'customer understanding' than 'customer trust'.

2. Multiple regression analysis was conducted to analyze the effect of core-sales-tasks on job performance and job satisfaction. Both the influence of 'sales management' (β=.556, ρ<.001) and 'customer management' (β=.136, ρ<.05) on 'job performance' were significant. The influence of 'sales management' (β=.232, ρ<.01) and 'customer management' (β=.153, ρ<.05) on 'job satisfaction' was also significant. As a result of the analysis, it was confirmed that the higher the salesperson's awareness of his core-tasks, the better the job result. In particular, the 'sales management' task showed a greater influence on 'job performance' and the 'customer management' task showed a greater influence on 'job satisfaction'.

3. A multiple regression analysis was conducted to reveal the mediating effect of core-tasks in the effect of salesperson's customer orientation on job results. Customer orientation had a significant effect on job results (β=.550, ρ<.001) and core-tasks (β=.294, ρ<.001), and core-tasks had a significant effect on job results (β=.424, ρ<.001), confirming the mediating effect of core-tasks. As a result of the analysis, it was found that customer orientation had a significant influence on job results, and that the perception of core-tasks had a partial mediating effect. Looking at the mediating effects of 'sales management' and 'customer management', 'sales management' showed a significant influence on customer orientation (β=.346, ρ<.001), and had a significant influence on job results (β=.430, ρ<.001). In addition, 'customer management' showed a significant influence on customer orientation (β=.440, ρ<.001), and had a significant influence on job results (β=.181, ρ<.001)

Conclusion

1. Customer orientation is an important variable for salespeople to perform their sales duties well, and understanding of customers was relatively more important than gaining trust from customers. 2. Sales management had more influence on corporate-oriented job performance, and customer management had more influence on salespeople's job satisfaction. 3. Salespeople's core-tasks have a mediating effect in the effect of customer orientation on job outcomes, and sales management has a greater mediating effect than customer management

References

Ahmad, B., Da, L., Asif, M.H., Irfan, M., Ali, S. & Akbar, M.I.U.D. (2021). Understanding the antecedents and consequences of Service-sales ambidexterity: A motivation-opportunity-ability (MOA) framework. *Sustainability 2021, 13*(17), 9675. https://doi.org/10.3390/su13179675

Choi, J. E., Lee, K. M., & Hwang, S. J. (2014). The effects of service education and empowerment for sales person of fashion companies on customer orientation, job performance and job satisfaction. *The Research Journal of the Costume Culture, 22*(1), 28-41.

Kim, J.-Y. & Oh, H. J. (2019). A grounded theory study on the growth process as a fashion brand manager. *Journal of the Korean Society of Clothing and Textiles, 43*(5), 649-665.

Lee, C. Y. (2014). *Fashion brand shopmaster core job competency analysis* (Unpublished master's thesis). Chung-Ang University, Seoul.

Kim, J.-Y. & Oh, H. J. (2022). The effects of sales services and organizational member relationships of fashion brand salesperson on job performance and job satisfaction. *Human Ecology Research, 60*(1), 131-145. http://dx.doi.org/10.6115/fer.2022.009

Oh, H.-J. (2021). A study of the effects of the internal characteristics of fashion brand salespeople on core sales tasks. *Human Ecology Research, 59*(3), 311-324. http://dx.doi.org/10.6115/fer.2021.023

Rutherford, B., Boles, J., Hamwi, G. A., Madupalli, R., & Rutherford, L. (2009). The role of the seven dimensions of job satisfaction in sales person's attitudes and behaviors. *Journal of business research, 62*(11), 1146-1151.

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GENERATIONAL DIFFERENCES OF KOREAN CONSUMERS FOR THE PURCHASE BEHAVIOR OF FASHION PRODUCTS RELATED TO PRO-ENVIRONMENT AND ANIMAL ISSUES

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Introduction

In Korea, the market size of environmental and animal-friendly fashion is growing. Altruistic or health-related reasons are usually the reasons Korean consumers purchase eco-friendly products. In addition, people's ethical orientations drive their purchase of fashion items related to animal issues. Thus, it is likely that Korean consumers will buy these fashion products based on their ethical and philosophical values. Since consumers' values, lifestyles, and consumption tendencies vary across generations, generational difference in environmental and animal issues are expected to influence fashion purchases. However, very few academic studies have been conducted on how X, Y, and Z generation consumers differently react to such products that have recently been recognized as ethical or unethical. A specific focus of this study is to examine generational differences in consumer values and interests regarding environmental protection and animal abuse issues resulting from the purchase of fashion products. A generational difference was also examined in terms of perceived moral intensity toward purchasing fashion products relating to both positive and negative issues, and purchase intent and experience of organic, naturally dyed, natural leather, and natural fur items.

Literature Review

Generational cohort theory suggests that people born around the same time have similar values, beliefs, attitudes, and behaviors throughout their lives since they have experienced similar historical events (Inglehart, 1977; Strauss & Howe, 1991). Each generation's unique generational identity determines their preferences and behavior (Schewe & Noble, 2000). According to previous studies on generations X, Y, and Z Korean, Gen X is characterized as post-authoritarian, cynical, and pessimistic compared to their parents' generation. They do not trust the promises of governments or large corporations, and place greater importance on how they live individually rather than on common social issues. In contrast to the baby boom generation, Generation Y is more open to cultures and races from other countries, other people's values and tastes, and highly accepting of diversity. They have high self-esteem, are self-centered, rebellious, and challenge themselves. These consumers are trendsetters who care about their appearance, enjoy fashion shopping, and have voracious purchasing power. Gen Y spends time collecting and exchanging information and enjoys entertainment. Generation Z grew up with the Internet and enjoys playing online games and communicating with their friends and family via social networking sites. Their purchasing power increases in the online environment, they are savvy about image and video content, and they heavily influence their parents' decisions. The MZ generation is also more concerned about the environmental impact of their purchases than other generations and is more concerned about ESG behaviors such as social responsibility and corporate ethics. In particular, the MZ generations tend to express their identities through consumption, reflecting their beliefs, values, and what is important to them. As such, we anticipated that Gen X and Gen Y Korean female consumers would have different ethical standards when judging right and wrong, different interests in environmental and animal issues, different perceptions of moral intensity toward buying fashion products related to those issues, and different purchasing experiences and intents.

Research Method

Data were collected from Korean adult women by an online survey using a convenience sampling method, and 346 consumer data from Gen X (52%, birth in 1965-1980) and Gen Y (48%, birth in 1995-2002) were analyzed. Most respondents were married (57.8%), graduated from university or college (66.2%), and had an average monthly family income of 2 to 5 million won (71.3%), and lived in 16 provinces. 56.6% were office workers. Idealism, relativism, and moral intensity were measured on a 5-point Likert scale. The

interest in environment destruction and animal abuse issue and the purchase experience and intention of fashion products were measured by a 5-point evaluation scale. Demographic variables were measured forced-choice questions and free-responses. We conducted confirmatory factor analysis using AMOS 25.0, and t-test, Chi-square test, reliability and frequency analysis were conducted using SPSS 20.0.

Results & Discussion

A significant difference in consumer values was found between Gen X and Gen Y. While Gen X had higher idealistic values than Gen Y, the tendency to pursue relativism was not significantly different. Furthermore, Gen X consumers were significantly more interested in the environmental benefits of organic textiles and naturally dyed fabrics than Gen Y. However, Gen Y was significantly more concerned about the ecological destruction caused by fashion products made from wild animal fur than Gen X. In terms of interest in animal abuse caused by purchasing natural leather fashion products, generational differences were not significant. Third, there were significant generational differences in the perception of moral intensity regarding purchasing natural leather and fur fashion products. Compared to Gen X, Gen Y highly perceived the probability, magnitude, and concentration of moral intensity associated with purchasing natural leather and natural fur fashion products. Compared to Gen X, Gen Y perceived the immediacy and social consensus dimensions of moral intensity as more important in buying natural fur fashion products. Nevertheless, there was no generational difference in the three dimensions of immediacy, proximity, and social consensus of moral intensity regarding animal abuse caused by the purchase of natural leather fashion products. The proximity dimension of moral intensity regarding ecological destruction caused by natural fur fashion purchases was not significantly shown generational differences. Forth, compared to Gen Y, Gen X also highly valued the proximity dimension of moral intensity, namely that naturally dyed fashion products brought environmental protection benefits to them and their families. However, the perception of all six dimensions of perceived moral intensity were not different between the two generations regarding organic fashion product purchases. Lastly, the X generation actually purchased more fashion products made from organic textiles, naturally dyed fabrics, and wild animal fur than the Y generation. The actual frequency of buying natural leather fashion products did not differ between the two generations. Gen X showed significantly higher purchase intent for natural fur fashion products than Gen Y, while generational differences were not observed for organic textiles, naturally dyed fabrics, or natural leather fashion products.

Conclusion

By confirming generational differences in Korean female consumers' values, interest in animal cruelty and environment protection, perceived moral intensity of purchasing fashion products related to such issues, and actual purchase and purchase intent, the results provide helpful insights for fashion brands and companies. For example, Gen Y consumers have negative perceptions of animal-related fashion purchases and are passive when it comes to purchasing such fashion products. It implies that instead of natural leather and fur fashion products, Gen Y may be more inclined to purchase apparel like faux leather and fur than the Gen X. So global or domestic brands developing and promoting products to Korean female consumers need to pay attention to this fact. In addition, brands should recognize that Korean Gen X female consumers value fashion products that contribute to environmental protection and tend to buy more of them because protecting the environment benefits them and their families.

References

Inglehart, R. (1977). *The silent revolution: Changing values and political styles among western publics.* Princeton University Press.

Strauss, W., & Howe, N. (1991). Generations: The history of America's future, 1584-2069. New York: William Morrow and Company.

Schewe, C. D., & Noble, S. M. (2000). Market segmentation by cohorts: the value and validity of cohorts in America and abroad. *Journal of marketing management*, *16*(1), 129-142. http://dx.doi.org/10.1362/026725700785100479

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UNDERSTANDING PRO-ENVRIONMENTAL BEHAVIORAL INTENTION PROMOTED BY VIRTUAL VERSUS HUMAN INFLUENCERS: THE MEDIATING ROLE OF EMPATHY

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Introduction

Social media campaigns that appeal to sustainability have rocked in 2022, driven by Gen Z and millennial consumers (Peel-Yates, 2023). According to Pew research, engaging in social media has made them more aware of sustainability as 69% of Gen Z and 59% of millennial social media users reported anxiety about the future (Tyson, 2021). With the growing popularity of green activism on social media, many top brands started to present green campaigns using virtual influencers. For example, Prada created a virtual ambassador to promote the group's innovative projects (Sands et al., 2022).

In alignment with a new trend of "deinfluencing" that emerged as a further response to sustainability (Vladimirova et al., 2023), various green activisms ranging from sufficient consumption (e.g., Gossen et al., 2019) to mindful consumption (e.g., Bahl et al., 2016; Sheth et al., 2011), sustainable consumption (e.g., White et al., 2019), and "consume better but less" type of a lifestyle (Wiedmann et al., 2020) have become the focus of scholarly attention as well (Hermann, 2022). However, scant research investigated the effectiveness of green marketing advertised by a virtual influencer. Virtual influencers feature advantageous characteristics that demonstrate communicational dynamics through an artificial intelligence (AI)-powered voice agent. Moreover, as a semi-autonomous agent creating credible and subtle storytelling content, brands could harness virtual influencers as a tool for promoting pro-environmental behavior.

With that in mind, the current research aims to investigate when and how virtual influencers could promote pro-environmental behavior on social media more effectively than human influencers. As part of the research project conducting a series of experimental studies, this study focused on providing preliminary evidence by examining the underlying mechanism of pro-environmental behavior based on the theoretical foundation of empathy.

Literature Review

Empathy refers to "an affective response that stems from the apprehension or comprehension of another's emotional state or condition, and which is similar to what the other person is feeling or would be expected to feel (Eisenberg & Fabes, 1998, p.702)". Thus, empathy is combination of emotional reactions and the cognitive understanding of other people's experiences and feelings (Pelau et al., 2021).

Empathy facilitates the development of social relationships (Anderson & Keltner, 2002) as it increases similarity, fondness, and affiliation (De Vignemont & Signer, 2006). Research on empathy in human-machine interaction (HMI) reported that empathic robot agents could also foster feelings and considered trustworthy (Brave et al., 2005; Paiva et al., 2004). In this vein, the research views empathy as the core mediating factor that could encourage followers to engage in pro-environmental behavior when green activism was advocated either by human or virtual influencers (Eisenberg and Fabes, 1990; Hoffman, 1982).

Research Method

A total of 268 participants were recruited via the Prolific platform. The majority of the participants were young (M_{age}= 36.0), female (61.6%), White (67.5%) with a bachelor's degree (38.4%), and household income over $60K (51.8%). Participants responded that they spend less than 30 minutes a day using social media (59.4%) and use Instagram on a daily basis (37.7%).

All measurements were adopted from previous studies. Also, all items were measured on a 7-point scale, and all measurements demonstrated acceptable internal reliability (Cronbach's α >0.8). The factor loading for all measured items was above 0.6. The correlational analysis revealed that all dependent measures were moderately correlated (r < .07).

Results & Discussion

An independent t-test result showed that the manipulation of influencer type was successful ($p < .01$). A one-way ANOVA was conducted to test the main effects and the result revealed the main effect of influencer type on empathy [$F_{1,266}=16.8$, $p<.001$]. The human influencer led to higher empathy than the virtual influencer ($M_{human}=3.5$, $M_{virtual}=2.9$). There was the main effect of influencer type on pro-environmental behavioral intention [$F_{1,266}=7.9$, $p=.02$]. The human influencer led to higher pro-environmental intention than the virtual influencer ($M_{human}=5.2$, $M_{virtual}=4.9$).

A mediation analysis was conducted using the Haye's PROCESS path-analysis macro for SSPS (Hayes, 2008; Model 4). The 95% confidence interval of the indirect effects was obtained with 5,000 bootstrap resamples (Preacher & Hayes, 2008). The 95% bias confidence interval did not include zero (95% CI=[.02, .21], $\beta= .09$), supporting the indirect effect of influencer type on pro-environmental behavior intention through empathy.
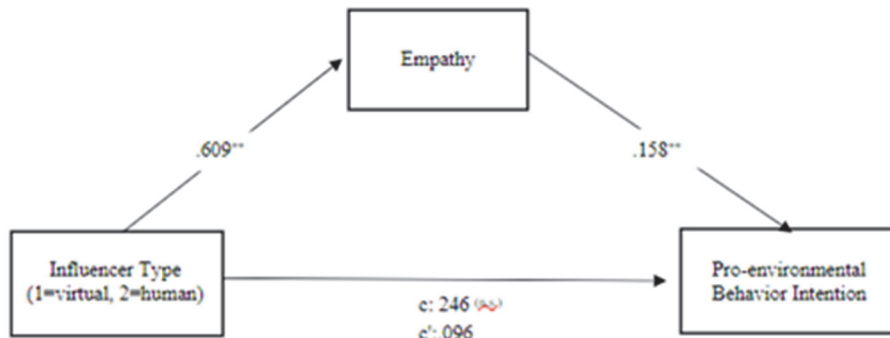
Figure 1. Direct and mediation model with path coefficients

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Conclusion

The findings of the study revealed that both virtual and human influencers could lead consumers to engage in pro-environmental behavior when mediated by empathy. The findings of the study align with a stream of existing literature that reported that inducing empathy could be effective in improving environmental behavior (Tian & Robertson, 2019; Want et al., 2022). The findings of the study provide preliminary evidence for utilizing virtual influencers as appealing affective tools for promoting pro-environmental behavior (Gerrath et al., 2024). Lastly, the findings of the study could suggest marketers and stakeholders use virtual influencers as viable sources for promoting green activism.

References

Bahl, S., Milne, G. R., Ross, S. M., Mick, D. G., Grier, S. A., Chugani, S. K., ... & Boesen-Mariani, S. (2016). Mindfulness: Its transformative potential for consumer, societal, and environmental well-being. J*ournal of Public Policy & Marketing, 35*(2), 198-210.

Holmgren, R. A., Eisenberg, N., & Fabes, R. A. (1998). The relations of children's situational empathy related emotions to dispositional prosocial behaviour. *International Journal of Behavioral Development, 22*(1), 169-193.

Gerrath, M. H., Olya, H., Shah, Z., & Li, H. (2024). Virtual influencers and pro-environmental causes: The roles of message warmth and trust in experts. *Journal of Business Research, 175*, 114520.

Hermann, E. (2022). Leveraging artificial intelligence in marketing for social good—An ethical perspective.

Journal of Business Ethics, 179(1), 43-61.

Peel-Yates, V. (2023, February 26). Sustainability Social Media Campaigns that rocked: 2022. The Sustainable Agency. https://thesustainableagency.com/blog/sustainability-social-media-campaigns-that-rocked/

Tyson, A. (2021, May 26). Gen Z, millennials stand out for climate change activism, social media engagement with issue. Pew Research Center Science & Society. https://www.pewresearch.org/science/2021/05/26/gen-z-millennials-stand-out-for-climate-change-activism-social-media-engagement-with-issue/

Pelau, C., Dabija, D. C., & Ene, I. (2021). What makes an AI device human-like? The role of interaction quality, empathy and perceived psychological anthropomorphic characteristics in the acceptance of artificial intelligence in the service industry. *Computers in Human Behavior*, 122, 106855.

Sands, S., Ferraro, C., Demsar, V., & Chandler, G. (2022). False idols: Unpacking the opportunities and challenges of falsity in the context of virtual influencers. *Business Horizons*.

Sheth, J. N., Sethia, N. K., & Srinivas, S. (2011). Mindful consumption: A customer-centric approach to sustainability. *Journal of the Academy of Marketing Science, 39*, 21-39.

Tian, Q., & Robertson, J. L. (2019). How and when does perceived CSR affect employees' engagement in voluntary pro-environmental behavior?. *Journal of Business Ethics, 155*, 399-412.

Wang, L., Sheng, G., She, S., & Xu, J. (2023). Impact of empathy with nature on pro-environmental behaviour. *International Journal of Consumer Studies, 47*(2), 652-668.

White, K., Habib, R., & Hardisty, D. J. (2019). How to SHIFT consumer behaviors to be more sustainable: A literature review and guiding framework. *Journal of Marketing, 83*(3), 22-49.

Vladimirova, K., Henninger, C. E., Alosaimi, S. I., Brydges, T., Choopani, H., Hanlon, M., ... & Zhou, S. (2024). Exploring the influence of social media on sustainable fashion consumption: A systematic literature review and future research agenda. *Journal of Global Fashion Marketing, 15*(2), 181-202.

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SUSTAINABLE STANDARDS, SITUATIONAL CHOICES: ECO-FRIENDLY LEATHER AND NORM ACTIVATION

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Introduction

As the fashion industry is compelled to reduce environmental impact, traditional leather faces scrutiny due to the vast depletion of resources the industry has seen in its manufacturing process (McKinsey & Company, 2023). However, sustainable practices are advised to be integrated with caution as they are prone to elicit unexpected responses from consumers in both quality evaluation and brand reception (Santa & Drews, 2023), leaving outcomes questionable for brands This study explores consumer perceptions of eco-friendly leather, applying the norm activation model to domain-specific situational information search behavior. Given the environmental and ethical criticisms of animal-based materials in fashion, we used the norm activation model to clarify how situational involvement with eco-friendly leather products is influenced and to examine the extent to which consumer decisions are driven by moral obligations.

Literature Review

Norm activation model: The norm activation model provides a robust framework for understanding the interplay between knowledge, values, and action, enriching the discourse on consumer behavior and sustainability. The framework emphasizes the role of the awareness of consequences, which influences ascribed responsibility, thus shaping personal norms that an individual adheres to. However, prioritizing sustainable fashion in purchase behavior, despite personal norms, has proven to be a challenge (Santa & Drews, 2023). While individuals are explained to act in accord to personal norms, when and where they choose to activate these obligations is susceptible to situational factors, such as accessibility and affordability (Onwezen et al., 2013).

Situational product involvement: While enduring product involvement has been observed to be crucial for an individual's self-concept and be during in nature, situational product involvement depends on personal circumstances (Rahman, 2018). Given that broad product involvement falls short in fully explaining consumer behavior in ethical contexts, situational product involvement can be more effective in directly influencing purchase decisions (Bezençon & Blili, 2010). This study focused on situational product involvement as a key determinant, recognizing its dual role in facilitating both purchase behavior and the active seeking of product information.

Guilt and consumer decisions: Guilt can be elicited when an individual is aware that their actions do not reflect personal norms and thus recognize the discrepancy between moral obligations and actual behavior (Antonetti & Maklan, 2014). Consequently, emotions such as guilt and pride play a crucial role in encouraging consumers towards pro-environmental or altruistic decision-making, particularly within consumption contexts (Onwezen et al., 2013). Thus, we formulated the following hypotheses:

H1: High awareness of consequences will influence high ascribed responsibility, regarding eco-friendly leather products' impact on the environment.
H2: High levels of ascribed responsibility will influence high personal norms of (a) altruistic and (b) biospheric values in eco-friendly leather products.

H3: The emotion of guilt will show positive correlation with situational product involvement of eco-friendly leather products.

H4: The emotion of guilt will mediate the relationship between personal norms of (a) altruistic and (b) biospheric values and situational product involvement.

Research Method

An online survey was conducted to gather data regarding eco-friendly leather products. 359 responses were gathered from South Korean consumers, with a prescreening question of whether they were aware of eco-friendly leather. Personal norm measures adopted from previous studies, awareness of consequences, ascribed responsibility, guilt arising from purchase patterns, and eco-friendly leather product situational involvement was measured. For measurement model assessment and hypotheses testing, SmartPLS4 was employed for confirmatory factor analysis and structural equation modeling.

Results & Discussion

First, the measurement model was validated with no issues in collinearity. Aligned to previous framework of the norm activation theory, awareness of consequences showed positive correlation with a consumer's ascribed responsibility, supporting H1. Higher levels of ascribed responsibility influenced personal norms, supporting H2. Guilt positively influenced situational involvement, supporting H3. Next, personal norms based on biospheric values, but not altruistic values, had significant indirect effects on situational involvement through guilt, thus H4 was partially supported.

Conclusion

With the growing importance placed on sustainability, this research holds many theoretical and managerial implications. First, despite previous studies that support the trait of altruism to influence sustainable consumption, specific norms that focused on adhering to pro-environmental values determined the situational product involvement of eco-friendly leather products. Next, guilt was a key factor that showed high correlation with norms and situational involvement. Fashion practitioners are advised to consider these aspects when implementing eco-friendly leather products, to maximize positive influence of sustainable leather. Furthermore, as previous research explains that high environmental values can be reflected in various areas of purchases, this research provides insight on how to encourage consumers to prioritize eco-friendly leather to fulfill their obligations toward sustainable consumption.

References

Antonetti, P., & Maklan, S. (2014). Feelings that make a difference: How guilt and pride convince consumers of the effectiveness of sustainable consumption choices. *Journal of Business Ethics, 124*(1), 117–134. https://doi.org/10.1007/s10551-013-1841-9

Bezençon, V., & Blili, S. (2010). Ethical products and consumer involvement: What's new? *European Journal of Marketing, 44*(9/10), 1305–1321. https://doi.org/10.1108/03090561011062853

McKinsey & Company. (2023). *The State of Fashion 2024.* McKinsey & Company.

Onwezen, M. C., Antonides, G., & Bartels, J. (2013). The norm activation model: An exploration of the functions of anticipated pride and guilt in pro-environmental behaviour. Journal of Economic Psychology, 39, 141–153. https://doi.org/10.1016/j.joep.2013.07.005

Rahman, I. (2018). The interplay of product involvement and sustainable consumption: An empirical analysis of behavioral intentions related to green hotels, organic wines and green cars. *Sustainable Development, 26*(4), 399–414. https://doi.org/10.1002/sd.1713

Santa, J. C., & Drews, S. (2023). Heuristic processing of green advertising: Review and policy implications. *Ecological Economics, 206*, 107760. https://doi.org/10.1016/j.ecolecon.2023.107760

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INVESTIGATION OF CONSUMER ATTITUDES AND USAGE INTENTIONS TOWARDS FASHION RENTAL SERVICES

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Introduction

With the rise in attention towards the sharing economy as an alternative consumption method for the future, the concept of sharing has begun to spread in the fashion industry as well. The online fashion rental market has been rapidly expanding in many countries recently, with successful examples including Girl Meets Dress in the UK, Rent the Runway in the US, Meilizu and LendMyTrend in China, as well as HUMM (Edbring et al., 2016; Lai et al., 2018). Despite the expectation of fashion rental services as a new source of economic generation in the fashion industry, academic research in this area remains insufficient. This study holds significance in that it conducted research targeting consumers with experience in rental consumption. The resulting attitudes toward rental services and intentions to utilize service benefits are expected to provide substantial assistance in formulating marketing strategies for fashion-sharing platforms anticipated to experience future growth.

Literature Review

Advances in e-commerce technology have made online fashion renting more convenient and accessible, and consumers' demand for more affordable and sustainable fashion items has accelerated the growth of access-based consumption in the fashion industry (Jess. C, 2017). Despite the potential of the online fashion rental market, there is limited information regarding consumer perceptions of online fashion rental and the factors influencing the intention to rent clothing online(Lee & Show, 2020). The attributes of fashion rental services were categorized into diversity, economy, eco-friendliness, and pleasure(Kwak, 2017). Higher inclination towards conspicuous consumption resulted in a more favorable attitude towards fashion rental services. The service quality of fashion rental services positively influenced customer satisfaction, while lower prices in fashion rental services had positive impact on customer loyalty. Furthermore, differences in attitudes and intentions towards fashion rental services were noted based on consumer shopping values, sales promotion types, and types of fashion products (Jang, 2017). The range of items handled by fashion rental platforms has diversified beyond traditional offerings, including sports attire, everyday wear, and clothing for specific occasions. There is a need for empirical research on the expected benefits and usage intentions of fashion rental services among consumers who have changed their values regarding fashion consumption recently.

Research Method

Since the utilization of fashion rental services has not yet become commonplace, respondents with recent experience in rental services were selected as the target of this study. Online surveys were conducted targeting female consumers aged 20-40 who have had experience using shared platforms for accommodation, office spaces, etc., within the past year, and who also have experience with online shopping. The survey was conducted from January 20th to January 31st, 2024. Data from 300 valid respondents were analyzed using factor analysis, and regression analysis, etc. and for the data analysis, SPSS v.28 was used.

Results & Discussion

This study exclusively targeted individuals who had experience using shared platform services for accommodation or office spaces, setting it apart from other studies in terms of respondent characteristics. The factor analysis on the expected benefits of using fashion product rental services were four factors. The first factor, "Expression and Convenience," comprised items related to "expression" "reasonable" and "convenient" while the second factor, "Sustainability" consisted of items related to "resource-saving" and "sustainable." The third factor, "Economy" was composed of items related to "economic" and "cost-saving" and the fourth factor, "Social Communication" consisted of items related to "social life" and "social value."

As a result of regression analysis, both the "Expression and Convenience" factor and the "Economy" factor significantly influenced the intention to use fashion rental service platforms. Interesting point, the content of factors influencing the intention to use the platform varied depending on the rented fashion products, such as daily wear, office wear, sportswear, and so on. For daily casual wear, factors such as "Expression and Convenience," "Economy," and "Social Communication" significantly influenced the intention to use fashion rental services. For office wear, factors such as "Expression and Convenience," "Economy," and "Sustainability" were influential. For luxury brand products, factors such as "Expression and Convenience" and "Social Communication" significantly influenced the intention to use fashion rental services.

Conclusion

This study aims to investigate the expectations and intentions related to fashion product rental services among users of shared service rental platforms such as Airbnb, WeWork, and WeOffice. By surveying consumers who have experience with rental services on their intention to use fashion product rentals, fashion rental platform companies can provide insights into what specific benefits they should offer to consumers. Particularly, the fact that factors influencing the intention to use fashion rentals may vary depending on the product category is highly significant.

References

Jess, C. (2017). Spotify for fashion: does renting clothes signal the end for our wardrobes? The Guardian. November. Available from: https://www.theguardian. com/fashion/2017/nov/01/spotify-for-fashion-renting-clothes-walk-in-closet-obsolete-rental-subscription-brands-dior-prada, Accessed date: 6 June 2018 1

Lee, S. & Chow, P. (2020). Investigating consumer attitudes and intentions toward online fashion, renting retailing, *Journal of retailing and Consumer Service*, 52, 969-989.

Edbring, E. G., Lehner, M., and Mont, O. (2016). Exploring consumer attitudes to alternative models of consumption:motivations and barriers. *Jounal of Cleaner Production*. 123, 5-15.

Lai, X., Song, S., Xu, Y., and Chiu, C.H. (2018). Supply chain strategic fit: two fashion-renting cases. In: Chow, P.S., Chiu, C.H., Yip, A.C.Y., Tang, A.K.Y. (Eds.), Contemporary Case Studies on Fashion Production, *Marketing and Operations*. Springer Nature, Singapore, pp. 165–179.

Kwak, Y. (2018). A Study on Consumer Attitude of Fashion Rental Service, Doctoral dissertation, Seoul National Univ.

Jang, Y. & Hwang, S.(2018). The Effect of Shopping Value, Sales Promotion Type, and Fashion Product Type on Use Intention of a Fashion Rental Service, *Journal of the Korean Society of Costume*, 68(8), 66-80.

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CONTINUOUS TRAINING OF ROUGH AND DETAILED MODELS FOR FASHION CLOTHING

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Introduction

South Korea's fashion market has seen significant growth due to increasing interest in fashion, with the online sector experiencing similar expansion. A key development in this industry is the digitalization of fashion images, crucial for improving customer shopping experiences by providing detailed product information. This digitalization facilitates services like personalized styling recommendations, product tagging for easier search, and visual matching. A major challenge in this process is the manual labor required for accurate labeling and bounding box operations on a large scale, which is time-consuming and costly. To overcome this, we propose a system that leverages pre-trained model and YOLO object detection technology for efficient fashion apparel label data generation. This system automates the extraction and normalization of bounding box coordinates. It also matches classes to add new item data to the label data, facilitating the creation of labeled data for YOLO training and streamlining the labeling process.

Literature Review

Fashion Clothing Detection: Previous research has developed an object detection system known as YOLOv2-opt, based on YOLOv2 (Feng, Luo, Yang, Kita, 2018). This research integrates a convolutional neural network combined with fashion clothing detection, and proposes optimizations to the input and network layers of YOLOv2 to improve detection performance. Experimental results show that YOLOv2 outperforms other object detection techniques such as R-CNN, Fast R-CNN, and Faster R-CNN, and the optimized system is more accurate than YOLOv2.

Clothing Labeling Task: In addition, a proposal to improve the task effectiveness of labeling fashion apparel images is YOLOv4-TPD (Two-Phase Detection) (Lee & Jin, 2021). The system aims to improve the effectiveness of the task in the target domain by transferring knowledge from the source domain to the target domain, which is implemented through a two-stage training approach that utilizes transfer learning.

Research Method

This paper aims to enhance the efficiency of labeling tasks for fashion clothing images and conducts research on automating the labeling process by generating the necessary data as its ultimate goal. To achieve this, the paper outlines a four-step process, and Figure 1 illustrates the concept of the system.
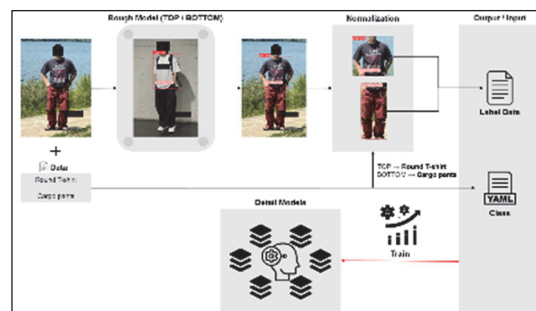
Figure 1

1. **Images Collection**: This study utilized fashion images from Musinsa, one of the largest online fashion platforms in South Korea, obtained through web crawling. Images of clothing products and their corresponding product names and category were crawled and used for training. The selected images include those with a clear distinction between tops and bottoms, as well as images featuring models wearing the entire outfit, to ensure the accuracy of experimental results.

2. **Create a pre-trained model**: Prior to the study, a pre-trained model is generated to distinguish between tops and bottoms. This model undergoes labeling tasks for 100 images, defining two classes: "TOP" and "BOTTOM". This model is utilized to discern whether the fashion item within the image is a top or a bottom(Lim, Choi, & Choi, 2024).

3. **Object Detection and Coordinate Normalization**: In this study, the YOLOv8n, which demonstrates high performance even with minimal capacity compared to the latest models such as YOLOv8, is utilized. Typically, the labeling format used for YOLO training employs relative coordinates, which requires a normalization process to accurately detect the bounding box of image.

4. **Label Data and Model Generation**: Finally, the system generates label data. Additionally, the labeling file stores both the coordinates of the normalized bounding boxes and the class information indicating which class the bounding box belongs to. Through this process, the output data is used to create a new model through YOLO training.

Results & Discussion

This paper demonstrates how the final developed model utilizes a pre-trained model to accurately detect tops (TOP) and bottoms (BOTTOM) within fashion images input by users, and generates new label data through matching these detected items. Specifically, when a user inputs an image of a model along with data on fashion items, the pre-trained model analyzes this input to detect tops and bottoms. The bounding box coordinates of each detected object are normalized, and subsequently, the fashion item data is matched as tops and bottoms, adding to a new labeling class. Figure 2 illustrates the results.
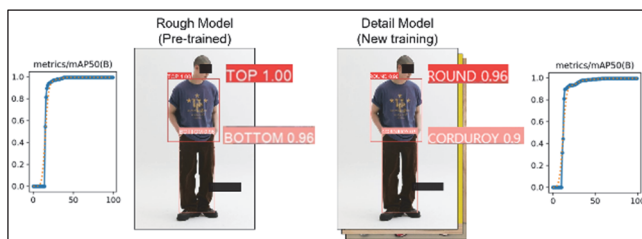
Figure 2

Conclusion

This paper proposes a system to automate labeling tasks for a large number of fashion images. This system utilizes a pre-trained model and the object detection technology of YOLOv8. It detects bounding boxes for tops and bottoms and normalizes the obtained coordinates to generate the data required for YOLO training. Through this system, it has been demonstrated that labeling tasks for a large number of images can be performed more efficiently and accurately. In future research, we aim to enhance the system's versatility and utility by incorporating additional fashion items and classes.

Acknowledgement

References

Feng, Z., Luo, X., Yang, T., & Kita, K. (2018, December). An object detection system based on YOLOv2 in fashion apparel. In *2018 IEEE 4th International Conference on Computer and Communications (ICCC)* (pp. 1532-1536). IEEE.

Lee, C. H., & Lin, C. W. (2021). A two-phase fashion apparel detection method based on YOLOv4. *Applied Sciences, 11*(9), 3782.

Lim, J., Choi, W., & Choi, B. (2024). Automated Fashion Clothing Image Labeling System. *IHCI 2023*, LNCS 14532, (1-6)

Trendresearch. (2023). *2022 Korea Fashion Market Big-data Trend, Domestic market research report*. Retrieved from https://www.fashionnet.or.kr/textile-fashion-industry-trend/domestic-market-research-report/

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HOW YOUTUBE FRONT ADVERTISING AFFECTS CONSUMERS' PURCHASE INTENTIONS?

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Introduction

Recently, YouTube has attracted consumers' attention because it has advantages in terms of easily describing competitiveness of products and services with interesting story lines and increasing consumers' brand intimacy as compared to traditional advertisements. As features and channels of brand advertisements are rapidly changing, brand advertisers and marketers strive to increase brand intimacy and attract new customers through YouTube content marketing. For example, YouTube front advertising use interesting storylines to directly expose them as marketing. This enhances content competitiveness and enables consumers to naturally increase brand intimacy (Jeong, 2023). Although the importance of understanding contended YouTube advertising has been emphasized, research on contented YouTube advertisements is still insufficient. Therefore, this study focuses on analyzing the characteristics of YouTube advertisement videos and examine how they affect purchase intention.

Literature Review

Based on Ducoffe's web advertising model and flow experience theory, this study attempted to examine the effect of "front advertising" content attributes on advertising attitudes and flow experiences on purchase intentions that can reliably recognize that customers are advertisements among YouTube content advertisements. The web advertising model is developed by Ducoffe (1985) from the theory of uses and gratifications, and a website advertising model was created by emphasizing advertising value. Advertising value refers to a subjective evaluation of the relative value or usefulness of an advertisement to a consumer (Ducoffe, 1995). The flow theory was first introduced by Csikszentmihalyi & LeFevre (1989). Flow refers to a fully immersed state that people experience when they act with complete immersion. In the state of immersion, people become absorbed in their activities, and the focus is narrowed to the activities themselves (Kim & Han, 2014). Based on this theory, the attributes of YouTube front advertising were set as informativity, reliability, entertainment, creativity, and incentives. Advertising values change consumers' perceptions of advertisements in terms of cognitive and emotional aspects, resulting in positive brand attitudes (Koslow et al., 2022; Molinillo, 2020). In addition, these values draw consumers' attention by focusing on advertising messages (kim & Han, 2014).

Specifically, this study focused on examining (H1, H2) the effect of YouTube's front advertising content attributes (informativity, reliability, entertainment, creativity, and incentives) on perceived advertising value and flow experiences, (H3) the effect of perceived value on flow experiences, and (H4, H5) the effect of perceived advertising value and flow experiences on purchase intentions.

Research Method

An online survey was conducted. The sample of the study was for those who had previously watched YouTube fashion advertisement content, and those who had not watched it were asked to respond to the questionnaire after viewing the video provided before the questionnaire. The YouTube advertisement video was carefully selected. A total of 145 people responded to the questionnaire, and 128 valid responses were finally analyzed. An exploratory factor analysis and reliability analyses of variables were performed using SPSS 26.0, and a confirmatory factor analysis, a structural equation model analysis, and a multi-group comparative analysis were performed using AMOS 24.0.

Results & Discussion

The results of the study revealed that among the attributes of YouTube's front advertisements, informativity and reliability had a positive effect on advertising value(partially supporting H1), and entertainment and creativity had a positive effect on the flow experience(supporting H2). Advertising value had a significant effect on the flow experience(supporting H3), and it was found that both advertising value and flow experience had a positive effect on purchase intention(supporting H4, H5).

Through the results of this study, there are managerial implications that it is possible to provide an indicator of fashion YouTube advertising content by subdividing the attributes of YouTube advertising content that has recently become an issue. It is also suggested that a specific marketing promotion strategy should be established so that consumers can positively evaluate and immerse themselves in YouTube advertising videos.

Conclusion

Currently, YouTube is not only used as an app to watch simple videos, but it has become a marketing tool that can promote products and services with video content. Therefore, in this study, a research model was constructed based on web advertising theory and flow experience theory to confirm whether the attributes of YouTube's front advertisements have a positive effect on advertising value and flow experience. Based on the findings of this study, it can be suggested that it is important to provide reliable information and to give attractive elements together when producing YouTube advertising videos.

References

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of personality and social psychology*, *56*(5), 815.

Ducoffe, R. H. (1995). How consumers assess the value of advertising. *Journal of current issues & research in advertising*, *17*(1), 1-18.

Jeong J. E. (2023). Make a drama, fly a drone... "Catch MZ" A distribution industry that is sincere about YouTube. *sisaon*.
http://www.sisaon.co.kr/news/articleView.html?idxno=155007http://www.sisaon.co.kr/news/articleView.html?idxno=155007

Kim, Y. J., & Han, J. (2014). Why smartphone advertising attracts customers: A model of Web advertising, flow, and personalization. *Computers in human behavior*, *33*, 256-269.

Koslow, S., Sameti, A., van Noort, G., Smit, E. G., & Sasser, S. L. (2022). When bad is good: Do good relationships between marketing clients and their advertising agencies challenge creativity?. *Journal of Advertising*, *51*(3), 385-405.

Molinillo, S., Navarro-García, A., Anaya-Sánchez, R., & Japutra, A. (2020). The impact of affective and cognitive app experiences on loyalty towards retailers. *Journal of Retailing and Consumer Services*, *54*, 101948.

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ANNOYING OR USEFUL?: CONSUMER LOYALTY TO ONLINE FASHION PLATFORM THROUGH BENEVOLENCE AND MALEVOLENCE BELIEFS TOWARD APP PUSH NOTIFICATIONS

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Introduction

Several online fashion platforms use app push notifications to communicate directly with users to increase users' engagement and frequency of visits. With app push notifications, users can immediately check useful information such as the news of the launch of new products or discount events. Previous studies have shown that push notifications are effective in allowing users who have left the app to re-access the app and increasing the number of active users (Bidargaddi et al., 2018). However, excessive app push notifications can disturb users, causing negative reactions such as notification denial and app uninstallation(Okoshi et al., 2016). It is necessary to set up push notifications that can effectively persuade users without causing discomfort(Tiffany et al., 2020). Thus, this study explores the effects of app push notifications on loyalty to an online fashion platform, considering both positive and negative mechanisms, and determine any moderating effect of the age of the platform users.

Literature Review

Technology Acceptance Model (TAM), which describes the acceptance behavior of new technologies(Davis, 1989), can be used to explain the acceptance of app push notifications. Earlier studies explained consumer attitudes and behaviors by focusing on ease of use and perceived usefulness. Ease of use refers to the degree to which an individual perceives that efforts will not be required to use a new technology, while perceived usefulness is the degree to which an individual perceives that their performance can be improved by using a new technology. Consumers are more likely to use the new technology if they perceive it to be easy to use and useful (Davis, 1989). Thereby, this study employs the antecedents of TAM, namely ease of use and perceived usefulness, and incorporates irritation as an additional antecedent to identify the negative impact of app push notifications.

Benevolence belief holds that a trustee possesses altruistic motives and genuinely engages in beneficial actions for customers. Conversely, malevolence belief views a trustee as driven by egocentric motivations and unlikely to act in the best interests of customers (Dimoka, 2010). Benevolence and malevolence beliefs, sub-concepts of trust and distrust, strongly affect customer attitudes and behaviors by evoking positive and negative emotional judgments(Pavlou & Dimoka 2006). It has been shown that malevolence beliefs have a greater impact on customer trust and behavior than the effect of benevolence beliefs, so it is necessary to pay attention to malevolence beliefs(Ha-Brookshire & Bhaduri, 2014). Depending on the level of ease of use, perceived usefulness, or irritation of app push notifications, benevolence and malevolence beliefs toward the sender may also vary. This study explores the influence of these antecedents on loyalty to a fashion online platform as mediated by positive and negative reactions to app push notifications, specifically benevolence and malevolence beliefs.

Research Method

The questionnaire included variables such as perceived ease of use, perceived usefulness, irritation, benevolence/malevolence belief, and loyalty to the fashion online platform, utilizing a 5-point Likert scale (ranging from 1: strongly disagree to 5: strongly agree). The questionnaire was randomly distributed to 1,401 active members of an online fashion platform in Korea, with 247 respondents (response rate: 17.6%). Respondents were incentivized with 3,000 points for use on the online fashion platform. The collected data

were analyzed using SPSS 26.0 for descriptive analysis and reliability analysis and AMOS 26.0 for confirmatory factor analysis (CFA) and structural equation modeling (SEM).

Results & Discussion

The results of the CFA indicated a satisfactory fit of the measurement model: $\chi^2 = 93,410$ (df = 56, p < .001), GFI = .9471, CFI = .981, NFI = .954, RMSEA = .052. Additionally, the instruments demonstrated acceptable levels of convergent validity, composite reliability, and discriminant validity for the constructs. Further analysis using SEM revealed that an increase in perceived ease of use was associated with higher perceived usefulness. However, no significant influence existed on irritation. Perceived usefulness was associated with a decrease in irritation and malevolence belief and an increase in benevolence. Whereas, irritation was associated with decreased benevolence belief but increased malevolence belief. Finally, benevolence belief increased loyalty, whereas malevolence belief decreased loyalty to the online fashion platform.

To examine the moderating effect of user age on the online fashion platform, a multigroup SEM was conducted, and model fits and path coefficients between groups were compared. The sample was divided into two groups by age (30–40s: young users vs. 50–60s: older users). For younger users, perceived ease of use was associated with increased perceived usefulness, leading to an increase in benevolence and a decrease in malevolence. However, perceived usefulness did not exhibit a significant effect on irritation, which in turn was associated with decreased benevolence and increased malevolence. Consequently, benevolence positively influenced loyalty, while malevolence negatively impacted loyalty. This implies that app push notifications from the fashion shopping platform inducing irritation might escalate negative perceptions and reduce loyalty to the online fashion platform. Interestingly, for older users, perceived usefulness was associated with lower irritation, suggesting that if the messages in push notifications are useful, they may actually mitigate irritation. Furthermore, the effects of irritation or malevolence on other variables were not statistically significant, indicating that negative perceptions stemming from app push notifications do not significantly impact overall perceptions or loyalty to the platform.

Conclusion

This study enhances the TAM by broadening its scope from technology acceptance to user loyalty towards a service provider. This expansion improves our comprehension of user behavior in technology adoption and prolonged usage, offering a comprehensive framework for analyzing factors that influence user loyalty beyond the initial acceptance stage. By empirically verifying both the positive and negative effects of app push notifications within a unified model, this integrated approach enhances the theoretical understanding of how diverse factors, such as user perceptions of usefulness and irritation and user beliefs in benevolence and malevolence, collectively influence loyalty. The findings of this study also hold managerial implications: Retail managers can focus on crafting push notification messages that are highly relevant and useful to the target audience of the online fashion platform. By ensuring that the content aligns with user interests and preferences, individual users can have a more positive reception and experience lower levels of irritation resulting from frequent app push notifications.

References

Bidargaddi, N., Pituch, T., Maaieh, H., Short, C., & Strecher, V. (2018). Predicting which type of push notification content motivates users to engage in a self-monitoring app. *Preventive Medicine Reports, 11,* 267–273.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.

Dimoka, A. (2010). What does the brain tell us about trust and distrust? Evidence from a functional neuroimaging study. *MIS Quarterly, 34*(2), 373–396.

Ha-Brookshire, J., & Bhaduri, G. (2014). Disheartened consumers: impact of malevolent apparel business practices on consumer's heart rates, perceived trust, and purchase intention. *Fashion and Textiles, 1,* 1-12.

Okoshi, T., Nozaki, H., Nakazawa, J., Tokuda, H., Ramos, J., & Dey, A. K. (2016). Towards attention-aware adaptive notification on smart phones. *Pervasive and Mobile Computing, 26,* 17–34.

Pavlou, P. A., & Dimoka, A. (2006). The nature and role of feedback text comments in online marketplaces: Implications for trust building, price premiums, and seller differentiation. *Information Systems Research, 17*(4), 392–414.

Tiffany, P., Pinem, A. A., Hidayanto, A. N., & Kurnia, S. (2020). Gain-loss framing: comparing the push notification message to increase purchase intention in e-marketplace mobile application. *IEEE Access, 8,* 182550-182563.

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UNVEILING SHEIN: EXPLORING STRATEGIES AND CHALLENGES IN E-COMMERCE INDUSTRY DEVELOPMENT

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Introduction

During the last years, the e-commerce industry has grown rapidly, specifically the retailer Shein, one of the fastest growing e-commerce companies in the world. Shein attracts young consumers in their teens and twenties with its huge range of low-priced and ever-changing fashion. Founded in 2008 by Chris Yangtian Xu in Nanjing, China. Shein moved its headquarters to Singapore in 2022, to target overseas markets outside China. On its US website, customers might find a top costing less than USD10 and a pair of jeans with a price tag of USD20. In addition, Shein introduces new items frequently, realizing 700-1000 new items per day, and can update about 50,000 new products per week, which is 6-10 times more than ZARA's new items(Liu, 2022). Shein's success was built on its proprietary supply chain management system and China's garment production ecosystem. Shein mainly relied on digital marketing, collaborating with celebrities and influencers to market its products on social media platforms such as Instagram and TikTok. During the COVID-19 pandemic, Shein saw its business boom. In the US, its largest market, Shein's fast-fashion market share jumped from 7% in January to nearly 30% in June 2020(Jeffrey, 2021). Shein's revenue in 2018 and 2019 was about USD1.2bn and USD2.4bn, respectively (Drizzie, 2020). Having grown over 100% per year between 2013 and 2020, Shein's revenue reached USD9.8bn in 2020(Sun, 2021). In 2022, Shein's revenue increased further to USD24bn(Wu et al., 2022). In 2023, Shein was valued at USD66bn, making its debut in the global top 100 of the world's most valuable brands, and becoming the highest ranked newcomer brand at 70th place(David et al., 2023). Despite keeping a low profile, Shein found itself at the center of a series of controversies. Such as being accused of low quality, copyright infringement, and encouraging a culture of excessive consumption. This research takes Shein as a case study, uses Big Kinds big data analysis system to analyze the news reports about Shein, examines the development trend of Shein as one of the fastest growth rates in the world and the challenges, and further compares and analyzes the differences with other e-commerce platforms using social big data from Sometrend. It is expected to inspire the development of other e-commerce companies in their global business.

Case description

For the study, keyword trend analysis, correlation analysis and associated word analysis were performed using the Big Kinds big data analysis system. Data were collected from September 16, 2019 to December 5, 2023 by selecting the keywords "Shein." This time corresponds to Shein's emergence in media attention since 2019 and its subsequent rapid growth. From the 186 news data initially collected, 8 duplicates and irrelevant news were excluded, A total of 178 news were collected finally for analysis. Using Sometrend, Vive company's big data analytics platform in Korea, a comparative analysis of relevant words and comparative sentiment analysis of news about Shein and its competitor - Temu was conducted. The data was collected from December 1, 2022 to November 30, 2023, "Shein" and "Temu" were selected as key words. This period was chosen as Temu was founded in 2022. A total of 192 news items were collected for "Shein" and 256 news items related to "Temu" were used in the analysis.

Discussion and evaluation

Big Kinds' keyword trends analysis reveals that Shein has experienced a surge since the COVID-19 pandemic, peaking in July 2022, June 2023, and November 2023. The first peak was due to Shein's

trademark infringement and design plagiarism issues. The second peak was driven by Shein's announcement that it planned to go public on the US stock market in 2024. Shein was heavily reported in the media again in November 2023 as a result of the explosive growth of China's direct purchase market, posing a threat to South Korea's e-commerce industry. The results of the correlation analysis, some countries and regions appear, like "United States," "United Kingdom," "France," "New York," "Canada," "Europe," "Ireland," "Singapore," "Japan," and "Hong Kong," which indicates that Shein is expanding into the international market. The associated word analysis results reveal top keywords like "Temu," "trademark infringement," and "forced labour." This indicates that Shein's primary competitor is Temu, another Chinese e-commerce company, and highlights challenges such as suspicions of forced labor and trademark infringement that Shein currently faces. Also prominent in the list are terms such as "IPO," "initial public offerings," "Goldman Sachs," "Morgan Stanley," "private," "NYSE listing," and "SEC." The reason for this is that Shein is currently pursuing an initial public offering in the United States. Supported by investment firms like Goldman Sachs and Morgan Stanley, Shein aims to be listed on the New York stock exchange in 2024. Comparative analysis of related words using Sometrend reveal that the common associations between Shein and Temu with the following order "company," "shopping," "products," "consumer," "enterprise." Additionally, key words associated with Shein include "investment banks," "IPO," and "IPO markets." On the other hand, the main words related to Temu include "customs and excise department," "stock price," "country," and "government." This indicates that both companies are under scrutiny due to economic and political factors. The results of the comparative sentiment analysis show that both Shein and Temu have a 64% of the positive ratings. The positive-related words common to both brands are "growing up," "hugely popular," "low price," "cheap," "gusty." Common words related to negative direction include "aggressive," "suspicion," "concerns." This indicates a gradual increase in the number of people using Chinese e-commerce platforms as the influence of Chinese companies continues to expand. While there have been various analyses of the success factors of Chinese shopping apps, there is no doubt that overwhelmingly low prices are their competitive advantage. According to the Korea Customs Service, Korea's overseas direct purchases amounted to KRW4,792.8bn as of the third quarter of 2023, up 20.4% from the same period last year. Among them, China ranked first with KRW222.17bn, taking up 46.4% of the market share. This trend threatens the Korean e-commerce industry, with market share being affected in every category from fashion to lifestyle products.

Conclusion

This study aims to analyze strategies for the global business development of e-commerce companies, using Shein, an emerging startup, as a case study. Big data analysis reveals that Shein, a fast-fashion e-commerce company that gained prominence through online shopping, is trending towards international market expansion. The rapid rise of Chinese low-cost shopping apps, driven by post-pandemic price increases, is gradually disrupting other established competitors. Despite enjoying explosive sales growth due to low prices and frequent updates, Shein's model is revealing shortcomings. Forced labor and trademark infringement are the primary challenges faced by Shein. To achieve sustainable growth, Shein must enhance brand management, increase social responsibility, and protect the environment by eliminating sweatshops and adopting more sustainable manufacturing processes.

References

David, W., Raam, T., & Hiten T. (2023, October 20). Kantar BrandZ most valuable global brands 2023. Retrieved from https://www.kantar.com/campaigns/brandz/global

Drizzie. (2020, December 25). After Shein became popular. Retrieved from https://mp.weixin.qq.com/s/fbdzMt2cjsehlsPbzStzcw

Liu, J. (2022, December). Research on the Business Strategy and Deficiency of the Fast Fashion Industry to Enhance Development-a Case Study of Shein. In *2022 2nd International Conference on Economic Development and Business Culture (ICEDBC 2022)* (pp. 1794-1801). Atlantis Press.

Jeffrey, T. (2021, February 18). An incomplete business story about Shein. Retrieved from https://pandayoo.com/2021/02/18/an-incomplete-business-story-about-shein/

Sun, W. X. (2021, June 9). Shein's fortune code: Chinese styled recommendation + made in China. *Beijing News*. Retrieved from http://www.xinhuanet.com/fashion/2021-06/09/c_1127544503.htm

Wu, K., Potkin, F., & Murdoch, S. (2022, January 25). Chinese fashion retailer SHEIN revives plan for New York listing in 2022. Retrieved from https://www.reuters.com/markets/europe/exclusive-chinese-fashion-retailer-shein-revives-plan-new-york-listing-2022-2022-01-25/

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IS BACKGROUND REALISM BENEFICIAL OR HARMFUL IN THE VIRTUAL INFLUENCER MARKETING?: BASED ON THE THEORY OF SOCIAL IDENTITY THREAT

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Introduction

With continuous development in science and technology, a new form of digital agent, virtual influencer (VI) has emerged as a valuable marketing strategy in the social network advertising (SNA) landscape (Farivar & Wang, 2022). VIs are computer-generated humans who have highly anthropomorphized appearance and are often used to share promotional content to obtain influence among young consumers (Arsenyan & Mirowska, 2021). The contemporary VI SNA is said to be characterized by highly realistic representation of physical layout. Creators attempt to incorporate real-world attributes such as existing physical locations, objects, or real human beings into the imagery to enhance realism and immersion in humans. For example, Rozy appears riding deftly a longboard beside the Han River in Seoul on her recent television commercial, and Lil Miquela is observed playing with a Samsung Galaxy smartphone in Times Square New York on her Instagram post. What remains debatable is how might consumer respond to this hyper-realistic virtual world. It may enhance consumer engagement, but it could also cause problem of heighted perceptions of confusion or even threat in consumers since too-much resemblance with the real world may generate psychological discomfort somewhat.

Literature Review

In virtual influencer marketing, consumers' relationship with the virtual agent is an important precursor of endorsement effectiveness (e.g., Pelau et al., 2021). Since people tend to develop negative feelings such as weirdness or eeriness towards human-like artificial agents (MacDorman et al., 2009), it is particularly important to understand how these mixed agents are processed in certain contexts and deploy relevant advertising strategy to mitigate negative consumer responses on them. The extant literature has heavily focused on the role of form or behavioral realism of the virtual agent in the formation of consumer acceptance of VI endorsement (e.g., Kim et al., 2023). Identifying the optimal level of VI's human likeness, specifically, has been an important research subject so that marketers can create sufficiently realistic, yet non-aversive human-like agent. One of the neglected, but prominent factors determining the levels of compliance or reactance on the virtual agent, however, may be the level of threats perceived by the context the virtual agent is presented in the advertisement. Depending on the perceived realism of the media scene (e.g., robots serving social functions in the workplace), people will likely envision different levels of threats by robots on their identity, material resources, job, safety or well-being of humans. This will, in turn, lead to different behavioral intents with the VI agent. To fill the literature gap on the contextual effect (i.e., background realism) on consumers' acceptance of VI, this paper examines how perceived realism of the background image of VI SNA can be associated with psychological reactance towards the virtual agent in consumers. Drawing on social identity threat theory, the current study contends that perceived realism of the background image will be positively associated with consumers' reactance against the VI agent through the mediating effect of heightened perceptions of threat to human identity.

Research Method

An online survey was administered in October of 2023 among a total of 200 South Korean female Instagram users aged between 20 and 50 (M_{age}=31.25). In order to control the effect of model, participants who have awareness of Rozy, a VI character used in the stimulus, were not included in the study sample. Participants were recruited via a data collection company in Korea, Macromill Embrain Co. Ltd. In the survey, a mock Instagram post of Rozy was provided posing to take a picture in the famous Champ-Elysees shopping district in Paris. Additionally, verbal information elaborating the fabricated identity of

Rozy was provided as well. In the verbal information, Rozy's occupation as a virtual fashion influencer, her age, gender, follower counts, popularity, hobbies and regular daily routines were included. After being exposed to the stimulus, participants rated perceived realism of the background image, perceived threat to human identity, psychological reactance on the VI and demographic information. All the scale items were adopted from the literature, and were scored on a 5-point Likert scale with endpoints "strongly disagree" and "strongly agree".

Results & Discussion

The data was analyzed using Hayes' Process Macro model 4. The bootstrapping method was applied using 5,000 samples. The results reveal that perceived background realism is positively associated with higher level of psychological reactance against the VIs (b=0.135, se=0.059, bootstrap 95% CI=[0.019, 0.251]). Specifically, perceptions of threat to human identity mediated this relationship with full mediation effect (b=0.054, se=0.027, bootstrap 95% CI=[0.006, 0.109]). The findings demonstrate that increasing background realism in the VI imagery is not always beneficial for eliciting consumers' positive attitudes towards the VIs. It can rather elevate consumers' psychological reactance towards the VI agent due to increased sense of threat to human identity.

Conclusion

The current study examined how background realism of the VI imagery can affect viewers' responses towards the VIs. Specifically, this paper tested if perceived background realism leads to higher level of psychological reactance on the VI agent due to perceptions of threat. Contrary to the traditional belief, the findings of this study reveal that higher level of perceived background realism can negatively affect viewers' attitude towards the VI agent. As predicted, the more realistic viewers perceived the background image of the VI SNA, the greater level of threat viewers on human identity, thus experiencing higher level of psychological reactance against the VI agent. This paper enriches theoretical research of social identity threat theory and psychological reactance model by extending those in the context of VI-human interactions. As for the practical implications, brands should note that hyper-realistic representation of the real world in the VI SNA may not always be beneficial for eliciting viewers' positive response, but utilizing virtuality cues can be more effective to enhance consumers acceptance of the VI SNA. Since VI imagery is purely artificial, creative fabrication, its background image can take on various forms and content based on creators' thoughts, motives, and graphic expertise. In order to alleviate threat perceptions, it may be wiser to create some fantasy mood using color, shade, texture or grading effects or include fiction-like entities or attributes along with the real-world physical objects.

References

Arsenyan, J., & Mirowska, A. (2021). Almost human? A comparative case study on the social media presence of virtual influencers. *International Journal of Human-Computer Studies, 155*, 102694. https://doi.org/10.1016/j.ijhcs.2021.102694

Farivar, S., & Wang, F. (2022). Effective influencer marketing: A social identity perspective. *Journal of Retailing and Consumer Services, 67*, 103026. https://doi.org/10.1016/j.jretconser.2022.103026

Kim, D. Y., Lee, H. K., & Chung, K. (2023). Avatar-mediated experience in the metaverse: The impact of avatar realism on user-avatar relationship. Journal of Retailing and Consumer Services, 73, 103382.

MacDorman, K. F., Green, R., Ho, C. C., & Koch, C. (2009). Too real for comfort? Uncanny responses to computer generated faces. *Computers in Human Behavior, 25*, 695-710. https://doi.org/10.1016/j.chb.2008.12.026

Pelau, C., Dabija, D.-C., & Ene, I. (2021). What makes an AI device human-like? The role of interaction quality, empathy, and perceived psychological anthropomorphic characters in the acceptance of artificial intelligence in the service industry. *Computers in Human Behavior, 122*, Article 106855. https://doi.org/10.1016/j.chb.2021.106855

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UNDERSTANDING USER RESPONSES TO PROMOTED CONTENT OF SOCIAL MEDIA INFLUENCERS: A MACHINE LEARNING PERSPECTIVE

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Introduction

The daily use of social media has made social platforms crucial communication and relationship-building channels for fashion brands. Social media influencers are gaining attention due to the development of these platforms. They form a deeper psychological bond with their followers by sharing personal content based on their lifestyle and interests (Ki et al., 2020). Previous studies have demonstrated that a positive perception of influencers by their followers is effective in creating brand influence in the advertising space (Lou and Yuan, 2019). However, as companies' social media marketing becomes more prevalent and user fatigue with brand advertising messages increases (Jacobson et al, 2020), it is increasingly leading to unsatisfactory performance for companies' efforts in social media marketing (Beckers et al., 2018). Therefore, fashion companies are forced to raise strong questions about how their branded content can be effective in what form and by what influencers they are currently exposed to. This study proposed a promotion engagement model in the fashion sector using machine learning to identify how the promoted content characteristics and the external characteristics of influencers are related to the participation behaviour of social media followers. The model can assist companies in producing effective content and selecting influencers.

Literature Review

Social media influencer produce compelling stories around their interests and lifestyles to build their online identity while gaining enthusiastic followers (Lou and Yuan, 2019). In this respect, they are considered experts in certain areas of interest (e.g., fashion, lifestyle, food, travel, etc.) (Ladhari et al., 2020). Influencers communicate with their followers in a unique way and build relationships through the content they provide (Dhanesh and Duthler, 2019). Their success lies in the ability to create content that induces favorable responses from consumers, thus maintaining their influence over them. Currently, followers are highly engaged with the content presented by influencers, while also forming parasocial relationships with them (Sokolova and Kefi, 2020). For example, comments on posts or clicking 'likes' are observed. Therefore, the engagement of followers on social media plays a key role in responsible for the performance of social influencer marketing while expanding the reach and influence of influencer's messages. Previous studies have reported that influencer and promoted content characteristics are important antecedent variables in verifying the effectiveness of social media marketing. However, most of these studies have measured these characteristics subjectively. This study aims to address this issue by considering influencer and promoted content characteristics as objective attributes. This study defines engagement as the effectiveness of promoted content created by social media influencer. Promotion engagement is evaluated by indexing figures such as likes, comments, and sharing.(Ji et al., 2017; Muntinga et al., 2011).

Research Method

The study's procedure is as follows: we analysed the posts of 38 Korean influencers with over 10,000 followers who have previously endorsed fashion and beauty brands on Instagram. 14,000 post and 880,000 replies were crawled. The data collected includes the post content, number of phots in the post, number of likes on the post, time of post creation, number of replies, content of replies, number of likes per replies,

and time of replies. After conducting preprocessing steps that align with the objectives of this study, we applied machine learning algorithms to the dataset to construct a regression model for predicting promotion engagement. A total of 19 machine learning algorithms, including Random Forest, Gradient Boost and XGBoost were applied and compared to construct the model. During the learning process, the training and test data were randomly divided and learned at an 8:2 ratio, repeated five times in total.

The model using Gradient Boosting Regressor achieved the best performance with MAE value of 1160.06 and RMSE value of 2947.44 (See Table1). We then proceeded with ensemble learning to make more accurate predictions. This is a method that uses multiple models to train data and then averages the predictions of all models to make a prediction. Ensemble learning was performed on the top three best performing models, Gradient Boosting Regressor, Random Forest, and Extra Trees Regressor. The Voting Regressor, which uses weighted averaging of the predictions of its constituent models, was employed as an ensemble method. The combined model has MAE value of 500.95 and RMSE value of 1088.95, which is much better than the individual models. Therefore, the important variables influencing promotion engagement were identified based on this model.

<Table 1> Performance Evaluation Comparison between Basic and Ensemble Models>

Base Model	MAE	RMSE
1. Gradient Boosting Regressor	1160.06	2947.44
2. Random Forest Regressor	1168.62	3080.91
3. Extra Trees Regressor	1166.50	3144.85
4. Extreme Gradient Boosting	1305.15	3384.35
5. Light Gradient Boosting Machine	1295.70	3525.43
Ensemble Model	**MAE**	**RMSE**
6. Voting Regressor	500.95	1088.95

Results & Discussion

The research results revealed that the factors affecting promotion engagement, in order of their influence, were as follows: (1) the engagement of informational content, the number of followers, and hashtags; (2) reaction duration, number of photos, minimum reaction time, length of post content; (3) following number, percentage of advertising posts, and total number of posts. Upon examining the results, it is apparent that the effectiveness of advertised content's engagement with consumers is influenced not only by the content's quality, but also by the quality of the informational content that influencers regularly create. This suggests that the effectiveness of promoted content is crucially dependent on how engaging and trustworthy an influencer's daily content appears to consumers. The most important attribute of promoted content identified was the hashtag variable, indicating that consumers prefer to receive only essential information when engaging with promoted content.

Conclusion

Our findings contribute to the literature by analyzing the relationship between promoted content and user engagement using objective numerical data rather than subjective perception. It provides guidance on which influencer can communicate well with social media users and which content elements can increase engagement. Therefore, advertisers and marketers are expected to develop more effective marketing strategies in social media based on these insights.

Acknowledgement

References

Beckers, S. F., Van Doorn, J., & Verhoef, P. C. (2018). Good, better, engaged? The effect of company-initiated customer engagement behavior on shareholder value. *Academy of Marketing Science, 46*(3),

366–383.

Dhanesh, G. S., & Duthler, G. (2019). Relationship management through social media influencers: Effects of followers' awareness of paid endorsement. *Public Relations Review*, *45*(3), 101765.

Jacobson, J., Gruzd, A., & Hern´andez-García, A. (2020). Social media marketing: Who is watching the watchers? *Journal of Retailing and Consumer Services, 53*, 1–12.

Ji, Y. G., Li, C., North, M., & Liu, J. (2017). Staking reputation on stakeholders: How does stakeholders' Facebook engagement help or ruin a company's reputation?. *Public Relations Review*, *43*(1), 201-210.

Ki, C., Cuevas, L. M., Chong, S. M., & Lim, H. (2020). Influencer marketing: Social media influencers as human brands attaching to followers and yielding positive marketing results by fulfilling needs. *Journal of Retailing and Consumer Service, 55*, 1–11.

Ladhari, R., Massa, E., & Skandrani, H. (2020). YouTube vloggers' popularity and influence: The roles of homophily, emotional attachment, and expertise. *Journal of Retailing and Consumer Services*, *54*, 102027.

Lou, C., & Yuan, S. (2019). Influencer marketing: How message value and credibility affect consumer trust of branded content on social media. *Journal of Interactive Advertising, 19*(1), 58–73.

Muntinga, D. G., Moorman, M., & Smit, E. G. (2011). Introducing COBRAs: Exploring motivations for brand-related social media use. *International Journal of Advertising*, *30*(1), 13-46.

Sokolova, K., & Kefi, H. (2020). Instagram and YouTube bloggers promote it, why should I buy? How credibility and parasocial interaction influence purchase intentions. *Journal of Retailing and Consumer Services*, *53*, 101742.

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A COLLABORATION BEYOND FASHION: OO WEARS PRADA

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Introduction

As convergence technology and knowledge develop, collaboration between different fields is increasing. Collaboration, which refers to collaboration, is when two entities in different fields establish a mutually beneficial and clearly defined relationship to achieve a common goal. Whether the entity is a company, public, or individual, they share their resources to produce more effective results (Mattessich & Monsey, 1992). In other words, participants in seemingly unrelated areas share their own know-how and work methods through collaboration, reducing resource investment when participating in a new area and quickly producing results (Jeong & Ko, 2023).

The meaning of the collaboration described above can also be found in Prada's actions over the past few years. Prada's greatest achievement in achieving international success is its nylon bag. Prada achieved international success by abandoning the prejudice that bags should be made of leather and launching a bag using Pocono nylon, which was used for parachutes and tents (LuxuryActivist, 2013). In addition, Prada has established itself as an institution that provides culture and art by conducting exhibitions and projects related to architecture, film, art, and philosophy beyond fashion (Judge, 2020). In this way, Prada has maintained its innovative value and brand identity through convergence with new areas. In fact, according to data reported by Brand Finance (2023), even though the economic recession occurred due to COVID-19, Prada's brand value ranking has been growing steadily since 2020. The reason why Prada was able to maintain its reputation even under extreme circumstances is its challenging spirit that quickly embraces changes of the times while adhering to tradition. Therefore, this study seeks to confirm the value of Prada by examining Prada's unique collaboration activities that were not seen in other brands.

Research Method

To collect data, news data was collected for the entire period using Prada as a keyword in 'BIG KINDS', a news data analysis system. Among these, unnecessary content was excluded and news data related to collaboration in other fields was extracted. In other to refine the collected data and increase accuracy, additional data was collected from Prada's official website (http://www.prada.com). It accessed 'PRADASPHERE' from the main menu and extracted the necessary data from the Events and Special Projects items.

Results & Discussion

Prada became a solid brand in 1978 when it launched a bag using Pocono nylon, a waterproof fabric used in parachutes and tents, rather than leather. Since then, Prada has been recognized for its cutting-edge style and experimental spirit that combines structure and image in a way that goes beyond trends, and Prada's collaborations resulting from this special challenge are broadly classified into three categories.

First, digital wears Prada. As it entered the digital age, Prada has been pursuing a digital strategy to communicate with customers. A representative example in this regard is the 'LG Prada Phone'. In 2006, Prada collaborated with LG Electronics and succeeded in developing the world's first capacitive touch screen mobile phone, and more than 1 million units were sold in 18 months. Afterwards, the second Prada phone was released in 2009, and it came with a watch named 'Prada Link', which was similar to the current smart watch. In addition, Prada collaborated with Hyundai Motor Company in 2012 to produce the 'Genesis Prada', limited to 1,200 units. Prada's signature Saffiano leather was used for the car's interior seats, and Prada's logo and serial number were attached to increase its scarcity value. Although sales fell

short of expectations due to issues such as cost and repair, it was recorded as an innovative attempt by a fashion brand.

Second, sky wears Prada. In January 2023, for its first collaboration with the world of racing and aerobatics, Prada created a pilot suit with Dario Costa, professional aviator, stuntman and athlete, the first and only Italian to participate in and win the Red Bull Air Race World Championship. Also, in October of that year, Prada announced that it would collaborate with American space company Axiom Space to develop a spacesuit for NASA's Artemis project scheduled for 2025.

Third, cultural content wears Prada. Prada Mode, which started in Miami in 2018, is a traveling social club and a contemporary cultural project that travels around the world to experience music, dining, art talks, and unique local culture. Additionally, starting in the UK in 2021, Prada Extends is an invitation-only private live music project, an event that uses the unique and universal connection of music to unite different cultures and regions through dialogue. Prada gained inspiration for design by analyzing society through these activities, and reinterpreted reality in design by combining fields such as art, film, and photography.

Conclusion

The commonality of Prada collaboration is that it expands Prada's identity into new areas by providing rare and unique experiences for limited customers. In this way, Prada has renewed the boundaries of being a fashion brand through design innovation and a future-oriented approach. Prada's success is due to Miuccia Prada's unique approach and original designs: experimental, visionary and obsessed with the power of ideas. Prada has strengthened its brand image through digital marketing and partnerships in various fields and has increased its brand value by contributing to the development of cultural and artistic contents. Prada's enterprising actions opened the way for new challenges for other fashion brands and proved that fashion can also integrate with various fields. Prada will continue to pioneer new markets and maintain its brand position through new designs and strategic marketing. It looks forward to seeing how far Prada's collaboration which transcends its image as a fashion brand can continue in the future.

References

Mattessich, P. W., & Monsey, B. R. (1992). *Collaboration: what makes it work. A review of research literature on factors influencing successful collaboration.* Amherst H. Wilder Foundation, 919 Lafond, St. Paul, MN 55104.

LuxuryActivist. (2013, July 3). *Miuccia Prada, 21st century visionary and anti-fashionista.* Luxury Activist. https://luxuryactivist.com/fashion/miuccia-prada-21st-century-visionary-and-anti-fashion ista/

Judge, L. (2020, July 5). *A history of the Fondazione Prada, a modern way of understanding art and culture today.* Aeworld. https://aeworld.com/lifestyle/art/a-history-of-the-fondazione-prada-a-modern-way-of-understanding-art-and-culture-today/

Jung, Y., & Ko, J. (2023). A phenomenological study of the collaboration of artist and corporation - focused on artist-. *Journal of Basic Design & Art 24*(5), 493-506.

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A STUDY ON CONSUMERS' REACTION TO CELEBRITY-ENDORSED SNS ADVERTISING: USING SEMANTIC NETWORK ANALYSIS

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Introduction

Social media such as Instagram, Tik Tok, X(new version of Twitter), etc. has become a fashion brand's important communication channel with its consumers(Torregrosa et al., 2023). In particular, Instagram has been the favorite social media platform among consumers between 16 and 64(Digital 2024, 2024). Prior research insisted that Instagram could be an effective means for collaborations with fashionistas to reinforce brand management strategy and consumer engagement(Jin &Ryu,2019). For example, Gucci, the Italian luxury fashion brand, has expanded continuously its influence on its Instagram account through which its advertising or contents with celebrities are released(Kim, 2019). As in the case of Gucci, fashion brands still widely use the digital communication strategy with consumers by using celebrity endorsements on Instagram. Therefore, in order to examine consumers' reactions to such digital communication, this study tried to analyze consumers' comment reactions to advertisements or content containing celebrities on Gucci's Instagram using text-mining techniques.

Literature Review

Since social media plays an essential role in the brand's communication strategy in the fashion industry, Instagram has been used in delivering the fashion brand's offline events, collaborations, season campaigns, and various content including promotion videos. Prior studies reported that such digital communication of fashion luxury brands on Instagram has increased brand awareness, favorable brand image, consumer engagement, and purchase intention for luxury products(Chu et al., 2013 ; Phan et al., 2011). In particular, luxury fashion brands like Gucci have used actively Instagram platform to promote their event or content related to celebrity endorsement(Kim, 2019). As few studies have been conducted about consumers' reactions to celebrity-endorsed advertising on Instagram, it is necessary to examine how consumers react to such celebrity-endorsed SNS advertising by posting their comments.

Research Method

To examine the consumers' reaction to celebrity-endorsed SNS advertising, this study selected the content including photos and video clips about Gucci's 2021 collaboration campaign with Kai, the Korean male singer globally famous, released on Gucci's Instagram account. The 7 posts of Gucci's 2021 collaboration campaign with Kai were collected and 9,679 comments left on 7 posts were extracted. In addition, this study conducted frequency analysis, TF-IDF analysis, N-gram analysis, and CONCOR analysis using a text-mining method by TEXTOM and semantic network analysis by UCINET to analyze consumers' comments posted on selected content.

Results & Discussion

The results of this study revealed that the most frequent appearance keywords were Kai, Gucci, king, and boy, and the last two words king and boy were descriptive keywords for depicting Gucci's ambassador of celebrity. Most of the consumers who left comments on the 7 posts used in this study used positive words, which can be assumed to be because they are mostly Kai's fans. The results of the CONCOR analysis showed that a total of 5 groups were classified, and 2 groups had the most number of nodes. The first group consisted of keywords related to the praise of celebrity's appearance attractiveness such as elegant, adorable, classy, and to proudness of being Asian ambassador of Gucci such as iconic, proud, and perfect. The second

group consisted of keywords related to celebrity-endorsed advertising to promote Gucci's collection such as Gucci vibe, professional, aesthetic, work of art, and aura, etc.

Conclusion

This study tried to analyze the comments left on luxury fashion brand's posts on Instagram using a text-mining method and semantic network analysis. According to the results, consumers reacted most to the celebrity's attractiveness and collaboration work between the celebrity and the brand in the context of celebrity-endorsed SNS advertising. The results also indicated that when a celebrity as a brand ambassador endorses the brand by carrying out collaboration, users showed favorable attitudes toward brand products such as clothing worn by celebrities. Additionally, this study provides insight that when a celebrity recommends a brand's new collection campaign through videos or photos featuring the celebrity on the brand's SNS, the user's positive response to this visual stimulation can increase the advertising effect of the brand's new product. This study suggested how to effectively use the keywords for digital communication with consumers for brand use of celebrity endorsement advertising.

References

Digital 2024.(2024). Global overview report. https://www.meltwater.com/en/global-digital-trends

Jin, S.V. & Ryu, E.(2019). Instagram fashionistas, luxury visual image strategies and vanity. *Journal of Product & Brand Management. 29*(3), 355–368.

Kim, S. J. (2019). An analysis of new media fashion contents in the Gucci instagram. *Journal of Fashion Design, 19*(1), 147-164.

Torregrosa, Ma. Sánchez-Blanco, C. SanMiguel, P., & Pérez, J. del R. (2023). Instagram: digital behavior in luxury fashion brands. *International Conference on Fashion communication: between tradition and future digital developments*. Fashion Communication in the Digital Age, Conference paper, 14-26. N. Sabatini et al. (Eds.): FACTUM 2023, SPBE.

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EFFORTS BY DEVELOPING COUNTRY TO SECURE INTERNATIONAL COMPETITIVENESS IN THE GLOBAL TEXTILE MARKET: UZBEKISTAN

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Introduction

As a leading global cotton producer, Uzbekistan has long been acclaimed for its superior cotton cultivation and export capabilities, dating back to the Silk Road era. Renowned for producing high-quality cotton, the country is now focusing on boosting its finished textile production, aligning with its economic development objectives. Aiming to transcend its role as merely a cotton exporter, Uzbekistan aspires to become a pivotal textile and resource hub in Central Asia. To fulfill this ambition, the nation is fostering private investments through the implementation of cluster systems in cotton production, textiles, and apparel. In addition to, in response to the escalating global concerns over the environmental and social ramifications of cotton farming, Uzbekistan is undertaking significant measures to adopt sustainable practices. The textile sector in Uzbekistan is proactively incorporating these practices into its strategic development plan, highlighting a commitment to sustainable cotton production, enhanced labor practices, and environmental conservation. This research delves into Uzbekistan's multifaceted efforts to enhance its competitive edge in the international textile market. By exploring these endeavors, the study aims to provide valuable insights for other developing nations on overcoming similar obstacles and implementing effective strategies.

Literature Review

Uzbekistan's textiles industry and sustainability Uzbekistan's textile tradition, celebrated for its exquisite silk weaving and ikat dyeing techniques, has deep roots in cities such as Margilan, renowned for its traditional silk production. This rich heritage continues to shape the work of modern fashion designers in the country. Additionally, as one of the leading cotton producers globally, Uzbekistan is proactively shifting towards sustainable practices amid rising global concerns about the environmental and social impacts of cotton farming (Erdenesanaa, 2023). The government's support for the textile and fashion industries is evident in its economic development strategies, which prioritize enhancing labor conditions and promoting environmental sustainability in cotton production. According to The United Nations Economic Commission for Europe (UNECE, 2022), Uzbekistan is working on strengthening the prevention and mitigation of environmental and social risks, introducing formal procedures for the certification of management systems in line with best international standards, and improving ESG traceability and transparency.

Uzbekistan's cotton cluster
In a significant policy shift in 2018, Uzbekistan adopted a cluster approach in its cotton sector, transferring the oversight of cotton production from state control to private enterprises, or clusters (Babadjanov & Petrick, 2023). This move illustrates the government's commitment to partnering with the private sector, facilitating a synergistic relationship between the state and textile companies. Clusters, as defined by Michael Porter in 1998, are geographic concentrations of interconnected businesses, suppliers, and associated institutions in a particular field, offering mutual benefits such as increased efficiency and innovation (Porter, 1998). In the context of Uzbekistan's textile and clothing industry, these private enterprises are crucial for implementing eco-friendly manufacturing practices. By utilizing clean energy, adopting green transportation, minimizing waste, and promoting recycling, clusters enhance resource efficiency and creativity, proving to be more productive than isolated firms.

Research Method

To conduct our analysis, we began by gathering a broad range of materials, including newspaper articles, journal articles, government reports, and strategic plans published by both the Uzbekistan government and

the United Nations. Our search utilized key phrases such as 'Changes in Uzbekistan's textile industry', 'Uzbekistan's textile industry and sustainability', and 'Uzbekistan's textile cluster' to ensure a comprehensive collection of relevant data. Additionally, we compiled secondary data from published sustainability reports to deepen our understanding of the topic. Following the data collection phase, we embarked on a detailed analysis of the international standing and recent developments within Uzbekistan's textile industry. This examination focused on the strategic efforts underway to bolster the industry's competitiveness on the global stage. Our analysis was enriched through the investigation of specific case studies, which provided concrete examples of how Uzbekistan is navigating challenges and seizing opportunities within the textile sector. This methodical approach allowed us to gain insights into the complex dynamics shaping Uzbekistan's textile industry and its pursuit of sustainability and international prominence.

Results & Discussion

In recent years, Uzbekistan's cotton and textile industry has seen an impressive transformation, securing a sustainable position in the international textile arena. Highlighting its appeal as a prime destination for foreign investment in textiles, Uzbekistan has established 142 new cotton textile clusters in the past five years, drawing in investments totaling $3.8 billion. This shift towards cluster-based cotton textiles exemplifies the country's commitment to practices that are both sustainable and efficient. Remarkably, these clusters have received over $2.2 billion in investment, leading to enhanced cotton production, agricultural development, technological advancements in agriculture, and improved water resource management (Kohan Textile Journal, 2023). Leading clusters like Art Soft Holding, Uztex Group, and Global Textile among others, play a crucial role in reinforcing Uzbekistan's significant impact on the textile market by capitalizing on its distinctive advantages.

Furthermore, Uzbekistan is actively fostering stronger ties with the European Union (EU) to expand its export capabilities and generate local employment opportunities. The government's focus on sustainability, traceable supply chains, and circular practices in cotton manufacturing reflects a robust commitment to environmental and social stewardship. Emphasizing the importance of Environmental, Social, and Governance (ESG) principles along with Corporate Social Responsibility (CSR), Uzbekistan is paving the way for responsible and sustainable business practices in the textile sector (UNECE, 2022). Such forward-thinking strategies elevate Uzbekistan's status as a leader in the global textile industry, driving innovation, sustainability, and ethical practices.

The country's strategic and comprehensive approach has not only facilitated continuous growth but also enhanced the global standing of the Uzbek brand, setting new standards for sustainable production. Specifically, the textile sector has experienced remarkable expansion over the last five to six years, with exports almost tripling and a significant increase in the proportion of finished goods exported. This progression is a testament to Uzbekistan's successful strategies in leveraging its cotton production strengths, fostering innovation through cluster development, and attracting substantial foreign investment, thereby affirming its prominent position in the global textile market.

Conclusion

To enhance the global competitiveness of developing countries, this study focuses on Uzbekistan's cotton and textile industry's transformation and adoption of the cluster model. Since the adoption of the cluster approach in 2018, Uzbekistan has successfully established 142 new cotton textile clusters and attracted $3.8 billion in foreign investments, balancing productivity with sustainability. Moreover, Uzbekistan is striving to position itself as a global leader in textiles by strengthening ties with the European Union, boosting exports, and nurturing sustainable brands. The study emphasizes the importance for developing countries to achieve international competitiveness in the global textile industry through cluster formation and sustainability efforts. Future research on sustainable fashion brands in Uzbekistan, the impact of fashion companies' efforts to promote sustainability on consumer awareness, and research on Uzbekistan's efforts at each stage of the fashion value chain can help raise understanding of Uzbekistan's fashion industry's sustainability.

References

Babadjanov, J., & Petrick, M. (2023). Uzbekistan's cotton clusters in the context of the industrial policy debate. *Eurasian Geography and Economics,* 1-30. https://doi.org/10.1080/15387216.2023.2267093

Erdenesanaa, M. (2023, August 8). *Uzbekistan's Journey to Better Cotton Production Continues.* TRIPLE PUNDIT. https://www.triplepundit.com/story/2023/uzbekistan-forced-labor-cotton/780811

Kohan Textile Journal. (2023, December 25). *Uzbekistan's Textile Industry Evolution and Global Ascent.* Kohan Textile Journal. https://kohantextilejournal.com/uzbekistans-textile-industry-conversation-uztextileprom/

Porter, M. E. (1998). Clusters and the new economics of competition. *Harvard Business Review, 76*(6), 77-90.

UNECE. (2022, May 5). *UNECE supports Uzbekistan's strategy towards sustainable practices in the garment and footwear industry through its "Sustainability Pledge".* UNECE. https://unece.org/sustainable-development/news/unece-supports-uzbekistans-strategy-towards-sustainable-practices

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NAVIGATING HMD TECHNOLOGY FOR FASHION: ADDRESSING CONSUMER CONCERNS AND EXPLORING APPLICATIONS

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Introduction

Head-mounted displays (HMDs) are a rapidly evolving technology with applications in various fields, including gaming, education, and healthcare. Understanding consumer reviews of HMDs is important for several reasons. Consumer reviews provide valuable insights into the user experience with HMDs, including comfort, visual quality, and ease of use. This information is crucial for improving the design and functionality of HMDs to better meet consumer needs. Analyzing consumer reviews can help researchers understand market trends, consumer preferences, and the factors that influence the adoption of HMDs. This information is vital for companies and researchers looking to develop and market HMDs effectively. Moreover, consumer reviews can highlight common issues or concerns with existing HMDs, such as motion sickness, display quality, or content availability. Addressing these issues through research and development is essential for the continued advancement of HMD technology. This study uses consumer reviews to provide valuable insight into the design, development, and marketing of HMDs, which are expected to be actively used in the fashion retail field in the future.

Literature Review

From a technological perspective, virtual reality (VR) is developing rapidly and is becoming increasingly successful in providing users with realistic-looking virtual environments at relatively low costs (Siegrist et al., 2019). In particular, the development of HMDs has shifted the use of VR away from professional applications and toward widespread consumer use (Lanier et al., 2019). In a HMD, a stereoscopic image is created using two separate views for the user. The system tracks the user's movements and head rotations in the real world and mirrors these in a virtual environment displayed by the computer. The visual output is dynamically adjusted based on the user's current position and viewing direction, ensuring it matches what they would naturally see. HMDs typically offer a diagonal field of view around 100 degrees, providing users with a convincing sense of being surrounded by the virtual space (expansive field of view with real-time perspective adjustments) (Meißner et al., 2020).

The use of Head-Mounted Displays (HMDs) in the fashion retail industry can play an important role in enhancing customers' shopping experience through virtual reality (VR) and augmented reality (AR) technologies. According to the study, VR and AR technologies can be used to try and demonstrate fashion products through applications such as Virtual Fitting and Virtual Mirror, which could revolutionize the traditional shopping experience (Jayamini et al., 2021; Kim & Ha, 2021; Park et al., 2018). Virtual reality technology can also be used cost-effectively by fashion retailers to develop and test store designs, and can help them understand customer purchase intent and interactions by simulating real-life shopping environments. Accordingly, HMD technology is expected to be useful in improving customer experience and securing market competitiveness in the fashion retail industry (Ricci et al., 2023).

Research Method

Apple's Vision Pro and Meta's Quest Pro were selected as a representative case for the empirical study. In this study, HMD customers who shared their unboxing experiences were considered as early innovators or opinion leaders. They provided reviews while opening a received HMD, so they were also considered as reviewers. This pilot study selected 20 HMD unboxing and review videos from YouTube based on the number of views, the recency of video posted, and gender of reviewers. This convenience sample includes 2 females and 18 male reviewers. Videos transcripts were created automatically and analyzed using Python. Then, frequency analysis and sentiment analysis were performed to reveal the similarities and differences between the two HMDs (Meta's Quest Pro vs. Apple's Vision Pro) and consumer perceptions of the HMDs.

Prior to the main analysis, the text data was cleaned using basic text processing (i.e., tokenization, stop words removal, and lemmatization) to eliminate insignificant words, symbols or characters. Then, all the text documents were combined to create the corpus (i.e., the body of text used for further statistical analysis) (Schütze et al., 2008).

Results & Discussion

As a result of the study, there were many review videos of Vision Pro that directly experimented with the pros and cons of using Vision Pro in real life, such as spending 24 hours wearing Vision Pro, spending 50 hours wearing it, and living daily life in New York while wearing Vision Pro. On the other hand, the review video of Quest pro mainly explains the functional aspects of the headset, such as newly added or improved features, battery life, graphics quality, audio quality, and comfort during long-term use compared to Meta quest's other model (Quest 2).

Furthermore, as a result of text mining, many words indicating compatibility with other Apple products such as 'apple,' 'apps,' 'iphone,' 'seamless,' 'flawless,' 'compatible,' and 'mac' appeared in the review video of Vision Pro. Specifically, reviewers evaluated that perfect integration with the Apple ecosystem, automatically connecting AirPods, and the ability to easily operate the control center with your fingers provide an overwhelming sense of immersion. In addition, being able to attract the attention of others and being comfortable to wear were cited as advantages of Vision Pro. On the other hand, many negative comments included the high price('expensive'), the necessity of using Vision Pro with other devices, the large size and burdensomeness for daily use, and the battery capacity is not enough for long-term use. In the case of Quest Pro, there was mainly mention of improved features ('resolution,' 'color,' 'eye_tracking,' 'battery_life'). Reviewers commonly emphasized the technology's impressive displays and potential, but also pointed out problems such as physical discomfort('tired,' 'uncomfortable,' 'hurt,' 'sick'), headaches('headache'), nausea('messing'), and the awkwardness of using it in public places('insane,' 'awkward').

Conclusion

HMDs play a crucial role in various sectors, necessitating a thorough understanding of consumer feedback for continual improvement. This study justifies its significance by analyzing consumer reviews to assess real-world experiences and market receptivity of HMD technology, thereby providing actionable insights for product development and marketing strategies. Findings underscore the importance of addressing user concerns while leveraging technological advancements to enhance user experience and drive widespread adoption of HMD technology. Short battery life, non-wearable size and weight, high prices, and cyber sickness such as headaches and nausea are problems that HMD must solve. It is also important to create realistic environments that mimic both physical spaces and online platforms they frequently visit and to allow them to freely control the world inside the device through advanced controllers and haptic technology to increase consumers' sense of immersion. In the fashion sector, it contributes by exploring the potential for new shopping experiences through VR and AR technologies, and by offering directions for product and service improvements that can enhance consumer satisfaction and strengthen market competitiveness through technological advancements. If research were conducted on the effects of virtual fitting provided by HMD on consumers' shopping immersion and the effect of brand experience using HMD on brand bonding, it could improve consumer experiences and help fashion marketers develop marketing strategies.

References

Jayamini, C., Sandamini, A., Pannala, T., Kumarasinghe, P., Perera, D., & Karunanayaka, K. (2021). The use of augmented reality to deliver enhanced user experiences in fashion industry. *Lecture Notes in Computer Science,* 12936.

Kim, J., & Ha, J. (2021). User experience in VR fashion product shopping: focusing on tangible interactions. *Applied Sciences, 11*(13), 6170.

Lanier, M., Waddell, T. F., Elson, M., Tamul, D. J., Ivory, J. D., & Przybylski, A. (2019). Virtual reality check: Statistical power, reported results, and the validity of research on the psychology of virtual reality and immersive environments. *Computers in Human Behavior, 100*, 70-78.

Meißner, M., Pfeiffer, J., Peukert, C., Dietrich, H., & Pfeiffer, T. (2020). How virtual reality affects consumer choice. *Journal of Business Research, 117,* 219-231.

Park, M., Im, H., & Kim, D. Y. (2018). Feasibility and user experience of virtual reality fashion stores. *Fashion and Textiles, 5*(1), 1-17.

Ricci, M., Evangelista, A., Di Roma, A., & Fiorentino, M. (2023). Immersive and desktop virtual reality in virtual fashion stores: a comparison between shopping experiences. *Virtual Reality,* 1-16.

Schütze, H., Manning, C. D., & Raghavan, P. (2008). *Introduction to information retrieval.* Cambridge University Press.

Siegrist, M., Ung, C. Y., Zank, M., Marinello, M., Kunz, A., Hartmann, C., & Menozzi, M. (2019). Consumers' food selection behaviors in three-dimensional (3D) virtual reality. *Food research international, 117*, 50-59.

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CONSUMER KNOWLEDGE AND PERCEIVED RISK ON ATTITUDES AND PURCHASE INTENTIONS OF PHYSICAL FASHION PRODUCTS ON METAVERSE

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Introduction

The emergence of the Metaverse has blurred the lines between real life and online experiences, creating a digital era that has transformed the fashion industry by changing the market and consumers' purchasing behaviors (Hadi et al., 2024). Initially, the Metaverse allowed gamers to purchase digital fashion for their avatars, but it now offers fashion retailers a new distribution channel to reach consumers who shop for physical fashion products, providing their products with greater exposure. Brands are increasingly using the Metaverse to provide immersive consumer experiences and create virtual spaces that promote brand image and engagement (Cottrell, 2022). Furthermore, as technology evolves, consumers are now able to purchase products while experiencing them in the Metaverse. However, this new era has brought challenges for fashion retailers in their interactions with consumers across various channels (Pantano, E., & Viassone, 2015), and many consumers remain hesitant to purchase physical products on the Metaverse and may face barriers to doing so (Cottrell, 2022). Although fashion retailers may see an opportunity to sell digital fashion, these fashion retailers still make the majority of their profit through sales of physical apparel. Therefore, this study aims to investigate how knowledge of Metaverse influences consumers' perceived risk and attitude towards the Metaverse, ultimately leading to their intention to purchase physical products. Additionally, the study aims to examine how the perceived risk of the Metaverse impacts consumer attitudes and purchase of products on the Metaverse.

Literature Review & Hypotheses

This study utilizes the theory of reasoned action as it explains the relationship between attitudes and behaviors within an individual's action (Fishbein & Ajzen, 2010). This theory will contribute to how individuals will behave based on their existing attitudes and behavioral intentions (Ajzen, 2010). To predict consumer attitude to purchasing physical products on Metaverse, knowledge and perceived risk of the Metaverse were examined. Recent studies have supported the idea that increasing consumer knowledge of the Metaverse can positively influence their attitudes toward using the platform to purchase fashion products. Consumers with higher levels of knowledge of virtual reality had a more positive attitude toward virtual reality products and were more likely to purchase them (Suh & Lee, 2005). Additionally, increased knowledge of augmented reality positively influenced consumers' attitudes and purchase intentions toward augmented reality products (Sun et al., 2022). Therefore, it is hypothesized that a consumer's knowledge of the Metaverse will have a positive influence on their attitude toward purchasing fashion products in the Metaverse (H1).

Perceived risk of the Metaverse can also influence attitudes towards purchasing physical products in the Metaverse. Consumers may perceive various risks such as privacy concerns, security issues, and virtual experience quality. The literature suggests that when consumers know a product or service, they are more likely to have a positive attitude toward it and perceive lower risks (Smith & Vogt, 1995). Hence, it is critical to increase knowledge of the Metaverse to enhance consumers' attitudes and decrease their perceived risk. It is hypothesized that a consumer's knowledge of the Metaverse decreases the perceived risk of purchasing fashion products in the Metaverse (H2). Moreover, research has shown that addressing perceived risk can help increase positive attitudes toward technology adoption. For example, a study by Chen and Lai (2023) found that reducing the perceived risk of using mobile payment systems increased consumer adoption of the technology. Similarly, a recent study by Uhm et al, (2022) found that addressing consumers' concerns about the perceived risk of using Augmented Reality (AR) technologies led to more positive attitudes toward using them for shopping. Thus, it is hypothesized that the perceived risk of the Metaverse has a negative

influence on a consumer's attitude towards purchasing fashion products in the Metaverse (H3) and their purchase intention of fashion products in the Metaverse (H4).

Understanding the influence of knowledge and perceived risk of the Metaverse on consumer attitudes and purchase intentions is critical to enhancing the consumer experience and increasing competitiveness in the fashion industry (Fishbein & Ajzen, 2010). Increasing knowledge of the Metaverse can lead to a more positive attitude towards purchasing physical products in the Metaverse (Suh & Lee, 2005), while addressing perceived risk can mitigate negative attitudes towards the platform (Chen & Lai, 2023). Furthermore, a positive attitude towards purchasing fashion products in the Metaverse is hypothesized to have a positive influence on a consumer's purchase intention of fashion products in the Metaverse (H5) (Sun et al., 2022).

Research Method
The research collected 352 usable surveys from U.S. consumers (Male = 30.33 years; female = 15.3%, male = 99.7%, 95.5 Caucasian) through Amazon Mechanical Turk. The study employed previously validated 5-point Likert-type scale measures, with Cronbach's alphas above .70 and variables exhibiting lower than .7 Pearson's correlations, indicating no multi-collinearity. The measure structures were confirmed using Confirmatory Factor Analysis [good fit: χ^2 (df = 38) = 45.097, CFI = .99, RMSEA = .037, SRMR = .047].

Results
The study used Structural Equation Modeling to test the hypothesized model, which showed a good fit with the model [χ^2 (df = 39) = 49.726, CFI = .982, RMSEA = .040, SRMR = .048]. Results supported H1 (β = .96, p < .001) and H5 (β = .537, p = .01), indicating that consumer knowledge positively influenced consumer attitude and, in turn, led to purchase intention in Metaverse. However, H2 (β = .56, p < .001), H3 (β = .17, p = .345), and H4 (β = -.238, p = .090) were not supported. Interestingly, consumer knowledge positively increased perceived risk.

Discussion & Conclusion
The study revealed that consumer knowledge had a positive impact on attitudes toward purchase intention, while perceived risk did not affect either attitude or purchase intention. This implies that existing knowledge about the Metaverse among consumers plays a significant role in influencing their attitudes toward purchasing physical fashion products. Additionally, it is interesting to note that the study found that consumer knowledge positively increased perceived risk. This finding is somewhat unexpected, as previous studies showed that increased knowledge can reduce perceived risk. It is possible that the increased knowledge about the Metaverse and its potential risks may have led consumers to be more cautious about making purchases, even though their attitudes towards purchasing were still positive. These findings provide valuable insights for marketers to consider when developing their marketing communication strategies. They need to ensure that their communication effectively delivers information about the Metaverse and its potential benefits to increase sales while addressing consumer concerns.

References
Chen, C.-L., & Lai, W.-H. (2023). Exploring the impact of perceived risk on user's mobile payment adoption. Review of Integrative Business and Economics Research, 12(1). 2414-6722.

Cottrell, J. (2022). Making sense of the metaverse. Fast Company. https://www.fastcompany.com/90759482/makin   -sense-of-the-metaverse

Fishbein, M., & Ajzen, I. (2010). Predicting and changing behavior: The reasoned action approach. Psychology Press.

Hadi, R., Melumad, S., & Park, E. S. (2024). The Metaverse: A new digital frontier for consumer behavior. Journal of Consumer Psychology, 34(1), 142-166. https://doi.org/10.1002/jcpy.1356

Smith, J., & Vogt, C. A. (1995). The effects of integrating advertising and negative word-of-mouth communications on message processing and response. Journal of Consumer Psychology, 4(2), 133-

151.

Suh, K.-S., & Lee, Y. E. (2005). The Effects of Virtual Reality on Consumer Learning: An Empirical Investigation. MIS Quarterly, 29(4), 673-697. https://doi.org/10.2307/25148705

Sun, C., Fang, Y., Kong, M., Chen, X., & Liu, Y. (2022). Influence of augmented reality product display on consumers' product attitudes: A product uncertainty reduction perspective. Journal of Retailing and Consumer Services, 64, 102828.

Pantano, E., & Viassone, M. (2015). Engaging consumers on new integrated multichannel retail settings: Challenges for retailers. Journal of Retailing and Consumer Services, 25, 106-114.

Yang, X., Xiong, S., Uhm, J.-P., Kim, S., Do, C., & Lee, H.-W. (2022). How augmented reality (AR) experience affects purchase intention in sport E-commerce: Roles of perceived diagnosticity, psychological distance, and perceived risks. Journal of Retailing and Consumer Services, 67, 103027.

You, Y., Vadakkepatt, G. G., & Joshi, A. M. (2015). A Meta-Analysis of Electronic Word-of-Mouth Elasticity. Journal of Marketing, 79(2). https://doi.org/10.1509/jm.14.0169

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FUNCTIONALITY AND SUSTAINABILITY ON CONSUMER PURCHASE INTENTIONS FOR SPORTSWEAR

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Introduction

The global sportswear market is experiencing robust growth, projected to increase from $203.26 billion in 2023 to $271.77 billion by 2030, thanks to the resurgence of sports activities and events post-COVID-19. This growth is particularly evident in the United States, where the market expanded by over 10% between 2021 and 2022 (Fortune Business Insights, 2023). As sportswear transcends its traditional athletic boundaries to encompass fashion and lifestyle segments, consumers are evaluating their purchases based on a multitude of factors, including functionality, brand loyalty, price, and increasingly, sustainability (Kim & Oh, 2020).

Sustainability has emerged as a paramount concern among fashion consumers, driven by heightened environmental awareness and social responsibility. This shift is reflected in the sportswear sector, where demand for sustainable products is on the rise, yet research on what drives sustainable sportswear purchases remains scant (Baier, Rausch & Wagner, 2020).

This study addresses the research gap by examining how functionality and sustainability influence consumer intentions to purchase sustainable sportswear, framed within the theory of planned behavior (Ajzen, 1991). This theoretical framework suggests that purchase intentions are shaped by attitudes toward sustainable sportswear, subjective norms, and perceived behavioral control. Employing an online survey and structural equation modeling (SEM), the study aims to elucidate the complex interplay between these factors, offering new insights into consumer behavior in the sustainable sportswear market.

Theoretical Framework and Literature Review

In exploring the determinants of consumer behavior toward sustainable sportswear, the literature underscores the Theory of Planned Behavior (TPB) as a critical framework. This theory suggests that an individual's behavior is influenced by their attitudes towards the behavior, perceived social pressures (subjective norms), and their perceived ability to perform the behavior (perceived behavioral control) (Ajzen, 1991). Research across various domains, including sportswear and sustainable product consumption, has leveraged TPB to elucidate the nuances of consumer decision-making processes (Hussain & Cunningham, 2023). The functionality and sustainability of sportswear emerge as pivotal factors influencing consumer attitudes and purchase intentions. Functionality, encompassing aspects such as comfort, durability, and performance enhancement, has traditionally been a primary consideration in sportswear selection (Gorade et al., 2021). However, the growing consumer consciousness towards environmental sustainability challenges this functionality-centric perspective. This shift is reflected in the increasing preference for sportswear that not only meets performance standards but also aligns with environmental and ethical values (Kopplin, 2023). Therefore, the literature review posits two hypotheses for further exploration: consumer attitudes to shape the purchase intention of sustainable sportswear will be influenced negatively by consumers' functionality expectations for sportswear (H1) and positively by consumers' sustainability expectations for sportswear (H2). H1 is grounded in the assumption that the perceived performance trade-offs associated with sustainable materials may deter consumers who prioritize functionality. H2 reflects the growing trend of environmental responsibility and the desire to make ethical purchasing decisions. Integrating TPB with the specific context of sustainable sportswear, generated the following hypotheses. Consumer attitude (H3), subjective norms (H4), and perceived behavioral control (H5) about sustainable sportswear will all be positively related to the purchase intention of sustainable sportswear.

Research Method

This study utilized an online survey via Amazon Mechanical Turk to collect data from 400 participants, focusing on the purchase intentions for sustainable sportswear, specifically golf cotton wear, due to its relevance in the context of functionality and sustainability. The survey, conducted from August 7 to August 13, 2023, employed scales to measure attitudes, subjective norms, perceived behavioral control, purchase intention, and ecologically conscious consumer behavior, alongside the functionality needs specific to sportswear. Golf was chosen as a case study due to its increased popularity and significant economic contribution, particularly during the COVID-19 pandemic, which saw a resurgence in the sport. Cotton was selected for its sustainability attributes, contrasting with the functionality often associated with man-made fibers like polyester. The study aims to bridge the research gap in sustainable golf wear purchase intentions, leveraging cotton's biodegradability and consumer perceptions of sustainability. Descriptive statistics provided insights into the demographic makeup of the respondents, with a balanced representation across gender, ethnicity, income, education, and occupation. Data analysis was performed using IBM SPSS and Mplus 8, employing confirmatory factor analysis and structural equation modeling to test the proposed hypotheses, ensuring the reliability and validity of the constructs measured.

Results & Discussion

Structural equation modeling (SEM) was applied to test hypotheses regarding the impact of functionality and sustainability on attitudes toward sustainable sportswear and, subsequently, on purchase intentions (χ^2 = 18772.50, $p \leq 0.001$; df = 1770; CFI = .919; RMSEA = .046; SRMR = .050). Contrary to initial assumptions, findings revealed that high functionality expectations positively influence attitudes towards sustainable sportswear (β = .28, $p \leq .001$), rejecting H1, while strong sustainability expectations were found to enhance positive attitudes (β = .40, $p \leq .001$), supporting H2. Furthermore, positive attitudes, subjective norms, and perceived behavioral control were significantly associated with higher purchase intentions for sustainable sportswear, affirming H3(β = .19, P = .013), H4(β = .29, P $\leq$ .001), and H5(β = .42, P $\leq$ .001).

The discussion highlighted that despite traditional concerns regarding the performance of sustainable materials, consumers with high functionality expectations still value sustainable sportswear. This suggests a shift in consumer perceptions, where the functionality of sportswear, particularly in terms of comfort and active use, does not deter interest in sustainable options. The study underscores the importance of consumer attitudes, social influence, and perceived control in fostering the intention to purchase sustainable sportswear, reinforcing the role of TPB in understanding consumer behavior toward sustainable fashion.

Conclusion

This study leverages TPB to explore sustainable sportswear purchase intentions, incorporating functionality and sustainability alongside traditional factors like consumer attitude, subjective norms, and perceived behavioral control. It broadens the understanding of attitude formation towards sustainable products and validates TPB in the context of sustainable sportswear. Findings reveal that both functionality and sustainability expectations positively influence consumer demand for sustainable sportswear, suggesting that consumers value these aspects when considering sportswear purchases. This offers practical insights for the industry to cater to the dual expectations of functionality and sustainability. However, the study also has limitations, primarily its focus on cotton golf apparel as a singular example of sustainable sportswear, and considering only functionality and sustainability as key variables. Future research could explore a wider range of functionality variables and sustainable materials like recycled fibers to gain deeper insights into consumer preferences for sustainable sportswear. This approach could yield a more nuanced understanding of the factors influencing sustainable sportswear purchase intentions.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Baier, D., Rausch, T. M., & Wagner, T. F. (2020). The drivers of sustainable apparel and sportswear consumption: A segmented kano perspective. *Sustainability, 12*(7), 2788.

Fortune Business Insight. (2023). Sportswear market size, share & COVID-19 impact analysis, by product (shirts & T-shirts, Trousers & Tights, shorts and Others), by demography (men, women, and kids), by distribution channel (online, and offline), and by regional forecast, 2023-2030. Retrieved November 27, 2023, from https://www.fortunebusinessinsights.com/sports-apparel-market-107401

Gorade, V. G., Chaudhary, B. U., & Kale, R. D. (2021). Polyester fabric with moisture management properties using a sol–gel technique for activewear. *Journal of Polymer Research, 28*(8), 1-13.

Hartmann, P., & Apaolaza-Ibáñez, V. (2012). Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern. *Journal of business Research, 65*(9), 1254-1263.

Kim, Y., & Oh, K. W. (2020). Effects of perceived sustainability level of sportswear product on purchase intention: Exploring the roles of perceived skepticism and perceived brand reputation. *Sustainability, 12*(20), 8650.

Kopplin, C. S. (2023). Sports fashion and sustainability: a perfect match? *International Journal of Sports Marketing and Sponsorship. 24*(5), 891-912.

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Poster Session 3.
Fashion Design & Cultural Study on Fashion

UNVEILING THE PERFORMATIVITY OF SEXUALITY AND GENDER IN SAM SMITH'S INSTAGRAM IMAGERY: A COMPARATIVE STUDY WITH LEIGH BOWERY'S WORKS

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Introduction

Since 2019, British singer Sam Smith has utilized Instagram as a platform for sharing provocative images. Embracing his identity as both homosexual and non-binary, Smith employs these visuals to challenge traditional binary gender norms. The imagery reflects the concept of performativity, suggesting that societal perceptions of sex and gender are performative acts that can be altered. Notably, Smith's visual expressions bear a striking resemblance to the performances of Leigh Bowery, a London-based artist active in the 1980s. Bowery, through transvestism and androgyny, critiqued the artificial constructs of gender norms, representing a spectrum of sexes and genders that defy conventional boundaries (Kim & Yim, 2018). Consequently, this study aims to analyze the performativity of sex and gender by drawing parallels between the works of Leigh Bowery and Sam Smith.

Literature Review

The binary norms of sex and gender confine individuals to rigid categories of either woman or man. However, Judith Butler challenges this notion, contending that gender is an artificial construct shaped by societal norms. In Butler's view, gender reflects and mimics sex, the definition of which is intricately tied to the socio-cultural interpretation of the human body (Butler, 1990/2008). Butler thus introduced the concept of performativity, proposing that gender is molded through repetitive acts. Through continuous performances, gender codes emerge, embodying conventional representations of sex and gender, fostering the illusion that these codes are inherent in the body. Dress, functioning not only to accentuate sex-related features but also to underscore the interconnection between sex and gender, stands out as a prominent code in the performative enactment of sex and gender.

Leigh Bowery is celebrated for performances that challenge binary gender norms. Active during the 1980s, Bowery engaged with contemporaries such as singer Boy George, designer John Galliano, and painter Lucian Freud. His influence extended to later fashion icons and artists, including Alexander McQueen, Rick Owens, and Lady Gaga. Bowery defied traditional gender boundaries by projecting femininity onto his male physique through dress and performances. Employing his plump body, he transformed it to embody feminine features such as breasts and a pregnant form. Wigs, dresses, and high-heeled shoes became integral in his portrayal of the female appearance. In this way, Leigh Bowery artfully conveyed femininity on a male body, illustrating that gender is a performative construct shaped by actions rather than inherent traits of the body.

According to Butler (1990/2008), performative acts express identity through bodily signs and other discursive means. Both Sam Smith's imagery and Leigh Bowery's performance display bodily signs and discursive means reflecting identity, as outlined by Butler's theory. In their images, symbolic body parts represent sex, while dress conveys gender norms. Both artists utilize socially constructed symbols to perform sex and gender, categorized into bodily and sartorial signs. Hence, this study aims to analyze performativity in Sam Smith's imagery and Leigh Bowery's performances using Butler's explanation of bodily signs and discursive means as analytical frameworks. Even though Butler criticized the dichotomous distinction between sex and gender because both are socially constructed, this study attempts to differentiate between biological sex and social gender in the same way that Butler provisionally adopted the binary distinction to explain that sex is also a social norm like gender. Furthermore, while Butler suggests that

performativity can subvert or re-idealize gender norms, this study focuses on examining its subversive aspects.

Research Method

This study aims to conduct a comparative analysis of Sam Smith's images and Leigh Bowery's artworks with a focus on performativity. Employing literature review and image analysis as research methods, the study unfolds in two main phases. Firstly, the literature review delves into performativity concerning sex and gender, examining the characteristics of gender representations within Leigh Bowery's works through a performativity lens. Secondly, Sam Smith's Instagram images are systematically categorized based on the performativity of sex and gender. These categories are then compared with Leigh Bowery's artistic expressions to unravel manifestations of performativity and their implications. The research scope spans from Sam Smith's Instagram post on February 13, 2019, where a rejection of bodily norms was declared, to December 31, 2023. Among the 300 images from Smith's account, 35 were selectively chosen that prominently display bodily and sartorial symbols representing sex and gender identity.

Results & Discussion

First, both Sam Smith and Leigh Bowery underscore the performativity of sex by leveraging the fat male body as a conduit to symbolize the female or maternal form. Fat emerges as a pivotal instrument in embodying femininity within the male body, challenging conventional notions associated with the rigid male body and subverting binary gender norms. The incorporation of a fleshy body serves to feminize the male body, disrupt the expected attributes of a firm male form, and inherently poses a threat to traditional masculinity (Whitesel, 2014). Bowery employs tape to gather chest fat, creating the illusion of female breasts, while Sam Smith utilizes gynecomastia to achieve a similar effect. Both artists also utilize abdominal fat to depict a pregnant woman's belly, using their performances to portray childbirth. Bowery simulated giving birth to a woman in one of his performances, while Sam Smith conveyed childbirth by unfurling a voluminous skirt, revealing a female figure beneath his legs. Both Bowery and Smith focus on reproducing characteristics associated with the maternal body. These attributes, expressed through pregnancy and childbirth, are typically linked to women and often associated with trauma, enabling men to maintain authority and be exempt from the pain and fear associated with such experiences (Bancroft, 2019). By performing the maternal body within a male physique, Bowery and Smith illustrate that gender can be artificially performed through bodily symbols such as curvaceous bodies, breasts, and swollen bellies, exposing the failure of patriarchal masculinity.

Secondly, Sam Smith and Leigh Bowery articulate the performativity of gender by adopting quintessential women's dress. Their deliberate choice to outfit male bodies in various women's clothes, including dresses, skirts, corsets, stockings, and high heels, serves to dissolve the rigid binary distinctions of gender. Moreover, Sam Smith creatively merged a shirt and tie with a corset, synthesizing traditional gender codes associated with both men and women. The sartorial selections made by Bowery and Smith challenge normative gender expressions linked to the female body, underscoring that femininity is not inherently tied to the biological attributes of a woman (Kim & Yim, 2018). This not only signifies the social construction of gender through sartorial symbols representing femininity such as skirts and corsets, but also transcends the binary gender system which traditionally fails to acknowledge the intersectionality of sex and gender.

Sam Smith's Instagram images appear to draw inspiration from Leigh Bowery's oeuvre in illuminating the performativity inherent in discussions of sex and gender. A distinctive departure emerges, however, as Leigh Bowery obscured facial features to render gender identification impossible, whereas Sam Smith opts to reveal facial nuances. Smith skillfully juxtaposes traditionally distinct gender markers, featuring both feminine attributes like breasts and masculine elements such as a beard within a singular body. Consequently, Sam Smith's gender performance is suggestive of an embodiment of their non-binary identity. It is plausible that these artistic choices are influenced by Smith's role as a celebrity, necessitating self-expression through the contemporary lens of 21st-century social media platforms.

Conclusion

This study conducted a comparative analysis between Sam Smith's Instagram images and Leigh Bowery's artworks, centering on the performativity of sex and gender. The findings underscore that Sam Smith's photographs articulate the performativity inherent in discussions of sex and gender, exposing the fragility of binary distinctions and challenging established male-centric gender norms. The significance of this research lies in its exploration of how a male queer celebrity purposefully portrays gender and sex. Through a comparative analysis of 20th-century performance artists and 21st-century celebrities, it concurrently examines gender expressions utilized by queer individuals to overcome binary gender systems and heterosexual norms. Future inquiries could delve into the impact of Leigh Bowery on the gender expressions of contemporary artists.

References

Bancroft, A. (2019). Fashion and psychoanalysis: Styling the self. (M. Lee, Trans.). Kuminsa. (Original work published 2012)

Butler, J. (2008). Gender trouble (H. J. Cho, Trans.). Munhakdongne. (Original work published 1990).

Kim, H., & Yim, E. (2018). Analysis of Leigh Bowery's works through Bakhtin's discourse on the grotesque body. The Research Journal of the Costume Culture, 26(6), 823-835.

Whitesel, J. (2014). Fat gay men: Girth, mirth, and the politics of stigma. New York University Press.

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CHARACTERISTICS OF LUXURY BRANDS' COLLABORATION: FOCUSED ON MEDIA REPORTS

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Research Purpose & Method

Luxury fashion brands' collaboration trends are consistent with the discourse of postmodernism to some extent. For example, fashion and art collaboration trends began with the postmodern related features such as de-genreization, convergence, and new interpretations (Chu, & Kim, 2022; Yun & Choi, 2018). Therefore, this study aims to systematically examine and understand the modern and postmodern characteristics that emerged in luxury brand collaborations.

Gucci, Louis Vuitton, and Dior were selected as research subjects by referencing the top 50 luxury and premium brands of 2021 selected by 'Brand Finance' (Haigh, n.d.). Collaboration cases for each brand were searched on Hypebeast (hypebeast.kr). A total of 18 collaboration cases were found between January 2020 and July 2022. The scope of this research was limited to the specified period in order to minimize the overlap with cases addressed in previous studies. Through Google keyword and brand homepage searches, 824 related articles were collected. The collected articles were analyzed using a modified framework adjusted for this study (see Table 1), based on the modern and postmodern fashion characteristics proposed by Morgado (1996).

Table 1. Analysis framework adjusted from Morgado (1996)

Characteristics	Modern fashion	Postmodern fashion
Progressiveness	emergence of new designs as society progresses	the death of progress: recycling elements of the past
Style regularity	harmony and unity of dress; maintaining preexisting styling rules of clothing items	Ignoring the preexisting rules of harmony, unity, and styling rules of clothing items
Class status	existence of class superiority; white middle class-centered fashion	breakdown of elite and mass fashion; popularization of fashion
Style diversity	domination of limited fashion styles: existence of mainstream fashion	diversified fashion styles; expansion of fashion boundaries
Decorativeness	emphasis on simple and functional designs	emphasis on decorations
Symbolism	concern with inherited symbolic meanings	concern with images and surface appearance for its own sake
Harmony with the body	unequivocal relationship between garment structure and body parts	breakdown of relationship between garment structure and body parts
Wearing method	following the traditional rules of wearing garments	challenging the traditional rules of wearing garments

Results

The analysis result showed that there were more cases of collaborations with postmodern characteristics than modern characteristics (see Table 2). Luxury brand collaborations demonstrated postmodern characteristics in terms of 'progressiveness' as they incorporated elements from the past. 'Style regularity' showed both postmodern characteristics, including extraordinary design and the combination of collaboration target characteristics, and modern characteristics, such as maintaining the luxury-brand image and design. 'Class status' displayed both postmodern characteristics, such as accepting various cultures and weakening class status, and modern characteristics, including maintaining the luxury-brand heritage and adding artistic implications to brands to maintain brand authority. 'Style diversity' presented postmodern characteristics, such as combining heterogeneous elements and expanding design areas with various materials and colorways. This aspect also showed the modern characteristics of maintaining the brand's heritage and style. 'Decorativeness' showed both the postmodern characteristic of emphasizing decorative elements and modern characteristics, such as maintaining the brand's existing image and pursuing functionality.

Table 2. Characteristics of modernism and postmodernism by luxury brand collaboration cases

Collaboration cases		Modern (M)/ Postmodern (PM)							
		Progress -iveness	Style regularity	Class status	Style diversity	Decorativ -eness	Symbolism	Harmony with the body	Wearing method
Gucci	Disney	PM	PM	PM	PM	PM	-	-	-
	Mytheresa	PM	M	M	M	-	-	-	-
	The North Face	PM	PM	PM	PM	M	-	-	-
						PM			
	Doraemon		PM	PM	PM	PM	-	-	-
	Balenciaga	PM	PM	M	PM	PM	-	PM	-
	Adidas	PM	PM	PM	PM	PM	-	-	-
	MLB		PM	PM	PM	PM	-	-	-
Louis Vuitton	Nigo	PM	PM	PM	PM	PM	-	-	-
	NBA	-	PM	PM	PM	PM	-	-	-
	Lucien Clarke	-	PM	PM	PM	M	-	-	-
	Nike	-	PM	PM	PM	PM	-	-	-
Dior	Daniel Arsham	PM	PM	M	PM	M	-	-	-
	Shawn Stussy	-	PM	PM	PM	PM	-	-	-
	Nike	-	-	PM	PM	M	M	-	-
	Kenny Scharf	-	PM	PM	PM	PM	M	-	-
	Sacai	-	PM	M	PM	-	-	-	-
	Cactus Jack	PM	PM	PM	PM	PM	-	-	-
	Birkenstock	-	M	-	PM	M	-	-	-

There were challenges in identifying articles and information regarding 'symbolism,' 'harmony with the body,' and 'wearing methods.' In terms of 'symbolism' it was difficult to identify mentions of the symbols that clothing carries; however, judging by some references to high market and resale prices, this aspect can be interpreted as showing modern characteristics. In terms of 'harmony with the body' there was only one article on exaggerated silhouettes, which could be interpreted as a postmodern characteristic. However, the photographs of collaboration designs displayed modern characteristics since clothing designs followed the shape of human body. In addition, articles were not found on 'wearing methods,' since the designs followed traditional clothing-wearing methods, which could be interpreted as a modern characteristic.

Conclusion

The results of this study on fashion collaborations from the design perspective would broaden the academic scope of research, since the previous studies on fashion collaborations primarily focused on the marketing perspective. This study also has practical implications as it may be used as a design and marketing reference by brands and designers.

References

Chu, Y., & Kim, H. K. (2022). Developing fashion design through art collaboration. *Journal of Fashion Design, 22*(2), 73-86.

Haigh, R. (n.d.). Luxury & premium 50 2021. *Brand Finance*. https://brandirectory.com/rankings/ luxury-and-premium/2021

Morgado, M. A. (1996). Coming to terms with postmodern: Theories and concepts of contemporary culture and their implications for apparel scholars. *Clothing and Textiles Research Journal*, *14*(1), 41-53.

Yun, M, & Choi, J. (2018). Louis Vuitton fashion house's art collaboration case studies & art marketing semantic analysis. *Journal of Integrated Design Research*, *17*(3), 79-92.

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EVOLUTION OF FEMALE IMAGERY AND FEMININITIES IN YUEFENPAI NIANHUA

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Introduction

The imagery predominantly centered around dresses not only conveys an aesthetic sense but also serves as a medium for macroscopic delivery of societal, cultural, economic, political, and epochal spirits, as well as microscopic transmission of complex elements such as individual traits, temperament, inclinations, emotional values, and beliefs (Li, 2022). Moreover, the female images depicted in visual media during specific periods mirror the hairstyles, clothing, accessories, lifestyles, ideologies, and aesthetic preferences of women in that era. Thus, this study aims to scrutinize female images in Yuefenpai Nianhua from the late 19th century to the middle of the 20th century. It will explore how these images reflect the liberation of modern Chinese women and the evolution of femininities, aiming to analyze the various types of women's images and femininities in modern China.

Research Method

This study focuses on Yuefenpai Nianhua, a form of commercial advertising art that emerged using the late Republic of China, drawing inspiration from traditional Nianhua (New Year paintings) (Gong, 2015). To meet the research objectives, a combination of literature review, iconology analysis, and content analysis methods were employed. The research scope encompasses 227 Yuefenpai Nianhua pieces featuring female images, curated in 25 volumes (27 publications) by experts with credibility in this field.

Against the backdrop of a complex historical and political transformation in modern China, marked by the decline of the Qing Dynasty and the subsequent emergence of a semi-colonial and semi-feudal society following the Opium War, this study seeks to analyze the various types of female images and the reflected femininity and changes. Employing image analysis and content analysis methods, with image elements as the foundation, the study references constitutive elements of female images from prior research on "Femininity" (Brownmiller, 1985) and "Chinese Feminities/Chinese Masculinities" (Brownell, 2002). This involves a focus on the female body (chest, feet), clothing, pose, the number of subjects, makeup, hairstyle, accessories, and background. The analysis aims to elucidate the changes in female images and femininity. Through this comprehensive examination, the following types of female images and changes in femininity emerge.

Results & Discussion

Initially, Yuefenpai Nianhua featured the Traditional Female Image. In its early stages, a limited number of female figures emerged, predominantly depicted in courtly beauty paintings or as characters from traditional dramas, myths, and folk stories. These portrayals primarily conveyed traditional femininities, emphasizing qualities such as maternality, dependency, and sensuality.

Following this, a significant transformation occurred in the Female Image during the transition from tradition to modernity. From the late Qing Dynasty to the early Republic of China, amid the interplay of Eastern and Western cultures and the coexistence of agricultural and commercial traditions, women retained their traditional roles while gradually embracing a Western lifestyle. This evolution showcased a dual nature of women's character during this era, encompassing both traditional and enlightened feminine qualities.

By the mid-Republic of China, under stable political, economic, and cultural conditions, the New Women emerged onto the historical stage. This category includes "intellectual new women" focused on education and enlightenment and "fashionable modern girls" emphasizing consumerism, lifestyle, and fashion. These types of New Women embodied the temperaments of enlightened and westernized women.

Subsequently, the emergence of a new ideal of a virtuous wife and mother occurred in response to the economic challenges brought about by the "New Life Movement" during the mid-Republic of China era. This discourse emphasized the ideal of a virtuous wife and mother, incorporating both enlightened and Westernized feminine qualities along with traditional attributes like familial centrality, dependency, and maternality.

The progression continued with the Sexual Object Image during the mid-to-late Republic of China. The economic crisis and political turmoil led to an increase in erotic representations of female images in Yuefenpai Nianhua, with women being objectified. This period witnessed the rise of groups embracing sexual freedom, pleasure, and consumption, particularly within the prostitute community, formalizing its presence in society. Women during this era exhibited a sexualized femininity.

Finally, the National Female Images emerged with the outbreak of the Anti-Japanese War at the end of the Republic of China. Women, affected by the aftermath of the war, actively participated in a patriotic campaign for domestic products, aligning with men in the patriotic movement to save the nation. Although calendar posters rarely featured such images in Yuefenpai Nianhua due to their strong commercial attributes, women during this period embodied a patriotic femininity.

Conclusion

This study seeks a comprehensive understanding of women during the late 19th to the early-to-mid 20th centuries through the lens of Yuefenpai Nianhua. Specifically focusing on the female images during the transition from tradition to modernity, as identified in prior research, it marks a crucial juncture in the evolution of the modern female image and femininity. The insights gleaned from this research offer valuable references for the exploration of emotional design in portraying female imagery during specific recent periods. Additionally, the findings contribute to the ongoing refinement of modern and contemporary female image and femininity.

References

Brownmiller, S. (1985). *Femininity*. New York: Ballantine Books.

Brownell, S., & Wasserstrom, J. N. (2002). *Chinese femininities/Chinese masculinities*. Berkeley: University of California Press.

Gong, J. P. (2015). *Modern beauties: Calendar posters and Shanghai culture*[摩登佳丽——月份牌与海派文化]. Shanghai: Shanghai People's Fine Arts Publishing House.

Li, H. Y. (2022). Women's images and femininities represented in Nianhua, improved Nianhuaand Yuefenpai Nianhua. Unpublished doctoral dissertation, Sungkyunkwan University , Seoul.

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LUXURY FASHION BRANDS' COLLECTION VENUES AND CULTURAL APPROPRIATION

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Introduction

Gucci has been hosting its cruise collections at UNESCO heritage sites every year. These events combine fashion with the culture and history of each location. The 2024 Cruise Collection in Seoul was the first in Asia and reflected the luxury brand's interest in cultures beyond the Western world. The event received mixed reviews from the media - while some praised it for showcasing Korea's influence in both consumption and cultural aspects, others criticized foreign fashion companies for commercializing Korean culture at cultural heritage sites. This study aims to explore these negative perceptions from a cultural appropriation perspective. In this context, cultural appropriation refers to adopting elements from another culture without proper understanding or respect. The study examines the relationship between cultural appropriation and fashion collection venues. This study can identify the aspects interpreted as cultural appropriation by analyzing fashion shows perceived as culturally inappropriate compared to those not. Additionally, the study discusses the factors the fashion industry should consider when selecting fashion show venues to avoid cultural appropriation.

Literature Review

Fashion shows were originally a way to communicate in the 14th century, but today, they have evolved into cultural events. In the contemporary fashion landscape, designers seek differentiation by organizing shows in diverse locations and prioritizing visual impact to break away from commercialized settings(Ferrero-Regis & Lindquist, 2020). The rise of digital media significantly impacts visual communication in fashion. The development of video formats enhances the importance of venue and spatial presentation, emphasizing the intersection of fashion, technology, and multimedia experiences. Cultural appropriation is taking or using elements from a culture that is not your own without proper understanding or respect. ("Cultural Appropriation," n.d.). This includes unauthorized cultural expressions such as dress, music, language, folklore, cuisine, religious symbols, and other cultural artifacts(Ziff & Rao, 1997). This becomes particularly controversial when those from a dominant culture proper aspects of a minority culture (Young & Brunk, 2009). Cultural appropriation stems from postcolonial criticism of Western expansionism. The term denotes predominantly Western adoption of non-Western elements, encapsulating exploitative connotations(Rogers, 2006). This phenomenon has raised significant concerns primarily focused on design aspects in the fashion realm. Luxury brands wield substantial influence in the fashion market, drawing authority from the historical traditions inherent in many of these brands, particularly those with deep-rooted European heritage. This authority is further strengthened by the intrinsic value associated with luxury. Brands like Dolce & Gabbana, Gucci, Prada, Isabel Marant, and Tory Burch faced criticism for appropriating cultural symbols on their products without understanding the traditions, reflecting an amalgamation of style theft and Western intervention, often leading to negative public perceptions.

Research Method

Based on the concept of cultural appropriation derived through literature review, a case study was conducted to analyze instances of luxury brand fashion shows utilizing spaces from different cultures. To collect cases for fashion shows, Google searches used keywords like' fashion show location,' 'fashion show site,' and 'fashion show venue.' Data was gathered from each fashion show's official brand websites and magazine articles. This included information on the rationale and background for selecting venues and assessments from stakeholders and consumers. The analysis covers fashion shows that gained attention by

featuring diverse cultural settings, specifically beginning from the 2008 season held in 2007 and continuing through 2023.

Results & Discussion

This study analyzes the cultural appropriation aspect of luxury brand fashion shows and their venue choices. Luxury brands adapt to new media by hiring new creative directors and exploring unconventional fashion show venues. They also showcase their runway events worldwide in today's globalized fashion markets. Hosting fashion shows in historically significant locations of different cultures was uncommon until the early 2000s. The shift began with increased attention to China due to the Beijing Olympics. This was exemplified by the 2008 S/S collections of Pierre Cardin and Fendi in China(Allegranti, 2020). Other notable instances include Louis Vuitton's 2016 Cruise in Palm Springs, Chanel's 2016/17 Cruise in Havana, Raf Simons' 2018 S/S collection in New York City's Chinatown, Dior's 2020 cruise in Marrakech's El Badi Palace, and Chanel's 2019/20 F/W collection staged in a Swiss village-themed set.

Regarding fashion shows in foreign countries or culturally significant locations, it can be challenging to determine whether cultural appropriation has occurred based on a clear standard. However, it is universally accepted that borrowing specific parts of another culture without sufficient knowledge and respect is not acceptable. It is essential to differentiate between inspiration and appropriation and to recognize that cultural appropriation can cause problems because it is closely tied to the identity of each culture. This study aims to compare and describe cases that are considered cultural appropriation versus those that are not.

Pierre Cardin showcased his 2008 S/S collection in the desert of China's Dunhuang region, historically significant as part of the Silk Road. The theme was "Xanadu," referencing a utopian city mentioned by Marco Polo in his writings. Models wore red and white dresses inspired by traditional weddings. Fendi showcased their collection at the Great Wall of China, drawn by the allure of China's potential market and fascination with ancient Chinese ingenuity. The 88-meter runway featured 88 models donning black and white dresses with red accents, symbolizing Chinese culture's happiness motifs such as circles. While both collections were held to explore Chinese culture, they diverged in their themes and purposes. Fendi's show prioritized contemporary perspectives while highlighting China's national character. Meanwhile, Pierre Cardin's show showcased only Chinese culture's enchanting and ancient aspects. Likewise, Chanel's 2016/17 Cruise in Havana and Raf Simons' 2018 S/S collection in New York Chinatown exhibit superficial understandings, needing more consideration for current global perceptions. Both shows incorporated cultural elements into their designs to depict and celebrate the cultures of the respective locations. However, it is essential to note that location characteristics were utilized solely for aesthetic purposes rather than cultural representation. Louis Vuitton's 2016 Cruise in Palm Springs, Dior's 2020 cruise in Marrakech, and Chanel's 2019/20 F/W collection are examples that do not fall under the category of cultural appropriation. Given the widespread cultural exchange and increasing global cultural diversity, it is essential to note cultural appreciation and appropriation nuances. However, these specific instances have been deemed culturally respectful, as they do not exploit, misrepresent, or appropriate the cultural heritage of the respective regions. These fashion collections represent an appreciation of the local culture and its artistic and aesthetic value rather than the commodification of it. Louis Vuitton and Chanel, each set in Palm Springs and a Swiss village, merely use locations as backdrops without reflecting cultural traits showcasing designs harmonizing with the setting. Dior's 2020 Cruise collection in Morocco stands out for its in-depth research, collaborating with local artists to showcase African culture authentically. Public School's and Raf Simons' 2018 S/S collections in New York's Chinatown highlight Public School's authentic reinterpretation of immigrant experiences, delving into the intricacies of cultural narratives and personal stories. Raf Simons employs Chinatown more superficially, offering a less nuanced exploration of the immigrant experience and cultural context.

After analyzing the results obtained from the examples provided above, authentic cultural reflections help avoid appropriation concerns, unlike shows relying on exotic aesthetics. When using the spatial background of another culture for fashion shows, it is crucial to consider the reflection of the host

country's contemporary context and the incorporation of cultural elements into garments(Fendi 2008 S/S). Shows neglecting the current situation in favor of exoticism or fantasy are more likely to be perceived as cultural appropriation(Pierre Cardin 2008 S/S, Chanel 2016/17 Cruise). If the design lacks cultural elements based solely on environmental or geographical characteristics, it may not be considered cultural appropriation(Louis Vuitton 2016 Cruise, Chanel 2019/20 F/W). Conversely, when garments incorporate cultural elements, solely aesthetic use may be deemed appropriation(Chanel 2016/17 Cruise, Raf Simons 2018 S/S), while collaborations demonstrating a deep understanding and cooperation with the culture may mitigate concerns(Dior 2020 Cruise).

Conclusion

The luxury fashion industry has been grappling with a persistent problem of appropriating non-native cultural spaces in product design and fashion shows. This issue stems from the Western dominance and exoticization of non-Western cultures, which accentuates the power of luxury brands. With the advent of new media, fashion shows that integrate diverse cultural backgrounds have become visually impactful. However, this has highlighted the need to distinguish between shows that genuinely reflect the host country's context and those that rely on exotic fantasies. To prevent cultural appropriation, luxury brands must meticulously plan their shows, incorporating diversity and authentic cultural understanding. This requires a deep understanding and appreciation of the cultures in question and a commitment to representing them accurately. Further research is essential to validate these findings and explore practical solutions that can support the industry's efforts to move beyond cultural appropriation and towards a more inclusive and respectful approach to fashion design and presentation.

References

Allegranti, I. (2020). Fashion Shows in Archaeological Heritage Sites. Design/Arts/Culture, 1.

Ziff, B., & Rao, P. V. (Eds.). (1997). Borrowed Power: Essays on Cultural Appropriation. Rutgers University Press.

Ferrero-Regis, T., & Lindquist, M. (2020). Staging fashion: The fashion show and its spaces. UK: Bloomsbury Publishing.

Cultural Appropriation. (n.d.). In Cambridge English Dictionary. Retrieved January 26, 2024, from https://dictionary.cambridge.org/dictionary/english/cultural-appropriation

Rogers, R. A. (2006). From cultural exchange to transculturation: A review and reconceptualization of cultural appropriation. Communication theory, 16(4), 474–503.

Young, J. O., & Brunk, C. G. (2009). The ethics of cultural appropriation. Wiley-Blackwell.

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DEVELOPMENT OF LCA SERVICE DESIGN ADOPTED AI FOR SUSTAINABLE FASHION

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Introduction

LCA (Life Cycle Assessment), which evaluates environmental impacts throughout the product life cycle to manage the sustainability of the fashion industry, had limitations in its use in actual fashion design planning due to its extremely complex elements and the problem of using extensive data compared to its necessity. Accordingly, in order to overcome the difficulties of using LCA in the fashion design planning stage, this study planned LCA service design using AI according to user type in the fashion design field. In addition, low-fidelity prototypes were produced and evaluated focusing on material selection to ensure convenience. The results of this study are meaningful as a practical study on the diversification of LCA utilization methods in the fashion industry.

Method

In this study, service design was conducted according to the double diamond model (Council, 2022), which consists of four stages: discovery, definition, development, and delivery: 1) Discover (problem definition): The role and function of LCA in fashion design, the utilization plan of LCA, limitations of LCA use in the field, LCA tools and software. 2) Define (Persona Setting): Identify the challenges fashion designers face when implementing LCA and gain insight into the utilization. 3) Develop (prototype design): Constructs information structure design and service design utilizing AI. 4) Deliver (evaluation): Validation test and post-interview of low fidelity prototype (5 people), revision and supplementation.

Results

First, in the discover stage, we analyzed the challenges designers face in the sustainable fashion design process through literature review, and collected links and data for connection with AI learning through case analysis. Additionally, we analyzed the functional support that the use of AI optimized for LCA can provide to designers in the sustainable fashion design process. Based on these, in the early design phase, which involves selecting materials that can have the greatest impact on sustainability and can be evaluated quantitatively, we have established a design process that applies AI such as Tableau, Polymer, and Akkio, which analyzes data so that consumers can utilize it.

Second, in the define phase, we developed three types of personas according to the purpose of using LCA and identified problems and requirements for using LCA. The first type is a fashion design student who tries to understand the concept of sustainable fashion using LCA tools, However, finds it difficult to understand and utilize the LCA standard because it is complex. The second type is a fashion designer, who wants to establish a sustainable brand, has a balance between cost and sustainability, and seeks to obtain comprehensive and accurate data at all stages of the product life cycle. The third type is fashion design educators, who try to develop a systematic fashion design methodology that applies the concept of sustainability using LCA, despite the lack of comprehensive data related to LCA.

Third, in the develop stage, we developed an LCA service framework using AI based on persona types. First of all, an information structure design based on the material archive was created to solve the problems identified through persona settings. Material information based on LCA was planned using a sequential tree structure with AI applied. Based on the type of material, it was subdivided into three categories (Main, Sub, Finishing), and was set up to enable exploration of various options by category. Accordingly, designers can select materials suitable for the design through sub-options for each material type. If there are undetermined elements, suitable materials can be suggested through the 'Get recommendation' function. In addition, the 'Search' function was set to provide supplier information for

the material selected by the designer. Lastly, the 'Assessment' function allows designers to check the sustainability level of the AI-derived material combination. Then, based on the results provided, designers can go back to the initial steps and modify material selection to improve sustainability.

Fourth, in the delivery stage, we conducted a user evaluation of the developed framework. User testing and in-depth interviews on the prototype were conducted with 2 fashion design students, 2 designers, and 1 educator. Based on these, we derived an overall evaluation of the service, the impact of each function on sustainability and innovation, and potential challenges and improvements. In the case of Students, they evaluated that AI can promote informed decision-making according to sustainability criteria while providing innovation and inspiration to designers through the variety of options available in terms of materials and finishes. In the case of designers, the provision of information about companies supplying selected materials was evaluated positively and was considered very practical for those working in the field. In the case of a educator, the ability to visually confirm the level of sustainability was evaluated as having the advantage of motivating designers to modify their choices. In addition, since the proportion of selected materials plays an important role in environmental impact assessment, it was proposed to reflect the proportion of materials in the service

Conclusion

This study developed an LCA service design using AI that can help fashion designers make sustainable decisions during design planning. So, we analyzed the considerations and steps when planning sustainable fashion design, segmented needs according to user type, created LCA prototype using AI, and evaluated it. The results of this study were able to suggest directions for using AI in the development of sustainable fashion design, and could expand the use of LCA in the educational and industrial areas.

References

The Double Diamond. (n.d.). *Design Council.* Retrieved January 22, 2024, from https://www.designcouncil.org.uk/our-resources/the-double-diamond/

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CHINA'S NEW FASHION IDENTITY: EXPLORING BALANCE IN EXCHANGES WITH WESTERN FASHION

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Introduction

Chinese fashion has developed rapidly since the 1980s through frequent exchanges with the West, attracting the attention of the fashion industry. In particular, "Guochao" was officially recognized at the national level in 2018. It represents the new identity of modern Chinese fashion, changing the global perception of China's national identity and style in fashion. However, the genesis of the "Guochao" concept has involved a sustained process of uninformed exploration and imitation within Chinese fashion. This journey has led to a critical juncture where Chinese fashion endeavors to shed orientalism and stereotypes, actively forging a new identity within the globalized landscape of fashion. It is crucial to emphasize that this process remains inherently tied to the influence of Western fashion. While Western modernity accelerated the development of Chinese fashion, the mutual influence between Chinese and Western fashion existed long before modernity. Therefore, in the context of today's active promotion of decolonial fashion discourse, an analytical framework free of oppositions and dichotomies has also become an entry point for exploring and re-examining the relationship between Chinese and Western fashion. Hence, this study seeks to investigate the exploration of a new fashion identity in Chinese fashion under the influence of Western fashion. This will be achieved through literature review approach that combines postcolonial theory and decolonial fashion discourse and unraveling its nuanced complexity.

Literature Review

Postcolonialism highlights the challenge, critique, and dismantling of Western centrism and its cognitive paradigms in contemporary times. A pivotal figure in postcolonialism, Edward W. Said, criticized the West's view of the East as the exotic 'other' and the resulting East-West dichotomy that demonstrated the West's superiority, through the theory of Orientalism. Moreover, Said introduced the concept of a reciprocal relationship between the rulers and the ruled. Under the cultural influence of colonial rule, the conqueror and the colonized are interdependent. Thus, the actions or resistance of colonized peoples in the post-colonial era are equally influenced by the forms established or inspired by the culture of empire. This aligns with the perspective of another scholar, Homi K. Bhabha, who argued that the response of colonized people to colonial rule involved not only resistance or acceptance but also coexistence. The oppressed respond to their subjugation by reinterpreting their original culture through the imitation of the ruling class, thereby participating in a process of cultural production and identity formation. Accordingly, Bhabha proposes the concept of a 'third space', a realm in which colonizers and colonized explore the links between subjective identities and cultural differences, with the aim of overcoming hierarchical constraints, navigating cultural differences and highlighting the hybrid nature of these differences. This is in line with what decolonial fashion discourse emphasizes. Decolonial fashion discourse sees the need to reassess and recognize its marginalized, erased and discriminated diversity.

Research Method

Employing a literature review approach, this study conducted a comprehensive search on the Web of Science and CNKI (Chinese Knowledge Information Gateway website). A total of 382 papers published were scrutinized using the keywords 'Chinese,' 'fashion,' 'Western.' After eliminating duplicates and irrelevant papers, 45 relevant studies were selected to investigate the trajectory of modern fashion development in China.

Results & Discussion

The influence of Orientalism: Chinoiserie and China chic
Chinoiserie is an art form depicting Eastern sensibilities that flourished in Europe from the late 17th century to the end of the 18th century. The essence of Chinoiserie as it was originally presented was the Western desire for a romantic utopia and the fantasies that arose from images of China. The dominant image of China was a Western fabrication of the 'other', imbued with exotic mystery, embodies an Orientalism that reconfigures the other. Since the 19th century, the Orient has served as an exotic source of inspiration for Western designers. Orientalist imagery has offered a platform for designers to experiment beyond Western traditions and conventions. Examples include Paul Poiret's 'Reverend coat' in 1905, Yves Saint Laurent's 'Les Chinoises' collection in 1977, Dior's F/W collection in 1997, and 2001, Jean Paul Gaultier showcased an haute couture womenswear collection titled 'Peking Opera Blues.' This essence can be viewed as a method of emphasizing and delineating the exotic China chic present in Western fashion.

Presentation of Exotic Orientation: Westernization of Chinese Traditional Dress
In the 20th century, with the cultural invasion of the West and the spread of China chic, the traditional Chinese dress culture underwent a transformation. From the mid-20th century onward, the traditional qi Zhuang (旗袍, the traditional style of qipao) evolved into the modern qipao, integrating Western dress characteristics while retaining some traditional elements. Simultaneously, the Zhongshan suit (中山裝) emerged as the most distinctive style in modern Chinese men's clothing. It combines Western clothing features with aspects of Chinese dress culture, symbolizing the coexistence of revolution and fashion. This reflects the notion that qipao and the Zhongshan suit represent a new hybridity in Chinese fashion, created under the influence of Western culture. This is in line with Bhabha's proposal of mimicry, which reinterprets China's original dress culture by imitating Western fashion, thus engaging in a form of cultural production and identity creation.

New Fashion Identity as a Cultural Strategy: Guochao
In the early 21st century, Guochao emerged as a distinctive trend in the Chinese market, characterized by the fusion of traditional Chinese brands with contemporary trends. Guochao aims to inherit and reconstruct Chinese culture and national spirit from Western street culture, integrating traditional Chinese cultural elements and aesthetics into contemporary fashion. Therefore, it can be said that the emergence of Guochao is an inevitable outcome of the ongoing trend towards the fusion of Chinese and Western fashion cultures, contributing to the gradual blurring of the aesthetic binary system that traditionally separated China and the West. It also responds to decolonial fashion discourses that emphasize the recognition of neglected fashion diversity. The evolution of modern Chinese fashion is shaped by the interplay of both Chinese and Western fashion cultures, maintaining a nuanced equilibrium between upholding local traditions and assimilating Western elements. Consequently, Guochao represents a venture in modern Chinese fashion, seeking to establish a distinct Chinese cultural identity amid the diverse and hybrid landscape.

Conclusion

From the exploration of Chinoiserie to the constantly updated Chinese fashion trends, this study reveals that the identity of Chinese fashion has always been one that seeks a balance between Chinese and Western styles in its exchange with the West. In the current multifaceted fashion milieu, characterized by a deliberate embrace of diversity, Chinese fashion endeavors to catalyze a critical reevaluation of Orientalism and explore the nuanced interplay between modernity and tradition within the context of Western fashion emulation, thereby fostering the emergence of novel hybrid expressions. It can be seen as an effort to move away from historical stereotypes while exploring the formation of Chinese aesthetics in response to fashion diversity.

References

Deng, Z.W. (2015). *Polygon prism of modernity: Fashion* [doctoral dissertation, Wuhan University].

Fu, C. (2023). New fashion identity and the state in China: A decolonial interpretation. *Fashion Theory, 27*(4), 581-602. https://doi.org/10.1080/1362704X.2023.2166205

Gu, L. (2020). Traditional Chinese decorative patterns in contemporary Western fashion designs [中國傳統裝飾紋樣在當代西方時尚設計中的應用]. *Journal of Art Communication,* (1), 75-80.

Jia, X.Z. (2022). International fashion system and the cultural inheritance and subject reconstruction of Chinese style clothing [國際時尚繫統與中國風格服飾的文化傳承與主體重構]. *Art Criticism,* (02),36-51.

Jiang, W.Y., Li, Z.Q., & Liu, B.F. (2020, July 7-10). *The influence of Western culture on Republic of China vest* [Conference paper]. 13th Textile Bioengineering and Informatics Symposium (TBIS), Electr Network.

Li, Z.Q. (2016, May 23-25). *Research into Shanghai women's fashion clothes in Minguo Era* (1912-1949) [Conference paper]. 2nd International Conference on Arts, Design and Contemporary Education (ICADCE), Moscow, RUSSIA.

Liang, S. (2019). *The development and evolution of fashion culture since the opening of Shanghai [上海開埠以來時尚文化的發展與演變]*[Master dissertation, Shanghai Academy of Social Sciences].

Segre Reinach, S. (2012). The identity of fashion in contemporary China and the new relationships with the West. *Fashion Practice, 4*(1), 57-70. https://doi.org/10.2752/175693812X13239580431306

Wang, S. (2021). Fashioning Chinese feminism: Representations of women in the art history of modern China. *Critical Studies in Fashion & Beauty, 12*(2), 207-227. https://doi.org/10.1386/csfb_00027_1

Wang, Y.M. (2008, November 18-21). *The study of Chinoiserie in the 20th century Western fashion history* [Conference paper]. 86th Textile-Institute World Conference, Hong Kong, China.

Wang, Y.M., & Wu, S.H. (2004, May 23-27). *A study of Chinoiserie upon Western fashion in 1980s* [Conference paper]. 83rd Textile-Institute World Conference, Shanghai, China.

Wang, Z. (2022). Implementation of Chinese-styled branding in global fashion: 'Guochao' as a rising cultural identity. *Fashion, Style and Popular Culture, 9*(1–2), 149-183–183. https://doi.org/10.1386/fspc_00111_1

Xia, Y. (2010). Xiefeng: Chinese fashion still follows the West [謝鋒:中國時尚仍追隨西方]. *China Fashion,* (12), 24-25.

Yang, J. P., Sun, Y. Q., & Qing, S. N. (2011). The journey of silk to the international fashion design world. *Advanced Materials Research, 175*, 981-986. doi: 10.4028/www.scientific.net/AMR.175-176.981

Zhang, H.X., Jiang, X.W., & Wang, L.M. (2010, May 28-30). *Research on fashion design of Cheongsam* [Conference paper]. 3rd International Symposium of Textile Bioengineering and Informatics, Coll Textiles, Shanghai, China.

Zhu, H. F. (2007, August 22-24). *The inheritance and development of Chinese traditional fashion culture* [Conference paper]. 8th International Conference on Computer-Aided Industrial Design and Comceptual Design, Seoul, South Korea.

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FROM BLOGS TO INSTAGRAM: WHY DO FASHION INFLUENCERS SHIFT PLATFORMS?

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Introduction

The recent shift in the media landscape has seen fashion bloggers gravitating towards social media platforms like Instagram, TikTok, and YouTube. This trend necessitates an understanding of the differences in these media that are prompting influencers to migrate, and how this shift is impacting fashion communication. While extensive research has been conducted on fashion bloggers and influencers, there is a relative scarcity of studies focusing on the motivations behind their media transition. Therefore, this study aims to analyze the media migration of fashion influencers, exploring the characteristics and differences of each medium. The research questions are as follows: Firstly, we examine the perceived differences between blogs and Instagram as media platforms by fashion influencers. Secondly, we explore the causes, background, and motivations for fashion bloggers' shift to social media platforms.

Literature Review

Since the inception of fashion blogging in the United States in 2003 (Bartlett, 2013), fashion bloggers have increasingly developed activities around broad information encompassing brands and product experiences. Pedroni (2022) describes the transition and evolution of platforms used by fashion bloggers. In the early 2000s, fashion bloggers were characterized by their amateur nature, posting on personal spaces. By the mid-to-late 2000s, fashion blogging shifted to a more commercial space, forming a professional character. From the early 2010s, fashion bloggers began to play institutionalized roles in the fashion industry, launching their own brands or engaging in entrepreneurial activities. Post-2015, media evolution led to a shift in platforms used by fashion bloggers, notably towards Instagram and YouTube. Over the past two decades, the role of fashion social media practitioners, primarily represented by fashion bloggers, has expanded. Currently, platform migration, especially towards Instagram, is solidifying the influence of fashion bloggers (Pedroni, 2023). Meanwhile, the term 'influencer' refers to individuals with significant impact both online and offline, akin to celebrities (Shin et al., 2019). They utilize social media to build followers and generate income based on their influence. With the diversification of platforms, the types of influencers, such as power bloggers and Instagram influencers, are constantly evolving, standing at the intersection of personal identity and business aspects.

Research Method

This study investigates the transition of fashion influencers from blogging to Instagram, particularly focusing on the journey of fashion bloggers to social networking services (SNS), the resultant changes in fashion information dissemination, the impact on followers and consumers, and the evolution of fashion consumer behavior. To achieve this, qualitative research was conducted using in-depth interviews. The subjects were fashion influencers who had previously operated fashion blogs through Naver Blog and currently manage Instagram accounts with over 10,000 followers. Initial influencers fitting these criteria were recruited via direct messages in Instagram, and additional participants were then gathered through snowball sampling. All the recruited influencers were women in their 20s and 30s, having experience as influential fashion power bloggers in the past, and now either combining or solely operating Instagram accounts. The interviews were conducted in December 2023 through one-on-one, non-face-to-face Zoom video meetings. The questionnaire was semi-structured, primarily based on prior research, with additional questions adapted to each interviewee's context. This study is an exploratory research aiming to continue with a larger sample group in the future, pending IRB approval. As a phenomenological study, the

analysis was based on the transcribed text of the interviews, focusing on common themes mentioned by the interviewees and excluding individual peculiar cases.

Results & Discussion

1. Fashion Influencers' Utilization of Blogs and Instagram

This study investigates the different ways fashion influencers utilize blogs and Instagram. Influencers recognize that the audience for blog and Instagram content varies, leading to differences in the content and form of their posts. Blog content is primarily exposed to a general audience through search engine traffic. Consequently, influencers aim to provide detailed information about fashion products, rational purchasing advice, and include links such as advertiser-requested purchase pages, additional reference links, and personal monetization links. These links serve not only to provide information but also to drive traffic to the blog. Due to changes in blog search algorithms, continuous updates in keywords and writing styles are necessary to maintain visibility, allowing influencers to categorize posts and cover diverse topics.

In contrast, Instagram inherently exposes content to an influencer's followers, focusing on creating visually appealing content to attract new followers. Without a categorizing feature, influencers on Instagram focus on posting more visually refined content, considering the consistency and mood of their feed and selectively choosing advertisements based on the visual composition of their account. Hashtags are actively used on Instagram, with influencers strategically employing unrelated terms for increased exposure and follower attraction. The limited link functionality on Instagram is predominantly used as a tool for enhancing the marketing metrics and brand awareness of advertised products, rather than driving traffic to the content or account itself.

2. Motivations for Media Transition of Fashion Influencers

The study examined why fashion influencers, who initially focused on blogging, shifted to Instagram from 2016 onwards, with many now either using both platforms or solely focusing on Instagram. Four primary motivations for this media transition were identified: Firstly, the move to a more mobile-friendly environment: Influencers perceive Instagram as a platform more optimized for mobile usage compared to blogs. They have transitioned to Instagram for the ease of content creation and management in a mobile environment, often repurposing popular blog content for Instagram. However, promoting new Instagram accounts through blogs showed limited success. Secondly, the change in search engine algorithms: Search engines have advanced their algorithms to filter out commercial, low-quality blogs, making it harder for influencer blogs to gain visibility. This challenge has driven influencers to switch to Instagram, where content exposure is relatively easier. Thirdly, the efficiency in content creation: Influencers find creating content for Instagram more efficient than for blogs. Instagram's focus on visually appealing images over detailed text reduces the burden of post creation. Lastly, the ease of monetization: Fashion consumers prioritize visual information such as the fit, coordination, and visual mood of fashion products over textual information. Therefore, advertisers prefer Instagram for fashion content, which is advantageous for influencers in generating revenue. Additionally, this shift in influencers' media preference is also influencing advertisers to move their promotional activities to platforms favored by these influencers.

Conclusion

This study aimed to analyze the media utilization methods and the reasons for media transition among fashion influencers. The findings revealed that fashion influencers adapt their content and media usage based on the specific characteristics of each medium. Furthermore, influencers are shifting their active media to Instagram, motivated by factors such as mobile optimization, changes in search algorithms, and the ease of content creation and monetization. This research is significant as it offers an in-depth exploration of the reasons and nature of media transition from the perspective of fashion content creators, particularly at a time when media is becoming increasingly diversified.Moreover, this study serves as a precursor for more extensive research, highlighting the need for subsequent studies to include a wider range of influencer types.

References

Bartlett, D., Cole, S., & Rocamora, A. (Eds.). (2013). *Fashion media: Past and present*. A&C Black.

Pedroni, M. L. (2022). Two decades of fashion blogging and influencing: a critical overview. *Fashion Theory*, *27*(2), 237–268.

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Proceedings

DEVELOPMENT OF CONVERTIBLE JACKET DESIGNS CONSIDERING THE THEORY OF STIMULUS-ORGANISM-RESPONSE

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Introduction

With the rapid development of the fast fashion industry, people are buying clothes more often, leading to excessive clothing consumption. Therefore, sustainable fashion is becoming an essential trend in the clothing industry's evolution (Zuo & Li, 2023). Convertible apparel, which provides two or more functional or stylistic options through various adjustments, is seen as a sustainable choice in the fashion industry. It helps reduce the need for buying too many clothes by offering versatile styles in one garment. The objectives of this study are twofold: (1) to develop convertible jacket in response to sustainable fashion; and (2) to identify the influences of design variability, perceived ease of use, perceived usefulness, perceived sustainability, interactivity, fashion consciousness and the tendency for creative choice of convertible design methods on consumers' intention to purchase convertible apparel products. Convertible garments can be also defined as "garments that provide two or more functional or aesthetic alternative styles through a variety of manipulation methods such as wrapping, binding, rolling, twisting, tying, folding, and gathering" (Rahman & Gong, 2016). While convertible apparel design has received attention from both industry and academia, to date, no research has been conducted to determine the influence of convertible apparel design approach characteristics on purchase intentions for convertible apparel products. The theory of Stimulus-Organism-Response (S-O-R) was applied as the foundation for the conceptual framework, which considered design variability to be crucial factors influencing the intention (Mehrabian & Rusell, 1974). The specific objectives of this study include: 1) to design and develop five convertible jacket products using five different convertible design methods; and 2) to use the S-O-R model as the basis for a conceptual framework to determine the effects of design variability, perceived ease of use, perceived usefulness, perceived sustainability, interactivity, fashion consciousness and the tendency for creative choice of convertible design approaches on consumers' intentions to purchase convertible apparel products.

Literature Review

Three aspects of the literature were reviewed: (1) the theoretical background of sustainable fashion design strategies; (2) the different design methods and characteristics of convertible garments; and (3) analysis of the S-O-R model. Convertible garments are garments that offer two or more functional and/or aesthetic alternative styles. Convertible apparel design has the following advantages: (1) consumers' propensity to wear apparel will increase; (2) the lifespan of apparel will be extended (Black, 2008); (3) the psychological obsolescence of the product will be delayed (Fletcher, 2013); and (4) the disposal of apparel waste in landfills will be delayed. There are five types of convertible garments design methods: layered, reversible, removable details, open & close, and repositioning according to previous research (Chae et al., 2021). In this research, the five convertible methods were grouped and summarized through case studies as follows.

Research Method

To achieve the research goal, five convertible jacket products using five different convertible design methods was be developed. For examining consumer behavior towards convertible garments, we developed a research model that integrates the foundational framework of the S-O-R theoretical model. The five convertible garments developed in this study were used as research objects. Design variability was identified as the stimulus variable (S), perceived ease of use, perceived usefulness, perceived sustainability, and interactivity were identified as mediating variables (O), fashion consciousness and the

tendency for creative choice were identified as control variables and purchase intentions was identified as the final response (R).

Results & Discussion

In this research, five methods to design and develop five convertible jackets was be used. To ensure the uniqueness of the study variables, it was determined that Designs A, B, C, D, E were identical prior to transformation. The prototype comprises three fabrics: black and white wool blazer fabric, and gray embroidered organza. The design includes four eyelet buttons, an adjustment ring, and a D-ring as accessories. The jacket has a black blazer outer layer and a gray embroidered organza inner layer, with different lengths for the outer and inner layers. The jacket features cuffs made of black blazer fabric and gray embroidered organza. The back of the jacket includes cutouts and two straps. The left shoulder strap is connected by a silver-colored adjustment ring and a D-shaped metal ring with adjustable length. The right shoulder strap has a four-eye button that can be adjusted by changing its position. Design A was created using the reversible method. The jacket features contrasting black and white fabrics on both the outside and inside, allowing the wearer to achieve two distinct black and white looks by reversing it. Design B utilizes the repositioning method, allowing the jacket to be transformed into a halter dress. The wearer can insert their head into the center cutout on the back and extend their hands out from the cutouts on both sides, creating a natural hang. Design C was created using the removable method. The jacket features zippers at the cuffs and waist, allowing the wearer to transform it into a vest or bustier by removing the zipper. Design D was created using the layered method. The black jacket is overlapped with a gray embroidered organza halter dress, which can be separated to create two distinct garments: a black suit and a halter dress. Design E was designed by open & close method. The jacket can be transformed into a vest by opening the zipper, and into a handbag by closing the zipper at the bottom.

Conclusion

This study aimed to create convertible jacket fashion items as part of sustainable fashion efforts, and to analyze how their versatility, perceived ease of use, usefulness, sustainability, interactivity, fashion awareness, and creative design choices influence consumer attitudes and purchase intentions for convertible clothing. Five different convertible jackets were be developed, each with a unique design method, and conducted a survey to gather consumer responses. This is the first study to explore how the design variability in transformable fashion affects attitudes and buying intentions for such apparel. It lays the groundwork for future research to explore additional motivations. The findings will be beneficial for future designers in developing transformable fashion items that are more appealing to consumers, by enhancing their versatility and design complexity, thereby fostering stronger purchase attitudes and intentions.

References

Black, S. (2008). *Eco-chic: The fashion paradox*. Black Dog.

Chae Eun Ji, & Joo Bo Rim. (2021). A Study on Flexible Fashion Design Using the Attachment and Detachment Method - Based on a Rectangular Prototype -. *Journal of The Korean Society of Fashion Design, 21(3), 19-37.*

Fletcher, K. (2013). *Sustainable fashion and textiles: design journeys*. Routledge.

Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. the MIT Press.

Rahman, O., & Gong, M. (2016). Sustainable practices and transformable fashion design–Chinese professional and consumer perspectives. *International Journal of Fashion Design, Technology and Education*, *9*(3), 233-247.

Zuo, H. & Li, M. (2023). A discussion on the design method of "one garment for many wears" and its sustainability. *International Textile Guide (02), 25-29*. doi: CNKI:SUN:GFZB.0.2023-02-007.

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RESEARCH ON THE AESTHETIC SENSE OF CLOTHING IN CONFUCIAN CULTURE AND ITS CONTEMPORARY VALUES

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Instruction

Confucianism originated more than two thousand years ago in the region of Qufu. It was founded by Confucius during the Spring and Autumn period, with its main idea revolving around forgiveness, loyalty, filial piety, harmony, courage, benevolence, justice, politeness, wisdom, and integrity. Different people hold varying attitudes towards the traditional cultural values of Confucianism. Some believe that Confucian culture is an outstanding traditional culture of the Chinese nation, exerting significant influence on various aspects such as politics, economy, and culture. They considered Confucian culture to be the most valuable knowledge system in the East. The other argued that Confucianism is founded over two thousand years ago to serve feudal ruling dynasties and to oppress the people. They considered it a backward culture. Having a correct perspective on traditional culture, reinforcing research on traditional culture, and taking its essence and discard its dross are the correct attitude we should have towards traditional culture.This study sorted out the contents related to clothing in the Confucian five classics, and combined with literature, museum collection portraits and other materials, summed up the aesthetic feeling of clothing in Confucian culture.

Literature Review

Representative figures in the history of Confucianism include Confucius, Mencius, Xuncius, Dong Zhongshu, Han Yu, Zhu Xi, and others. Throughout the long history of more than two thousand years, there were various developments in Confucianism. First Emperor of Qin burned books and buried Confucian scholars. Emperor Wu of Han suppressed the Hundred Schools of Thought and promoted Confucianism, while the Tang Dynasty was dominated by Confucian thought alongside the development of Buddhism and Taoism. During the Song Dynasty, Confucianism evolved into Neo-Confucianism, and in the Yuan, Ming, and Qing periods, the content of Zhu Xi's Neo-Confucianism became the subject of imperial examinations. Until the May Fourth New Culture Movement against Confucianism, Confucian culture experienced countless praise and criticism. In the long history, the excellent traditional Chinese culture represented by Confucianism has been formed.

There is almost no research on the aesthetic sense of clothing in Confucian culture, and most of the research focuses on the contemporary value of Confucian etiquette culture such as "politeness" and "benevolence". Promoting traditional culture and fostering cultural confidence are crucial directions for the development of China's cultural industry. Studying Confucian culture and excavating and inheriting the practical significance of culture are considered the best ways to inherit traditional culture.

Research Method

Confucian culture promoted the vigorous development of ancient Chinese etiquette system and laid the mainstream of Chinese clothing culture. This study first combed the five Confucian classics, the bookofsongs, the book of history, the book of rites, the book of changes, and the spring and Autumn Annals, and obtained the relevant contents of clothing culture recorded in Confucian culture. Secondly, combined with other literature, enrich the clothing content in the Confucian culture, and combined with the image data in the library collection, summarize the valuable clothing elements in the Confucian culture.

Results & Discussion

"The Book of Songs" describes the magnificent clothes worn during weddings, such as the "象服 (symbolic clothing),""裳锦褧裳(gorgeous dress decorated with brocade),""衣锦褧衣(gorgeous clothes decorated with brocade)."The "Book of History" explicitly specifies that one's identity can be indicated through clothing patterns and colors, , while also depicting clothing worn during sacrifice and funeral. The "Book of Rites" introduces the colors of clothing worn during funeral in different dynasties, the form of headwear worn during funeral, the criterion of five colors for the emperor's clothing, and the distinctions in patterns for the clothing of the emperor, nobles, officials, and scholars. The "I Ching" consists of two sections: the classic and the commentary. The classic is originally a divination book, with the textual part explaining the symbolic meanings of corresponding hexagrams and providing judgments on auspicious or inauspicious events. The commentary provides an interpretation of the "I.""I Ching" emphasizes the harmonization of yin and yang, the balance of firmness and gentleness, aligning with the contrasting forms of beauty in design. The "Spring and Autumn Annals" records various instances of impoliteness among the nobles, officials, and citizens of the time. Historiographers of the State of Lu would also collect instances of impoliteness among the nobles, officials, and citizens of other countries, record the contents of letters between nobles and between officials. They didn't give details on the clothing.

Conclusion

A person's attire should conform to their profession, status, identity, etc., as it not only represents a person's mental state but also represents the spiritual outlook of a country. This study summarizes and restores the content of clothing aesthetics in the Five Classics of Confucianism, and applies excellent traditional culture to modern clothing design, which can promote Chinese culture to the world and promote the sustainable development of China's clothing industry.

Although there is no relationship between monarch and subject in modern society, it seems that there is no need to distinguish grades through dress patterns and colors. Think about it carefully, today's police and other professional clothing also has certain social and cultural connotations through different shoulder decorations, collar decorations and other accessories. In western culture, the hue, lightness and purity of color are emphasized, while Chinese culture is quite different from the west, connecting color with the five element culture. Cyan, sunrise in the East, spring when everything recovers, red represents summer, the scorching sun in the south, white represents the desolation of autumn, Northwest, decline and decline, as well as black and yellow.

References

Wang Xiumei(Translation and annotation).(2015).The Book of Songs.*Zhonghua Book Company*. Beijing, China.

Yang Tiancai(Translation and annotation).(2022).The Book of Changes.*Zhonghua Book Company*. Beijing, China.

Wang Shishuo, Wang Cuiye(Translation and annotation).(2012).Book of History.*Zhonghua Book Company*. Beijing, China.

Hu Pingsheng,Zhang Meng(Translation and annotation).(2017).Book of Rites.*Zhonghua Book Company*. Beijing, China.

Huang Ming,Zeng Yi(Translation and annotation).(2016).Spring and Autumn Annals. *Zhonghua Book Company*. Beijing, China.

Hu Xiaohong,Guo Zedong.(2023).The Evolution of Confucian Traditional "Li" and Its Contemporary Value,*Journal of China Three Gorges University,45(06),*25-32+116.

Liang Hua.(2010).The Essence and Contemporary Value of Confucian Traditional Etiquette Culture,*Education Exploration,*5-6.

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EVALUATING AFFECTIVE LEXICONS IN VIRTUAL FASHION DESIGN ELEMENTS: EMPHASIS ON COLORS AND TEXTURES

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Introduction

Advancement in the Metaverse and ICT convergence technologies have propelled the emergence of virtual fashion from mere visual representation to experiential dimensions. The Gen Z and Millennials, primary consumers of virtual fashion, are utilizing it as a means for self-expression, attributing newfound emotional values to it. While research on the marketing and technical aspects of virtual fashion thrives, investigations into its emotional design aspects are relatively scarce. From a practical design perspective, there's a critical need for approaches centered on the emotional quality of designs within virtual fashion creation. Therefore, this study sought to establish a theoretical foundation for understanding the affective qualities inherent in contemporary virtual fashion design creation, amidst the Metaverse paradigm. It analyzed collection designs from market-launched virtual fashion brand, with a particular emphasis on identifying the affective vocabularies of consumers. This included a special focus on understanding how the affective qualities of colors and textures interrelate.

Literature Review

Numerous studies, particularly those focusing on clothing, have systematically explored the expression of emotions in fashion design. This aimed to discern the intricate relationship between human emotions and the emotional dimensions associated with design elements such as color and material sensibility. Despite the progress, the precise and objective measuring of human emotions remains a significant challenge. Given the inherently subjective nature of emotions, which defy objective observation, scholars have commonly employed emotion evaluation surveys with adjective-rich vocabulary to assess users' emotional experiences (Jeong, 2007). The adjective classification system developed by Lee and Kim (2003), as explained in the methodology section below, provided a suitable approach for categorizing adjectives capable of evaluating emotions aligned with the proposed emotional framework proposed in this study.

Research Method

This research methodology involved a detailed analysis of five leading virtual fashion brands: RTFKT, Republiqe, The Fabricant, Tribute, and Dress X. Their collection designs from January 2021 to June 2023, spanning five seasons, were examined. From each brand and season, three representative designs were chosen, totaling 75 design pieces for analysis. Based on literature, emotional lexicons for virtual fashion design elements were established. A comprehensive collection of 3000 emotional words cited across brand websites, online reviews, social media posts, and blogs were collected and analyzed. Similarity judgments among lexicons were utilized to classify the collected vocabularies into 18 color adjectives and 20 texture adjective pairs, forming an emotional lexicon list for consumer evaluation. Subsequently, an emotional lexicon assessment based on a 5-point Likert scale was conducted with 30 consumers on the selected designs. Pearson correlation coefficient elucidated the correlation and directionality between color and texture adjectives, thereby offering insights into their emotional impact on consumers' perceptions in contemporary virtual fashion design.

Results & Discussion

By analyzing virtual fashion designs focusing on emotional quality, the results of the proportion of emotional vocabulary related to color and texture and the correlation between the two are as follows:

1) Primary emotional adjectives derived from the affective quality assessment for the top 3 colors were 'futuristic' (74.5%), 'stylish' (72.2%), and 'intense' (71.6%), while for the top 3 textures, they were 'suede-like' (82.3%), 'smooth' (77.5), and 'futuristic' (76.5%).

2) The correlation analysis between the emotional adjectives of colors and textures showed an average absolute value of the correlation coefficient of 0.43172, indicating significant relatedness. Cases where the correlation coefficient was ±0.5 or above accounted for 38.89% or the total, i.e., 140 pairs out of 360 color-texture pairs, and cases with a strong correlation coefficient of ±0.75 or above were 14.17%, i.e., 51 pairs.

3) Based on the average absolute correlation coefficient, the color adjective pairs showing high correlation with the top 3 texture adjective pairs were 'artificial/natural' (0.67121), 'subtle/bold' (0.6082), and 'classic/futuristic' (0.65891), and 'soft/hard'(0.55886)', 'fragile/sturdy'(0.54889), 'weak /strong'(0.51158) for text adjectives. Conversely, pairs showing low correlation were 'gloomy/bright' (0.29811), 'monochrome/colorful' (0.30506), and 'unpleasant/pleasant' (0.31376) for color adjectives, and 'inelastic/elastic' (0.27819), 'fluid/static' (0.32433), and 'rough/smooth' (0.34851) for texture adjectives.

4) Analyzing relationships based on the proportion of significant correlation coefficients (±0.5 or above), the color adjective pairs showing high correlation with texture groups were 'classic/futuristic' (80%), 'artificial/natural' (70%), and 'subtle/bold' (65%). In contrast, pairs showing low correlation included 'unpleasant/pleasant' (85%), 'light/heavy' (80%), and 'gloomy/bright' (80%) for color adjectives, and 'inelastic/elastic' (89%), 'fluid/static' (78%), 'rigid/flexible' (78%), and 'rough/smooth' (78%) for texture adjectives.

5) The groups with the highest correlation based on the correlation coefficient were 'artificial/natural−retro/futuristic' (-0.994226426), 'dark/bright −fragile/sturdy' (-0.986301597), 'artificial/natural−soft/hard' (-0.983213642)', 'relaxed/intense−wet/dry' (-0.980879346), 'relaxed/intense−wet/dry' (-0.980183492), 'artificial/natural−weak/strong' (-0.98018). Conversely, the groups showing the lowest correlation were 'pale/vivid−uneven/even' (-0.002211), 'cool/warm−inelastic/elastic' (0.002315), 'pure color/mixed color−fragile/sturdy' (-0.01296), 'monochrome/colorful−matte/glossy' (0.014556), 'relaxed/intense−thin-threaded/thick-threaded' (-0.023139), 'sloppy/stylish−inelastic/elastic' (-0.024041).

These analysis results revealed that choice of colors and textures in virtual fashion design significantly influences the emotional value, reflecting contemporary and forward-looking attributes. This emphasizes the necessity of an integrated design approach that considers the symbiotic relationship between color and textures in creating the overall modern aesthetic appeal and emotionally engaging virtual fashion designs.

Conclusion

This research elucidates the significant influence of color and texture choices on the affective responses of contemporary virtual fashion design, establishing a well-defined correlationship between these two elements. It offers crucial theoretical insights for understanding the affective qualities within virtual fashion design and supports the needs of an integrated, strategic approach to design. Recognizing the interplay between color and texture contributes to enhancing emotional engagement and aesthetic appeal in innovative virtual fashion design in the Metaverse era.

References

Jeong, S.-H. (2007). Development a self-report questionnaire-type scale for measuring user's emotions while using a product. Korean Journal of the Science of Emotion and Sensibility, 10(3), 403-410.

Lee, K. H., & Kim, Y. J. (2003). A study on the development of fashion sensibility (Part II). Journal of the Korean Society of Clothing and Textiles, 27(5), 505-516.

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THE CULTURAL AND HISTORICAL SIGNIFICANCE OF THE COSTUME POLICY TO ÜRIYANGQAI(兀良哈) IN THE EARLY JOSEON DYNASTY –FOCUSING ON THE POLICY IN THE KING TAEJONG'S REIGN-

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Introduction

The purpose of this study is to analyze the types of costumes that were given to the Üriyangqai(兀良哈), which was a major keyword of the international situation in the early Joseon Dynasty, and to illuminate its political and cultural significance. Üriyangqai was a tribe in Mongolia and is known as the etymology of 'Orangkae' in Joseon. The role of Üriyangqai in the confrontation between the Ming and Mongolia around the 14th century was the balance point of each country(Yoon, 2015).

The policy of Joseon on the this main variable was a conciliatory measure centered on clothing, including official attire, and fabrics that could be used as currency. By analyzing the characteristics and details of the costumes used in Joseon to conciliate Üriyangqai people, it will be possible to understand the valuation of the Üriyangqai in the international situation at that time and the type and role of the ~~four woman~~ clothing gift at that time. The most active use of costumes as a conciliatory measure for Üriyangqai was during the reign of King Taejong in the early Joseon Dynasty. Therefore, research is needed to analyze the cultural and historical significance and the characteristics of costume items around this period.

Literature Review

Records of giving clothes(衣) to key figures of Üriyangqai exist also in the Volume 35 of the 『Goryeosa』. However, It was from the record of 1404 in 『The Veritable Records of the Joseon Dynasty』 that the class of the Üriyangqai people subject to the offering and the names of the clothes and goods began to be recorded in detail. Before and after the King Taejong's reign, There were only a few record of clothing gift grant to Üriyangqai, and the name or kind of material which used in clothing gift for them were simple as like 'clothes, *rip*(笠), shoes'(National Institute of Korean History, 2005-2015). In addition, during the reign of King Sejong after the reign of King Taejong, not only did the number of meals for Üriyangqai decrease rapidly, and the type of clothings changed to military uniforms and accessories rather than official uniforms, showing a significant difference from those of the reign of King Taejong. This means that there was a significant difference in their political values during the reign of King Taejong and the reign of King Sejong when Üriyangqai were suppressed.

Research Method

This study is to analyze the cultural historical meaning and category of this costume policy and use it as basic data for costume historical research about the early Joseon period. Since there are very few existing clothing relics at that time, I would like to focus on analyzing and reviewing the records of 『The Veritable Records of the Joseon Dynasty』 and related previous studies. The research method is as follows. First, it analyzes the characters and types of costumes of the Üriyangqai who was given a command of costumes in the Annals of King Taejong. Second, the significance and shape of the clothing gifts that do not exist now are estimated through related prior researches. Third, by synthesizing this, the cultural significance and costume paradigm of the clothing style given to the Üriyangqai during the reign of King Taejong are revealed.

Results & Discussion

Üriyangqai Manho(兀良哈萬戶) were given lined clothing[裌衣] and *rip*, and below class than Manho were given to linen and ramie fabrics in 1404. Subsequently, in January 1405, it was *pyori-danui*(表裏段衣) that

the royal gift to Dongmaengga-cheommoga(童猛哥帖木兒), the Chief of Odori, a married blood relative to the Üriyangqai. At this time, only *pyori*(表裏:upper and lining) was granted to Üriyangqai-Manho(兀良哈萬戶), and compared to the record in 1404, it can be seen that the status of 'silk clothes with lining' was higher than that of 'simple *pyori*' and consultation. If it was a garment used as a conciliatory measure, it is highly likely that it was an official garment, *danryeong*(團領), but the specific form of these garments is unknown. It is possible that *danryeong*(團領) had a longer back than front as like Song Hyo-sang′s *danryeong* relic in the mid-15th century(Daejeon Prehistoric Museum, 2009). The colors of *danryeong* shown in the portrait of the contributor in King Taejong's period are various: dark blue, light pink, light blue, and white. However, during this period, dark colored clothing[彩衣] was recommended for the dignity and splendor, and light colored *danryeong* was considered negative (Kim & Lee, 2020). Therefore, if *danryeongs* were given to the chief of Üriyangqai with the purpose to subumption, it were likely relatively dark colors. Since then, during the reign of King Seongjong, it is possible to refer to the fact that Indigo colored *pildan*, *mokmyeon*, *jeosa*, *wonryeong*(圓領) with lining, and Single layered *wonryeong* were frequently given due to diplomacy with the Ming(Choi. 2020).

In February, *danui*(段衣) and a flower-patterned *eundae*(silver belt) were givend to Manho, and *chorip* (草笠), *mojugu*(帽珠具), lined cotton clothes[木綿裌衣], and *gwang-eundae*(光銀帶) were given to Cheonho under Dongmaenggacheommoga. The *danui* and the flower-patterned *eundae* represent the highest class, and lined cotton clothing represent the next. Considering the material, it is highly likely that *mojugu* for decoration was also a symbol of the highest class. On the very next month, there is another granted clothing gift indicating that the integration of Üriyangqai was very urgent during the reign of King Taejong. *Gwang-eundae* was given to Sangmanho, and *gakdae*(角帶) were given to Darugachi and Manho. Another items for them were lined *danryeong* of cotton[木棉裌團領], *juyuui*(紬襦衣), *jusosam*(紬小衫). The clothes for the people who has the lower status than Manho were cotton *jikryeong*[木綿直領] and *rip*. For the first time, specific clothing forms such as *danryeong* and *jikryeong* appeared, and even if they were built of the same cotton, '*danryeong*' was given to the higher classes. *Juyuui* and *jusosam* made with 'silk' are considered to have been independent high-end clothes. According to the these records, There are differences of status between a flower-patterned *eundae* and *gwang-eundae*/*gakdae*. Again, another kind of flower patterned *eundae*[起花銀帶] awarded to Manho, and *chomoja*(草帽子) to Tongsa(通事) in May 1406. The latter appears to be a practical costume, but the decorative silver belt would have been awarded with a dual meaning of monetary value and public office.

In the portrait of Joseon, Ryu Hong(柳泓, 1483~1551) was depicted with a dark blue *danryeong* without *hyungbae* and a silver belt with a sculpture that appears to be flowers. This is the official's attire in the 4th ranking of Jeongguk-gongsin(靖國功臣) of early Joseon(Seoul Museum of History, n.d.). Through this, it can be assumed that the importance of the head of the Üriyangqai during the reign of King Taejong was about the level about meritorious retainer of 4th ranking in Joseon.

However, after the major figures of Üriyangqai who received gift caused severe damage by looting and betraying in 1410, the policy of giving clothes changed significantly. Clothing symbolizing public office no longer appeared in the items of gift granted to Üriyangqai, and the gift items were recorded only as clothes, *rips*, and shoes. This can be seen as the result of the Joseon gorvenment's decision that Üriyangqai could not be incorporated into the Joseon government completely, or Joseon should to grant only the minimum amount of sincerity and form to them. During the reign of King Sejong, padded clothes and *jeonrip*(戰笠), *mokwha*(木靴) were given in return for local products of Üriyangqai, but by the time of King Sejo's reign, clothing was not included in the return of local products.

Conclusion

The paradigm of the costume policy for the Üriyangqai during the reign of King Taejong can be classified into three main categories. The first being official robe, silver belts, and silk clothes for the

head of Üriyangqai , which symbolize the official status of Joseon dynasty at that period. The second being casual robes needed for the daily life of Joseon men. This means the possibility of accepting them as the people of Joseon. The third being padded clothes required for the daily life of winter. This can be said to be an example of expressing their willingness not only to guarantee their status but also to promote the convenience of real life.

These paradigm of costume policy means that during the reign of King Taejong, King tried to conciliate Üriyangqai with various clothes which contained various life selections in Joseon for head of Üriyangqai. The costume policy to Üriyangqai does not seem to have been effective in the rapidly changing circumstances. However, the symbolism of that royal clothing gifts-especially the various silver belts, *danui* and *danryeong*, the class differences and types of materials, approximate uses of clothes, and various costumes including official clothes played important role in the conciliatory policy during the period, so it can be said to be of great significance in the history of costumes. Therefore, when reconstructing the historical contents of the early Joseon Dynasty, it is important to pay attention to the characteristics, significance, and need to prove these costumes.

References

Choi. J. (2020). A study on the historical research of indigo clothing gifts of early Joseon -Focusing on the po and ieom of King Seongjong's reign-. *Journal of the Korean Society of Clothing and Textiles*, *44*(1), 107-125. https://doi.org/10.5850/JKSCT.2020.44.1.107

Daejeon Prehistoric Museum. (2009). *Traditional costume of Joseon dynasty*. https://www.daejeon. go.kr/pre/index.do

Kim, M., & Lee, E. (2020). A study of the gwanbok (1st period) of meritorious vassals' portraits in the Joseon dynasty. *MUNHWAJAE Korean Journal of Cultural Heritage Studies*, *53*(2), 180-203. https://doi.org/10.22755/kjchs.2020.53.2.180

National Institute of Korean History. (2005-2015). 朝鮮王朝實錄[The Veritable Records of the Joseon Dynasty]. Retrieved from https://sillok.history.go.kr/main/main.do

Seoul Museum of History. (n.d.). 柳弘肖像[The portrait of Ryu Hong]. Retrieved from https://museum.seoul.go.kr/www/relic/RelicView.do?mcsjgbnc=PS01003026001&mcseqno1=016598&mcseqno2=00000&cdLanguage=KOR

Yoon, E. S. (2015). Üriyangqai 3-Wi and relations between Mongolia and Ming in the 14-15th century. *Journal of the Society for Ming-Qing historical studies*, *43*(0), 1-29. https://doi.org/10.31329/jmhs.2015..43.001

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SUSTAINABLE DESIGN PRACTICES AMONG FASHION DESIGNERS THROUGH ESG FASHION PROJECTS: FOCUSING ON SELF-EFFICACY AND SUSTAINABILITY

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Introduction

Through creative processes and design, sustainable fashion designers can enhance their capabilities. In order to reduce the use of temporary resources and promote sustainability, eco-friendly fashion education is essential. It is imperative for fashion designers to cultivate self-efficacy in environmentally friendly design, starting with material selection and ending with sales and disposal of their collections (Cassar, 2021). This study directs its focus towards the experiences and actions of designers participating in ESG projects sponsored by domestic companies. By scrutinizing these firsthand experiences, the study endeavors to discern shifts in awareness and attitudes toward sustainable design, providing valuable insights into the eco-friendly trajectory of both fashion and corporate ESG projects. The purpose of this study is to explore whether the participation experience of fashion designers who participated in the company-sponsored ESG projects influences eco-friendly self-efficacy and sustainable design practice. In addition, we examine the perceptions and behaviors of participants in the process of designing with sustainability in mind, and examine the problems and diversity encountered throughout the entire process from design planning to disposal. It aims to suggest the direction of fashion-related eco-friendly activities hosted by companies and further supports and strengthens the overall understanding for companies and consumers.

Literature Review

Designers with strong intrinsic motivation and high self-efficacy are more likely to undertake sustainable tasks despite environmental constraints (Faraz et al. 2021). As of now, there is a lack of substantial research on learning and experience related to sustainable design, and sustainable fashion design faces technical and economic limitations, making commercialization challenging (Aus et al. 2021). The field of sustainable fashion design confronts formidable technical and economic constraints, impeding seamless commercialization (Hu et al. 2023). The fashion industry's prevailing trend of overproduction and consumption poses a severe threat to the global environment, accentuating the urgency of ESG activities that underscore social and economic responsibility. Nonetheless, the effectiveness of a company's sustainable initiatives hinges on their practical integration with design processes, and without this linkage, tangible improvements become challenging. Unlike previous studies conducted under arbitrary assumptions, this study targeted participants who actually participated and experienced ESG projects in collaboration between industry and academia (Gurova & Morozova, 2018; Karell & Niinimäki, 2020). In other words, it is significant in that the research was conducted with a focus on changes in perception based on actual experience.

Research Method

To execute this study, preceding research was consulted to formulate the content of an in-depth interview questionnaire. Participants were chosen from the cohort of designers involved in a fashion-related ESG project sponsored by a domestic C-beer company, convened in September 2023. Participant recruitment was facilitated through online platforms, employing a convenience sampling method, culminating in the enlistment of 21 research participants. Among the 21 research participants, 2 males and 10 females were either enrolled in or had graduated from doctoral programs in fashion studies at domestic universities, subsequently assuming roles as professors or fashion designers. The remaining 9 participants comprised undergraduate students majoring in fashion studies. The semi-structured, in-depth interviews, averaging one hour in duration, were conducted either in person or virtually. Data analysis adhered to Giorgi's four-step approach (Giorgi, 1994).

Results & Discussion

Motivations underpinning participation in the ESG fashion project sponsored by the company encompassed a quest for learning opportunities, engaging experiences, environmental consciousness, endorsement from a major corporation, and individual background considerations. Participants anticipated accruing practical experience in sustainable design, fostering networks with stakeholders and fellow designers, contributing to personal development, and garnering support from a corporate entity. Evaluations of their sustainable design capabilities, whether positive or negative, were influenced by factors such as satisfaction derived from contributing to societal well-being or receiving external recognition. However, 42% of participants voiced negative assessments of their sustainable design capabilities, citing increased waste generation and comparing their works unfavorably with those of their peers during the project.

Insights garnered from interviews with participants possessing firsthand experience were utilized to explore avenues for enhancing eco-friendly self-efficacy and design behavior among designers involved in the company-sponsored ESG fashion project. Overall, the project exerted a positive influence on the sponsoring company's image and perception, offering participants both enjoyment and satisfaction. Moreover, it served as a platform for participants to acquire knowledge and experience personal growth in their endeavors toward sustainable design. Publicizing the project through media channels enabled participants to convey messages about sustainability, thereby heightening public awareness. Participants experienced a sense of responsibility and mission as designers committed to sustainability, finding relief from economic and psychological burdens due to the company's oversight of material supply, venue provision, and fashion show organization. Nevertheless, participants expressed disappointment in the project's lack of active networking activities among participants, stakeholders, the public, and colleagues due to the passive attitudes of certain participants and the large crowd during the project.

The impact of sustainable design practice on corporate designers is as follows. Firstly, participants were able to articulate their thoughts and plans regarding sustainable design practices following the project. Engaging in the project served as a catalyst, enabling participants to initiate exploration and establish direction regarding sustainable design through learning from design methods and materials acquired during the project. Subsequently, acquiring insights on improvement strategies to minimize errors when applying sustainable design, in practice post-project served as a driver to enhance organizational competitiveness. Furthermore, participants believed that sharing their experiences and disseminating knowledge to others post-project could potentially demonstrate a speaker effect, influencing others.

Conclusion

The study delineates strategies to fortify sustainability within the project, augment social impact, and yield a more positive influence on participants. Designers underscored the importance of acquiring knowledge about sustainable design, the practical implementation of sustainable design through technical assistance from the sponsoring company, and effective communication with project stakeholders. They also expressed expectations for activating various 'spaces for exchange' through personal, material, and academic support. The sponsoring company could realize its objectives by constructing an archive for sustainable fashion design works, disseminating participants' reflections and memories, and facilitating in-person presentations and discussions. The study underscores the significance of authenticity in conveying the project's intent and emphasizes the necessity of highlighting sustainability practices throughout the entire project process to ensure its continued viability. This research serves as foundational material for educating fashion designers in sustainable decision-making and holds practical significance for companies formulating ESG marketing strategies by furnishing specific approaches.

References

Aus, R., Moora, H., Vihma, M., Unt, R., Kiisa, M., & Kapur, S. (2021). Designing for circular fashion: integrating upcycling into conventional garment manufacturing processes. *Fashion and Textiles, 8*, 1-18.

Cassar, R. (2021). The Reading of the Piece: An Upcycler's Embodied Experience of Working with Material Culture of the Deceased. *Fashion Practice, 13*(3), 331-350.

Faraz, N. A., Ahmed, F., Ying, M., & Mehmood, S. A. (2021). The interplay of green servant leadership, self-efficacy, and intrinsic motivation in predicting employees' pro-environmental behavior. *Corporate Social Responsibility and Environmental Management, 28*(4), 1171-1184.

Giorgi, A. (1994). A phenomenological perspective on certain qualitative research methods. *Journal of phenomenological psychology, 25*(2), 190-220.

Gurova, O., & Morozova, D. (2018). A critical approach to sustainable fashion: Practices of clothing designers in the Kallio neighborhood of Helsinki. *Journal of Consumer Culture, 18*(3), 397-413.

Hu, J., Hur, E., & Thomas, B. (2023). Value-creating practices and barriers for collaboration between designers and artisans: a systematic literature review. *International Journal of Fashion Design, Technology and Education*, 1-12.

Karell, E., & Niinimäki, K. (2020). A mixed-method study of design practices and designers' roles in sustainable-minded clothing companies. *Sustainability, 12*(11), 4680.

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ANALYSIS OF ITEM COMPOSITION WITHIN A FASHION COORDINATION DATASET: FOCUSING ON FASHION EMOTIONS

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Introduction

The term 'fashion emotion' refers to the emotional response elicited by fashion products. The concept is inherently complex and multifaceted, comprising various factors that extend beyond a single evaluative standard. To enhance personalized service satisfaction, it is essential to consider the compatibility between fashion products and the segmented emotions of consumers. Furthermore, the advent of AI image creation technologies, such as Stable Diffusion, Midjourney, and DALL·E 2, underscores the importance of detailed and accurate fashion emotional data to fuel-efficient and innovative image creation within the fashion sector. The study aims to furnish foundational data to enhance the efficacy of offers personalized recommendations and tailored services and AI-driven fashion image generation by examining the combination of fashion items in each fashion coordination data set corresponding to classified fashion emotion.

Literature Review

Fashion emotion represents an innate human propensity to express oneself through the aesthetic quality of fashion items, rendering a distinct image via the formative characteristics of these products. The facets of emotional assessment conveyed through fashion items are multifaceted and resist encapsulation within a singular evaluative framework. Park & Choi (2021) characterized fashion emotion into three principal categories: 'Occasion', 'Gender', and 'Embellishment', further subdividing these categories into seven 'Occasion' groups, six 'Gender' groups, and three 'Embellishment' groups, respectively, based on specific criteria. 'Occasion' is structured into seven groups, derived from the four dimensions of 'personal-social, routine-unusual, indoor-outdoor, and informal-formal'. This research undertook an analytical examination by categorizing into groups based on 'Occasion' emotions.

Research Method

The present study collected and tagged 4,000 images of women's fashion items, resulting in an 11,000-fashion coordination dataset. Three fashion experts collected 4,000 images of 13 fashion items (coat, jacket, jumper, cardigan, vest, blouse, shirt, knit, sweater, pants, skirt, dress, and shoes) from 2018 to 2021 at a domestic women's online shopping mall in their 20s and 30s. The tagging was based on attributes such as shape, material, and color, as well as emotional categorization according to the Park & Choi (2020a, 2020b, 2021) classification system. This investigation combined images to create a collection consisting of 11,000 fashion coordination. A scholar specializing in fashion annotated each coordination image with an emotion, adhering to the fashion emotion classification system proposed by Park & Choi (2021). Subsequently, three experts in the field of fashion selected 7,000 coordination that had been marked with emotional tags, allocating 1,000 coordination set to each of the seven defined 'Occasion' emotions. They conducted an analysis on the prevalence of each designated emotion within the coordination and by analyzing the frequency of use of tops, bottoms, and outerwear used in coordination, the composition of fashion items for each 'Occasion' emotion was compared and their characteristics were analyzed.

Results & Discussion

The outcomes of the analysis concerning the composition of items within the seven 'Occasion' emotion categories are delineated as follows: Analysis of outerwear usage across each group revealed a notably lower usage rate of JP(jumper) in O3(semi-formal:2%), O4(formal:1%), and O5(dress-up:5%) groups, whereas JP was predominantly utilized in the O7(sporty:99%) category. Conversely, JK and CT exhibited a high usage rate particularly in O3(semi-formal:59%), O4(formal:80%), and O5(dress-up:69%). Within the O2(casual)

group, the five types of outerwear-jacket(JK:22%), coat(CT:22%), jumper(JP:29%), cardigan(CD:16%), vest(VT:11%)-were utilized in comparatively similar proportions.

Regarding inner top items, four types were utilized: knit(KN), sweater(SW), shirts(SH), and blouse(BL). The utilization ratios of BL and KN displayed contrasting trends across groups. KN was prevalently used in O1(home-wear:78%) and O7(sporty:81%), with the least utilization observed in categories denoting a pronounced formal emotion such as O3(semi-formal:7%), O4(formal:12%), and O5(dress-up:18%). BL was most frequently employed in O5(dress-up:48%), and SH saw its highest use in O3(semi-formal:42%).

Examining the overall use of bottoms, generally pants(PT)'s frequency surpassed that of skirt(SK), though the usage ratio varied by emotional group. O1(home-wear:61%), O2(casual:63%), O3(semi-formal:52%) and O7(sporty:100%) exhibited a high utilization rate of PT, whereas O4(formal:54%), O5(dress-up:63%), and O6(unusual:60%) favored SK. One-piece(OP)'s absolute usage frequency was low(5%), yet it was relatively frequently coordinated in O5(dress-up:12%).

Given these findings, which illustrate distinct item compositions across the 'Occasion' emotion groups, the representative item combinations for each category are summarized as follows: O1(home-wear) is characterized by JP/CD + KN/SW + SK; O2(casual) is characterized by JP + KN/SW + PT; O3(semi-formal) is characterized by JK + SH + PT/SK; O4(formal) is characterized by JK/CT + SW/SH + PT; O5(dress-up) is characterized by JK + BL + SK; O6(unusual)is characterized by JK + KN/SW + SK; and O7(sporty) is characterized by JP + KN + PT. Through a frequency analysis of item composition among seven fashion emotion groups, distinct patterns of use were identified. Results indicate that outerwear items, such as jackets, coats, and jumpers, are versatile in conveying nuanced emotional tones and exhibit significant variability in their usage across different emotional contexts. In contrast, inner top items like blouses and knits display contrasting trends across groups, with indications of their role in delineating specific emotional states. The analysis of bottoms highlights a strategic selection of pants, skirts, and dresses to resonate with particular emotional groups, emphasizing the importance of item combination in fashion coordination.

Conclusion

These findings offer insights into the complex relationship between fashion items and fashion emotion and suggest the potential for leveraging these insights in personalizing fashion recommendations. Additionally, the study highlights the potential of integrating these insights into AI image creation technologies, suggesting that a more nuanced incorporation of emotional words and item combinations into AI prompts could refine the quality of AI-generated fashion images. However, this study encompasses a limitation, primarily due to its focus on the attire of women aged in their 20s and 30s. Consequently, it is posited that future investigations should extend to encompass a diverse array of age demographics and gender identities to enhance the comprehensiveness and applicability of the findings.

References

Park, N., & Choi, Y. (2020a). A form attribute classification system for fashion items. *International Journal of Fashion Design, Technology and Education, 13*(1), 11–19. doi:10.1080/ 17543266.2019.1664641

Park, N., & Choi, Y. (2020b). Color & texture attribute classification system of fashion item image for standardizing learning data in fashion AI. *Journal of the Korean Society of Clothing and Textiles, 44*(2), 354–368. doi:10.5850/JKSCT.2020.44.2.354

Park, N., & Choi, Y. (2021). Classification System of Fashion Emotion for the Standardization of Data. *Journal of the Korean Society of Clothing and Textiles, 45*(6), 949-964. doi:10.5850/JKSCT.2021.45.6.949.

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ANALYSIS OF PRODUCT CHARACTERISTICS AND CONSUMER REVIEWS OF KOREAN TRADITIONAL SHOES IN ONLINE SHOPPING MALLS USING TEXT MINING

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Introduction

In recent years, the importance of research on Korean traditional clothing has been emphasized amid the growing interest in K-culture. However, traditional footwear has not received much attention as it is considered a secondary accessory. Most of the previous studies related to this have analyzed from the aspect of clothing history, so there is a lack of future-oriented research that analyzes the current consumption of it and suggests directions for revitalization. This study aims to analyze the types and characteristics of Korean traditional shoes products currently sold online, figure out the problems to seek ways to improve them.

Literature Review

Most of the studies on traditional Korean shoes have focused on the Joseon Dynasty, where there is a large amount of ancient documents and relics. In the 2000s, the field of researches expanded to various topics. The database of traditional shoe was established, and fashion products were developed based on it. The product sales and wearing behavior were also investigated. According to Hwang et al. (2011), traditional shoes product types were mainly the Kkotsin for female, and the Taesahye for male. The Kkotsin is a women's traditional shoes decorated with flower patterns, and the Taesahye is a men's traditional shoes with a line patterned detail. The material was artificial leather or silk, and the price was mostly low. The purpose of purchasing was to be worn with hanbok on special occasions such as weddings, art performances, and studio wedding photos, so they were mainly sold together with hanbok. Consumers regarded it as a valuable traditional culture, but the wearing experience and purchase rate is low, and there was a general lack of consumer interest (Hwang et al., 2011). Traditional shoes products have the problem of being monotonous in design and material, and lacking practicality for everyday wear (Park & Cha, 2009). Consumers wear them to complement their hanbok rather than for their own beauty, and reluctant to wear them because they do not match their fashion style and are uncomfortable for activities (Hwang et al., 2011).

Research Method

This study used the keyword search function of 'Naver Shopping' to select the research subjects. Traditional shoe shopping malls ranked high in terms of number of reviews, ratings, and sales volume was selected, and a total of nine were adopted: 'Ijehanbok', 'Limemomo', 'Hwahonghanbok', 'Nangjahanbok', 'Chunaeng', 'Theyehanbok', 'Yebokdotcom', 'Ggoggozihanbok', and 'Seoyeonhanbok'. The product information such as image, material, specification, color, price, and country of manufacture was collected and documented. The total number of consumer reviews was 3,735, and it was crawled using Python3.4 for content analysis. Data mining was performed using Textom to analyze word frequency, word cloud, and network, and CONCOR analysis was performed using Ucinet 6.

Results & Discussion

Types and Characteristics of Traditional Shoes

There were 5 shopping malls in which shoes were classified as an independent product category, and the rest arranged footwear mixed with accessories. In all shopping malls, shoe products were not classified by type, and only three shopping malls segregated by gender. The total number of products posted was 385, and 339 for women and 46 for men. The number of products posted by shopping mall varied from a minimum of 3 to a maximum of 145. Because if the same product was reposed as a different image or classified as a separate product according to the option of colorway or heel height, the number of posted

products increased. In fact, there were from 3 to 15 types of products with different designs. Most of the products were variations on a similar last form with different material, color, and embroidery details, so there was a very narrow selection of designs. The materials were faux leather, polyester satin or brocade, and some rubber. In terms of design types, women's shoes were solid, color combination, point embroidery, and full embroidery types, and men's shoes were solid, color combination types. The women's color combination type was a design with color fabrics on the toe and piping, while the men's designs were decorated with colorful pattern of Taesahwa. The products of all shopping malls were overlapped with the same design, and there were slight differences in prices. The product names were inaccurate and long. For example, the product named as "Kkotshin" was not flower shoes design, and product names were usually a combination of design, color, heel height, and promotional words.

Consumer Review Analysis of Traditional Shoes

As a result of frequency analysis, words related to shoe size such as 'the width of the foot is appropriate', 'it's a regular size', 'it's bigger than I thought' and 'size' appeared more frequently. Looking at the contents of the review in detail, opinions that regular-sized products were larger or smaller for each consumer were inconsistent, and there were many inquiries about exchange or return related to size. 'Buseon' was also included as a high-frequency word, which made it more difficult to choose the correct size because traditional shoes were often worn with the Buseon which is a traditional socks with generous size.

Words about wearing feel such as 'very comfortable' and 'uncomfortable' were also frequent, and not only the size but also the discomfort caused by hardness, slipperiness, and toe pain were confirmed in the specific review contents. The words of high co-occurrence frequency were 'regular size' with 'appropriate foot width' and 'narrow foot width', 'very comfortable' with 'regular size' and 'larger than expected', and 'uncomfortable' with 'regular size' and 'larger than expected'. In other words, the foot width was mentioned alongside the size, and a slightly large size could be experienced as either comfortable or uncomfortable depending on the consumer. The CONCOR analysis resulted in four groups: Group A included 'regular size', 'very comfortable', 'uncomfortable', Group B included 'bigger than expected', 'wide foot width', Group C included 'Buseon', 'one size bigger', 'socks', 'exchange', and Group D included 'regular size', 'narrow foot width'. Therefore, it can be inferred that size and comfort are frequently mentioned together, and that exchange issues may often appear when purchasing a larger size to wear with Burseon or socks.

Conclusion

In order to improve the ease of purchase of traditional shoe products in online shopping malls, it was necessary to systematically classify products with accurate item names and numbers, and product differentiation and diversification were required to broaden consumer choices. In particular, size standardization was urgent as consumers were inconvenienced in selecting product sizes. It would be necessary to accurately check the foot length and width of products. In addition, the thickness and stiffness of the outer shell, insole, and outsole material should be considered to solve the comfort problem, and the basic shape of the last that lifted front toe up should be checked to compare the shape of the foot when worn.

References

Whang, C. S., Park, E. H., Byun, H. H., Shu, J. H., & Han, N. R. (2011). College Students' wear status and perception of the Korean traditional shoes. *Journal of Korean Traditional Costume, 14(3),* 65-75.

Park, H. R. & Cha, E. J. (2009). Development of fashion shoes with Korean image as cultural goods by using Korea traditional shoes. *Journal of the Korea Fashion & Costume Design Association, 11(2),* 90-115.

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HOW CLASSICAL MUSIC CAN INSPIRE FASHION DESIGN CREATION

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Introduction

Creativity is a complex process of processing information within a given framework, or conceptual space, and is a cultural and social experience that includes education, family expectations, and sociocultural forces (Csikszentmihalyi, 1998). Thus, creativity can be seen as a more fundamental level of creative thinking, or the ability to think, hypothesize, or "play" at the boundaries of the senses by engaging in high-risk processes that challenge the rules that underpin the coherence of the space itself, and design work that utilizes multiple senses can further stimulate creative thinking. In fashion design education, students need to experience the convergence of different disciplines through creative design and emotional touch that can be effectively applied to enhance their creativity. The attention demanded by design also requires other mental processes such as memory, thinking, and feeling, so designers can invent themselves by paying attention to their important memories, thoughts, and feelings (Lee & DeLong, 2016). Therefore, the purpose of this study is to analyze the process by which design majors expand their ideas through visual and auditory materials and how they approach design based on visual and auditory materials. The research objectives of this study are, first, to analyze the process by which form is transformed through images and sound is embodied in images, and to analyze how integrated thinking in space and time affects the expression of creativity. Second, we aim to explore the process of creative thinking by analyzing in detail how spatial image materials and temporal music interact with each other and affect the process of implementing new ideas.

Literature Review

Gardner (2008) argued that when educators apply multiple intelligences theory to the design of learning environments, they improve their ability to engage students, dispel misconceptions, and build stronger, more flexible understandings. He argued that when educators apply the theory of multiple intelligences to the design of learning environments, they improve their ability to engage students, clear up misconceptions, and build more solid and flexible understandings (Gardner, 2008). The key to enhancing creativity is to enhance synesthetic competence, which involves strategies for combining different senses in the human perceptual system. Images are the same whether we see them with our eyes or hear them with our ears, and vision has no concept of time and presupposes space. Hearing, on the other hand, is spatial. Auditory stimulation through music stimulates the brain's neural networks in a more abstract way, encouraging us to access our own experiences. This happens as the human brain analyzes the different information coming in from the eyes and ears, so the eye must acquire the concept of time to understand the ear, and the ear must form the concept of space to understand the eye. Sight and hearing have different processing times, and visual and auditory information from the sensory organs require the brain to analyze different information, leading to more expansive thinking.

Research Method

This study conducted that convergence design talent is conducted for students majoring in basic fashion design courses through creative thinking through contemporary classical music. During the 3 months period, 60 fashion design students participated. The visual materials targeted in the experimental study are image-related publication magazines such as design, art, and architecture including fashion. The auditory materials are two pieces of contemporary classical music (songs without lyrics) created based on a specific concept and music that can develop the concept through image research, A Danse de lumiere and Dia de Muertos by composer Saeam Kim. The music selected was chosen so that the lyrics do not create a barrier to thought and do not interfere with brain activity. Through the process of experiencing the concept development through contemporary classical music created based on a specific concept and image

research, we explored and analyzed how auditory and visual materials affect idea expansion and design development.

Results & Discussion

This study was conducted to explore the effective design ideation process using visual and auditory stimuli for students majoring in the basic course of fashion design. For this purpose, 60 fashion design students were taught the design process using visual stimuli (magazines) and auditory stimuli (contemporary creative classical music) for three months. The results showed that the auditory (L) stimulus was more effective than the visual (S) stimulus in setting a topic (L: 72.9%, S: 69.2%), research process (L: 76.3%, S: 62.7%), converting conceptual images into fashion designs (L: 69.5%, S: 62.1%), and developing a collection (L: 76.3%, S: 72.9%). The largest difference was in the transition from concept image to fashion design, with a difference of 7.4%, indicating that music was a more effective tool than magazines. Visual stimuli were more effective than auditory stimuli in the process of expanding the design (L: 75.9%, S: 79.6%). "Using both visual and auditory senses allowed me to think more broadly," students said. "Using a mix of magazines and music allowed me to pick out a collection of images and themes and develop a design. I don't think I would have been able to think, imagine, and design as much if I had only used one or the other." Echoing this sentiment, participants overwhelmingly (83.3%) agreed that the combination of visual and auditory stimuli was effective for design ideation and design development. This shows that convergent thinking utilizing visual and auditory stimuli can induce effective learning in the process of developing creative fashion design. These results may provide a new turning point in the concept of visual arts, which has been focused on spatial thinking in fashion design education. It also shows that the auditory ideation process, which introduces temporality into the spatial design process based on vision, can induce multisensory convergent thinking and effectively enhance students' creativity when time and space are incorporated into the creative process of design.

Conclusion

This study aims to apply the process of creative idea expansion and design approach of fashion design majors by setting the same theme of fusing fashion and music. For this purpose, first, the production process of classical contemporary music (A Danse de lumiere, Dia de Muertos) created based on the theme of 'light' and the creative process of fashion design majors were conducted simultaneously to provide the same concept to the visual and auditory stimuli and to experience a convergent design environment through visual and auditory. After being introduced to the process of composing music through the composer of the thematic creative classical contemporary music and experiencing the process of developing it into a specific fashion design while complementing the research process that was previously conducted by recognizing only common themes, the results of the evaluation of the achievement of how creative classical music based on the concept affects the creative activities of fashion design majors are as follows.

References

Csikszentmihalyi, M. (1998). Implications of a systems perspective for the study of creativity. In R. J. Sternberg (Ed.), Handbook of creativity (pp. 313−336). Cambridge: Cambridge University Press.

Gardner, H. E. (2008). *Multiple intelligences: New horizons in theory and practice*. NY: Basic books.

Lee, Y. K., & DeLong, M. (2016). Improving Creative Design Skills-The Effects of Past Experience on Apparel Design Education. *Journal of the Korean Society of Clothing and Textiles*, *40*(2), 397-408.

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MAKER OF FACE INLAID GLASS BEAD AND TRADITIONAL CLOTHING WEARING NECKLACES

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Introduction

In 1973, the world's most beautiful glass bead, measuring 1.8 centimeters in diameter, was unearthed in the presumed tomb of King Michu in Hwangnam-dong, Gyeongju. The small glass bead is delicately inlaid with four human faces, six birds, and four flowering trees. The inlaid glass balls, which are both technical and artistic, are believed to have been made by craftsmen in the western region (Yumizu, 2019). Although there are various interpretations of the design of the inlaid glass beads, the absence of a headdress can be explained by the ancient Han people who wore robes. In addition, the six birds and four flowering trees can be seen as white chickens and trees in the eponymous birth story of ancient Korea, which means that there is a possibility that the inlaid glass beads were made in ancient Korea. However, due to the excellence of Inmyeon glass beads, speculation prevails that they were introduced from abroad (national Research Institute of Cultural Heritage, 2019). Therefore, this study aims to explore the cultural symbolism and design of face-inlaid glass beads, which has not been covered in previous studies. In addition to the significance of glass and necklaces to ancient Koreans, we also want to confirm that face-inlaid glass beads were made in Silla with the technology of the time.

Fig. 1. Face Inlaid Glass Beads
Reprinted from Face Inlaid Glass Beads. emuseum. go.kr

Literature Review

The patterns on inlaid glass beads have been analysed in previous studies. Because the faces in the beads are white and have round eyes, they have been studied to the exclusion of Korea, such as the Northern race (Jin, 2014) or the Roman emperor or empress (Yumizu, 2019).

Research Method

In order to verify that the face inlaid glass beads were made in Korea, research was conducted through various methods. A comprehensive study of literature and artefacts was conducted, and a visit to the Gyeongju National Museum of Art was made to observe the inlaid glass beads in person and sketch all the elements of the inlaid statues, white birds, and flowering trees to analyse their characteristic elements. Based on this analysis, the symbolism of the pattern was examined, and the meaning of the beads in ancient Korea and other ancient texts related to the necklace were examined. We examined the high level of technology in ancient Korea by referring to domestic and foreign glass-related papers and reports. The relationship between the Maritime Silk Road and the level of maritime technology was investigated by examining glass artefacts excavated in Korea and glass artefacts from neighbouring countries with which Korea had exchanges in the past.

Results & Discussion

The white colour of the four faces of the beads is not convincing from previous studies, as the birds and flowering trees are also represented in white. Furthermore, the white colour used in the inlaid glass beads is a natural colour, as white was considered sacred by believers in ancient Korea. Also, the sangtu and gold crown, which were not mentioned in previous studies, can be explained by traditional elements of ancient Korea. The six birds appear to be ducks or chickens, and bird figures were often used in ancient Korea for religious significance (Cheon, 2011). In addition, early Silla was referred to as the 'country of chickens', and the Sillaites worshipped chickens as gods (Lim, 2007). If we look at the design elements of Silla gold crowns, we find that they are heavily decorated with birds. This is related to Silla's fertility mythology (Lim, 2007). The flowering tree branches symmetrically from a central trunk and flowers bloom at its ends. The same form of flowering tree can be found in many Silla artefacts, including Geumdonggwan and Jeongchangwon (Choi, 1993). However, it is difficult to find similar floral patterns in neighbouring countries. We can also see that the ancient Korea valued beads and that they were not just ornaments but had special symbolism. Beads seem to have originated in the Neolithic period, as evidenced by the stone beads in the Hongsan jade artefacts, and in the early Gojoseon Dynasty, glassmaking developed and produced a wide variety of beads. The origins of beads are very ancient and they were considered sacred and were made from a variety of materials and worn on the body. Mahan writes that 'gold, silver, Geum and Kye were not prized, only beads were prized and were attached to clothes to decorate them and worn around the neck or ears', suggesting that beads were made and worn as necklaces. Gojoseon's ironmaking technology was world-class, and Silla inherited it, producing a wide variety of glass beads from slag, as evidenced by glass moulds and bronze and iron artefacts excavated throughout the country. There is also the fact that the Silla general work had a factory in Japan. And the precision of the metal inlay technique must have created a favourable environment for the production of inlaid glass beads. Glass artefacts from neighbouring countries are often similar to glass beads excavated in Korea, suggesting that glass beads may have been made in India and Southeast Asia. However, the rapid development of Southeast Asia along the maritime Silk Road and the establishment of states after the 7th and 8th centuries suggests that the technology and environmental conditions were not sufficient. Silla's shipbuilding and seafaring skills, which were the basis for exchanges with neighbouring countries, were at their highest level by the 9th century (Cheong, 2014). Based on these merchant skills, Silla's Jangbogo dominated the maritime trade in East Asia.

Conclusion

This study examines Silla inlaid glass beads from the perspective of their design and cultural elements. First, the protagonist of the inlaid glass beads wears a unique Korean sangtu and gold crown, and the white chicken and flowering tree, which were revered by the Silla, are delicately depicted, suggesting that the beads were produced for the purpose of strengthening royal authority. Second, the ancient Korean people used a variety of materials to make beads, suggesting that they were important both religiously and politically. Third, ancient Korea had excellent bronze and iron technology, and glass artifacts found throughout the country suggest that glass beads should be studied through an interdisciplinary analysis rather than as an import from other regions. Fourth, glass beads from neighboring countries are inferior in terms of artistry and technology. Based on the maritime capabilities of the time, it is quite possible that they were produced in Silla and exchanged with neighboring countries. We hope that the results of the inlaid glass beads will open a new chapter in the study of the cultural history of ancient glass beads in Korea.

References

Cheon, J. G. (2011). Study on the Regional SymbolicAnimals. *The Studies of Korean Literature*, 0(32), 197-220.

Cheong, S.I. (2014). *The cyclopedia of Sea Silk Road*, Changbi.

Choi, J. S. (1993). Contents and Characteristics of Shōso-inTreasures. *KOREAN JOURNAL OF ART HISTORY*(Formerly Art and Archaeology), 5-19.

Lee, D. & Kim, B. (2006). *Gojoseon was the ruler of thecontinent*, Wisdomhouse.

Lim, J. H. (2007). A Recognition Identity ofKimAlzi Myth and Silla Culture by Means of Contextual Interpretation. *Asian CompaarativeFolklore*, 0(33), 575-621.

National Research Institute of Cultural Heritage. (2019). *The world of ancient glass*.

Jin, B. C. (2014, March 20). Jung Hyeong-jin's History Walk (Episode11)-The Secret of the Glass Beads. *GBN*. Retrieved from http://m.egbn.kr/view.php?idx=44979, 2014,March 20.

Yumizu, T., *Roman culture blossomed in Silla, Seoul:Misewoom*, (Y. S. Lee, Trans). Original work published 2019.

象嵌琉璃玉 [photograph]. Emeuseum.

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PROANA IN THE MEDIA FROM THE PERSPECTIVE OF JEAN BAUDRILLARD'S CONSUMER SOCIETY THEORY

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Introduction

In Korean society, appearance carries significant weight, and women's bodies are frequently highlighted in the consumer market and mass media as commodities with investment value. As a result, it becomes evident that managing one's body is not merely a choice but a necessity. According to Baudrillard's theory, in consumer society, the most prominent object of consumption is the human body perceived as an individual's consumption activity with a capitalist nature (Hur & Lim, 2011). Modern individuals in Korean society are heavily exposed to the media, and the emphasis on slim bodies in the media significantly influences women's ideal body images, potentially leading to an idealization of excessively thin bodies and in turn, contributing to eating disorders (Han, 2000).

The rapid increase in such eating disorders is influenced by a subculture known as proana, which promotes excessive dieting and the pursuit of a thin body (Wilson et al., 2006). 'Proana' is a shortened form of the compound word 'proanorexia' which implies support for anorexia, an eating disorder. Proana refers to individuals who perceive and practice fasting as a way of life rather than a disease. In Korea, they are perceived as 'individuals who advocate anorexia' (Ryu et al., 2021). They share their experiences of fasting and other behaviors, take pictures of their bodies, and seek validation by verifying if they fit the criteria of a 'true proana' (Boero & Pascoe, 2012). The proana community was formed on various sites in the past but remained underground. Recently, proana has resurfaced, predominantly on online platforms, especially on Twitter and KakaoTalk open chat rooms, where the phenomenon is well observed. They directly meet or share information necessary for proana practices, such as fasting and restrictive eating situations, through Twitter hashtags (Ryu et al., 2021).

Although the fact that these behaviors further encourage eating disorders, there is a lack of research on this phenomenon in Korea compared to other countries. The phenomenon of proana regards the body displayed through fasting and extreme dieting as an object of consumption and investment. This aligns with Jean Baudrillard's assertion that in consumer society, the human body is the most prominent object of consumption. Furthermore, in Korea, proana is particularly observed among the generation aged 10 to 20, who are highly interested in appearance management, thus prompting the need for vigilance and concrete solutions. Consequently, in this study, we aim to examine proana behaviors in Korean society from the perspective of Jean Baudrillard's theory of consumer society. We seek to contemplate the phenomenon of proana in the media and the influence of the media.

Literature Review

French postmodern theorist Jean Baudrillard (1970) coined the term 'consumer society' to describe contemporary society, introducing a sociological analysis of consumption different from the economic concept of consumption defined in economics (Hur & Lim, 2011). Furthermore, Baudrillard identifies the core of postmodernism as the 'society of simulation', asserting that 'media' and 'the masses' constitute society (Kim, 2000). In a situation where production is dominated by the logic of consumption, mass media highlight symbolic values and stimulate consumption. Thus, what people desire becomes not the produced goods but the symbolic values created by advertising in the media (Lim, 2008). In the modern consumer society, the human body, a representative possession of individuals, is easily consumed in both media and daily life, with the management and control of an individual's body being recognized as a consumption asset (Kim & Ha, 2018). Hur and Lim (2011) examined the culture of shaping the bodies of young men

during their youth from the perspective of consumer society theory, categorizing it into two types. This research shows that the importance of the body in modern society is increasing, and the public desires the 'visible body' portrayed in the media. Body shaping occurs through the gaze and language of others, and interaction amplifies the need and desire for the body to be seen, leading to the classification of this phenomenon as 'body-making under the domination of the gaze'. Additionally, the form of the body is analyzed as 'body-making as self-reflection', where the body's shape is recognized as an individual's ability. This aligns with Baudrillard's assertion that in a consumer society, an individual's body must be taken responsibility for and managed by oneself. Furthermore, the phenomenon of the commodification of the body, constantly consumed and managed by people in modern society, is said to have become an important object of the production system that expands and maintains the consumer capitalist system. This is categorized as 'making the body as a production system'.

Research Method

According to previous studies, the proana phenomenon is reported to be increasing among teenage to young adult females, particularly evident online. We selected social media platforms as its analytical focus, considering them as modern major media. Among these platforms, Instagram, YouTube, and Twitter were chosen as the primary targets for collecting proana cases. However, Instagram's search for the keyword 'proana' resulted in self-filtering of posts. On YouTube, only documentary videos discussing the seriousness of proana or recovery content were found, with no personal activity content discovered. It is suggested that proana individuals tend to maintain anonymity and engage primarily in clandestine activities within niche communities. We referenced previous research indicating that the proana phenomenon, particularly, fosters communication and encourages disordered eating behavior through its own language on Twitter among various social media platforms. Ultimately, we selected Twitter as the sole data collection medium for this study. We searched for the keyword 'proana' on Twitter, sorted by popularity, and collected a total of 80 posts containing content related to proana from December 1, 2023 to March 8, 2024. The selection criteria for the posts were based on the judgment that they could help understand the behavioral characteristics of proana individuals. Posts that were not related to the activities of proana individuals were excluded.

Results & Discussion

The research results could be categorized into two types: 'Proana behavior under the domination of the gaze' and 'Proana behavior based on individual identity', adopting the classification criteria of Hur and Lim (2011).

1. Proana behavior under the domination of the gaze

It revealed that the body image presented in consumer society is being displayed and governed by the standards of the ideal body prevalent in Korean society. On Twitter, proana individuals were observed engaging in practical actions for the 'visible body', intensifying the desire for thinness. In particular, hashtags related to finding companions for engaging in proana behavior together on Twitter were being shared. Additionally, hashtags soliciting individuals interested in tightening their waist together were observed, encouraging co-participation in disordered eating behaviors. Furthermore, exchanges of various information, such as inducing vomiting or purging after eating, were observed as part of engaging in disordered eating behaviors.

2. Proana behavior based on individual identity

Proana behaviors are influenced by individual identity. They manifest in two main ways: as self-reflection actions and as actions within a product system. Initially, the exploration of 'Proana behavior as self-reflection' reveals that a majority of proana individuals considered managing their bodies as a crucial element in shaping their self-identity. They believed disordered eating conveyed meticulous self-management and diligent living through restraint and control. Especially, they found self-satisfaction in having a thin body and experienced a sense of fulfillment and achievement through disordered eating behaviors. They regarded this as a form of 'gat-saeng' a term denoting a perfect or ideal lifestyle, with

concurrently defined Korean criteria for this standard. Evaluation criteria for the body are becoming increasingly sophisticated, and among proana individuals, efforts were observed in adhering to these social norms with a compulsion to do so. The results of the study on 'Proana behavior as a production system' revealed that proanas were engaging in extreme dietary restrictions to meet specific aesthetic criteria portrayed in the media. These criteria include specific body measurements such as 'ki-ppae-mom', which is considered the most ideal when the difference between height and weight reaches 120, according to Korean society. Furthermore, efforts were observed to conform to culturally established norms, such as aesthetically refined standards prevalent in Korean society, including 'average female wrist circumference' and 'average female body fat percentage'. This reflects an attempt to meet culturally entrenched norms represented by the term 'average'.

Conclusion

In this study, we aimed to examine the phenomenon of proana in Korea from the perspective of Jean Baudrillard's theory of consumer society, as represented in the media. We conducted an analysis of the behavioral patterns of proana on Twitter. Summarizing the results, It was evident that they were encouraging each other towards disordered eating behaviors through mutual interaction. Furthermore, they were experiencing a sense of achievement and satisfaction through these behaviors, and were striving to conform to the increasingly refined standards of beauty in Korean society. The standards of the ideal body, as perceived in the media, were increasingly associated with thinness. The influence of the thin body image was powerful, acting as a preference and causing negative consequences. In this study, we sought to examine the influence of the media on the phenomenon of proana from the perspective of body image consumption. Additionally, we aimed to provide directions for establishing a proper value system regarding body image. A limitation of this study is the difficulty in obtaining diverse and in-depth data due to the nature of proana individuals predominantly engaging in activities in obscure online spaces while concealing their identities. In future research, it is suggested that in-depth studies be conducted not only on body image but also on the fashion styles and fashion consumption patterns of proana individuals.

References

Boero, N., & Pascoe, C. J. (2012). Pro-anorexia communities and online interaction-bringing the pro-ana body online-. *Body & Society*, *18*(2), 27-57.

Hur, J. M., & Lim, S. W. (2011). Korean male youth's body-making culture in the perspective of Jean Baudrillard's consumer society theory. *The Korean Journal of Physical Education, 50*(3), 155-164.

Han, M. J. (2000). A study on the effects of proccessings of thin promoting TV messages on college females' body satisfaction and dieting behaviors. *Korean Journal of Broadcasting and Telecommunication Studies, 14*(3), 291-317.

Kim, G. H., & Ha, J. S. (2018). Korean tattoo from the perspective of Jean Baudrillard's consumer theory. *The Research Journal of the Costume Culture, 26*(4), 485-502.

Kim, T. K. (2000). A study on the information society of Baudrillard's theory and designer's thinking. *Archives of Design Research*, 11-21.

Lim, J. Y. (2008). *A study on the stimulation theory of Jean Baudrillard* [Unpublished Master's thesis]. University of Ewha Women University.

Rye, J. H., Cho, Y. H., & Won, Y. J. (2021). Prana-disturbance of body politics-. *Media, Gender & Culture, 36*(4), 5-59, 10.38196/mgc.2021.12.36.4.5

Wilson, J. L., Peebles, R., Hardy, K. K., & Litt, I. F. (2006). Surfing for thinness-a pilot study of pro–eating disorder web site usage in adolescents with eating disorders-. *Pediatrics*, *118*(6), e1635-e1643.

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CHARACTERISTICS OF THE GENDER FLUID FASHION ON INSTAGRAM

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Introduction

Recently, the fashion industry has been presenting designs that break down the boundaries between traditional male and female identities, embracing a new concept of gender fluidity. Global luxury brands such as 'Gucci', 'Balenciaga' and 'Givenchy' have conducted gender-inclusive collections, reflecting the phenomenon of gender fluidity (Allaire, 2022). This perspective, which embraces gender and respects diversity, is not only evident in global fashion collections but is also gaining popularity in the Korean fashion industry. Consequently, this study explores the concept and history of gender fluid fashion to derive its characteristics. Additionally, the study aims to conduct research by observing social media to observe gender fluid fashion worn in everyday life, rather than formal fashion imagery such as fashion collection images, unlike previous studies. Among these, the study will collect and analyze instances of gender fluid fashion appearing on Instagram, which is suitable for fashion image posting due to its intuitive information exchange through images and hashtag functionality (Choi et al., 2017), in order to classify the types of gender fluid fashion and examine the characteristics of each type.

Literature Review

The concept to be explored in this paper, gender fluid, is a type of queer identity and falls under non-binary gender. Gender fluid refers to individuals whose gender identity is not fixed but flexible and can change, allowing them to move from one gender identity to another based on environmental or emotional factors (Kim, 2021). Diverse perceptions of gender identity have been widely accepted, leading to the gradual mainstreaming of a flexible gender perspective. This trend extends beyond popular culture, reaching various domains such as the fashion and beauty industries as well as society as a whole (Kim, 2021). Particularly noteworthy is the widespread adoption of gender fluid fashion in various fashion brands today, with collections themed around gender fluidity. Numerous previous studies have examined the characteristics of gender fluid fashion, focused on its unique features. Kim (2021), who researched gender fluid fashion designs manifested through epistemes, categorized the characteristics of gender fluid fashion into heterogeneous combinations, positive expressions of sexuality, and playful expansions. Additionally, Lee and Um (2023), focusing on gender fluid features expressed in contemporary knit fashion, classified the formative characteristics of gender fluid fashion into six categories: deconstruction, compromise, sensuality, playfulness, exaggeration, and femininity. Beyer (2023), who conducted a study analyzing JW Anderson's antigender fashion to integrate non-binary fashion into contemporary fashion design, classified gender fluidity as rebuilding male femininity, out of proportion, and playfulness. Im (2018) analyzed gender fluid expressive characteristics in feminism-themed fashion collections, categorizing features as direct representation using lettering, performance expression, the combination of men's and women's collections, and the representation of diversity and body positivity. Building on these previous studies, the current research categorizes the expressive characteristics of gender fluid fashion on Instagram into fashion images and videos, and hashtags for examination.

Research Method

The characteristics of Instagram as a fashion medium and the concept of gender fluidity along with the expansion of gender identity were examined through international previous studies. Subsequently, case images for the analysis of the expressive characteristics of gender fluid fashion were selected through keyword searches on Instagram. The data were collected from Instagram users' gender-fluid-related posts from 2021 to 2023 and categorized for analysis. The search terms used on Instagram were derived from

previous studies on gender fluid fashion and information collected from Korean fashion magazines. The collected information predominantly focused on items representing gender fluid fashion, and these were used as hashtags in Instagram searches, such as 'gender fluid,' 'genderless,' 'gender neutral,' and similar expressions. As a result, a total of 426 images, including commercial fashion-related content, were collected and utilized for analysis. Furthermore, this study, inspired by the notion that gender fluid fashion is not constrained by the wearer's gender, included both male and female photos as subjects for analysis.

Results & Discussion

Through a review of previous studies, the expressive characteristics of gender fluid fashion styles posted on Instagram from 2021 to 2023 are categorized into two main types: fashion images and videos, and hashtags. Firstly, the type of fashion images and videos includes Instagram users combining various fashion items to create their own gender fluid fashion, which is then shared in the form of photos or videos less than 90 seconds. This category encompasses content such as OOTD (outfit of the day), street photos, styling introductions, and fashion films. Within this type, three representative gender fluid fashion styles are identified. The most prevalent style observed through Instagram data collection emphasizes a vibrant and sexual mood, incorporating a diverse range of items and fabrics, particularly showcasing body-conscious fashion items. Additionally, there is a trend of pairing skirts with masculine items such as suits or jackets, revealing the frequent use of lightweight skirts to express femininity and suits to convey masculinity in gender fluid fashion. Lastly, there emerge styles that distort and transform the conventional structure of clothing to create new forms, often seeking unexpected and playful outcomes. Characteristics of these styles include imbalances in materials, silhouette distortions, and excessive embellishments. Items utilized in these styles include puff sleeves, oversized coats, power-shoulder jackets, and detailing like strings. Secondly, the hashtag type involves Instagram users sharing gender fluid fashion using the hashtag function, often accompanied by tags like 'clothing has no gender', 'makeup is for everyone', 'men can wear skirts too', and 'dresses are for everyone'. The use of hashtags reflects an activism characteristic of Instagram, with individuals conveying messages of inclusivity for various genders and challenging traditional gender role norms through gender fluid fashion activism.

Conclusion

The characteristics of gender fluid fashion posts examined through Instagram were classified into two main categories: fashion images and videos, and hashtags. Despite not restricting the gender scope of the research subjects, it was observed that the majority of gender fluid fashion wearers on Instagram are males. This can be attributed to the perception that females wearing a mix of traditional masculinity and femininity in fashion styles are considered to be in casual attire. On the other hand, for males, combining both masculine and feminine fashion styles is perceived as belonging to a new realm known as gender fluid fashion rather than daily fashion. This study, by examining the types and expressive characteristics of gender fluid fashion through social media, particularly Instagram, holds academic significance in understanding how types and trends of gender fluid fashion are embraced and disseminated on social media platforms.

References

Allaire, C. (2022, August 15). Intimates are the latest area of fashion to go genderless. *Vogue*. https://www.vogue.com/article/genderless-intimates-lingerie-brands

Beyer, J. (2023). Antigender fashion: JW Anderson and gender-fluid fashion. *ZoneModa Journal. 13*(1), 1-18. https://doi.org/10.6092/issn.2611-0563/17079

Choi, I., Lee, M., & Kim, E. (2017). A study on the formative characteristics of Hanbok in SNS proof shot -Focused on the women's Hanbok-. *Journal of the Korean Society of Costume, 67*(3), 15-30. https://doi.org/10.7233/jksc.2017.67.3.015

Im, M.-J. (2018). Gender-fluid images expressed in the contemporary fashion collection with the theme of feminism. *Journal of Korea Fashion & Costume Design Association, 20*(3), 63-78.

https://doi.org/10.30751/kfcda.2018.20.3.63

Kim, B.-R. (2021). *A study on gender fluid fashion design as an episteme* [Unpublished master's thesis]. Dongduk Women University.

Lee, Y., & Um, S. (2023). A study on the characteristics of gender fluidity expressed in modern knit fashion. *The Research Journal of the Costume Culture, 31*(1), 91-106. https://doi.org/10.29049/rjcc.2023.31.1.91

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TRANSVESTISM AND GENDER EXPRESSION: CHARACTERISTICS OF THE 21st CENTURY MALE CROSS-DRESSING

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Introduction

This study is based on the 21st-century male fashion evolution towards inclusivity, particularly focusing on the global trend of ungendered fashion as outlined by Menkes (2018) and the socio-cultural influences on male attire and self-expression highlighted by Singh (2023). Amidst growing awareness of gender-neutral fashion and the acceptance of female cross-dressing, male cross-dressing remains as a subject of controversy and discussion. The purpose of this research is to offer a detailed analysis of the characteristics and culture of male cross-dressing in the 21st century, enhancing understanding of its fashion features and cultural significance. By doing so, it seeks to contribute scholarly insights into gender diversity and the pivotal role of the fashion industry in driving societal change, thereby addressing a gap in current understanding and acceptance of male cross-dressing culture.

Literature Review

Transvestism, highlights the adoption of cross-gender attire without changing biological sex, indicating a pursuit of psychological satisfaction different from a transgender (Hirschfeld,1910). This practice, enriched by Ekins (2013) and further analyzed by Steele and Major (2023), underscores individual expressions of gender fluidity and societal challenges. Central to the discourse on cross-dressing is the Drag Queen phenomenon, which encapsulates gender exaggeration and often includes performative elements. Historically rooted in the Shakespearean era, where males first assumed female roles on stage, Drag Queens have become emblematic figures within the LGBTIQ+ culture. They epitomize the performative aspect of transvestism, using exaggerated aesthetics to question and redefine traditional gender roles. The cultural significance of Drag Queens has surged with the popularity of "RuPaul's Drag Race," bringing drag culture into mainstream acceptance. Clothing, as a medium of gender expression, elaborates on the intricate relationship between attire and identity, offering insights into the evolving dialogue on gender in society. This integration of drag artistry and the symbolism of clothing speaks to the deep sociocultural implications of gender differences, reflecting both personal self-identification and societal expectations and restrictions on gender roles, thereby showcasing the diversity and fluidity of gender expression.

Research Method

This study conducted in-depth interviews to explore the characteristics of male cross-dressing in the 21st century, employing MAXQDA for qualitative data analysis of audio recordings. Two male cross- dressers were interviewed once each, with sessions lasting 40-60 minutes. The main interview questions were as follows: 1. Happiness while cross-dressing (if not, reasons for cross-dressing) 2. Frequency/opportunities of cross-dressing 3. Definition of personal style (differences when cross- dressing vs. not) 4. Most important elements during cross-dressing (costume design, material, style, specific colors) 5. Aspects given most attention (makeup, costume design, accessory matching, wig selection) 6. Preferred locations for cross-dressing (bars/clubs) 7. Influencing factors on cross-dressing style(drag shows, punk culture, Y2K culture) 8. Essential elements for cross-dressing (wigs, accessories, etc.). The interviews primarily focused on these eight key areas to understand the motivations and distinct characteristics of their cross-dressing practices.

Results & Discussion

Through the interviews, it was discovered that cross-dressing is not merely a physical transformation but an artistic form involving a process of inner expression and holistic self-construction. The participants unanimously stated that engaging in cross-dressing activities brought them happiness, emphasizing that "no one would cross-dress if they did not find joy in it." They elaborated on cross-dressing as a multifaceted form of self-expression, enabling individuals to liberally present themselves within various socio-cultural landscapes. When asked about their reasons for cross-dressing, both interviewees reflected on the desire to "showcase their authentic selves."

Table 1 illustrated the various clothing elements utilized by the two interviewees in their cross-dressing practices. The interview content revealed that both interviewees emphasized the significance of "wigs" as the core element of their cross-dressing, stating that "wigs are the soul of a drag queen," which underscored their importance for transformation and self-expression. Their styles were characterized by an emphasis on exaggerated feminine features as displayed in Figure 1 and 2. Interviewee 1 accentuated feminine features through clothing, makeup, and body adornments, utilizing key elements such as wigs, breast and hip pads, and fitted outfits. By combining personal preferences and performance requirements, Interviewee 1 created an exaggerated and artistic overall feminine cross-dressing style that expressed individuality and cultural identity, exemplifying a modern form of drag artistry. Interviewee 2's style was influenced by American horror and punk aesthetics, exhibiting a stark contrast between the everyday attire and cross-dressing ensembles. While prioritizing comfort and paying little attention to fashion in both interviewees' daily wear, they demonstrated a keen eye for cohesion in clothing and accessories during cross-dressing occasions. Interviewee 2 particularly favored dresses or performance costumes paired with 6 to 7-centimeter high heels, reflecting the affinity for punk and horror-themed attire.

Table 1: Interviewees' Styling Elements

Element	Interviewee 1	Interviewee 2
Personal Style	Trendy style	Horror punk style
Wig	Character completion	Essential for transformation
Color	Color coordination	Purple
Lenses	Dramatic enhancement	Dramatic enhancement
Makeup	Exaggerated western-style	Exaggerated western-style
Skirt	long skirts	bodysuits
Shoes	High heel	Heels over 6cm
Stockings	Used for shaping	Used for shaping
Nails	Exaggeration	Exaggeration

Figure 1. Photographs of Interviewee 1   Figure 2. Photographs of Interviewee 2

When asked about the catalyst for their cross-dressing, they cited "the influence of RuPaul's Drag Race" as the reason for embracing the "drag queen" identity. Their cross-dressing styles primarily aimed to accentuate feminine features, and their responses during the interviews demonstrated the profound influence of cross-dressing culture on their behaviors, highlighting the importance of cross-dressing as a means of self-expression and confidence-building. Both interviewees' narratives underscored the role of cross-dressing in shaping personal identity and cultural expression, portraying it as a profound avenue for showcasing one's authentic self.

Through the analysis of interview contents, these high-frequency words were found to reflect core concepts and themes within the drag culture. Among them are words like "Queen," "Drag," and "Wig," which embody the unique nature of drag culture. Terms such as "Character," "Freedom," and "Personalization" emphasize the essence of self-expression and individuality inherent in the act of drag. Additionally, words like "Joy," "Confidence," and "Expression" underscore the profound significance of drag in relation to the emotional and psychological aspects of its participants. Furthermore, words such as "Costume," "Makeup," and "Breasts" represent the external elements of drag, specifically the adornments and attire that contribute to the overall visual presentation. Collectively, these keywords reflect the multifaceted characteristics of drag culture, encompassing elements of role-playing, self-expression, individuality, emotional experiences, and stylistic elements. They provide us with a comprehensive perspective to understand this unique cultural phenomenon, offering insights into the various dimensions that constitute the drag experience.

Conclusion

Overall, the results of this study found the multifaceted characteristics of drag culture, encompassing elements of role-playing, self-expression, individuality, emotional experiences, and stylistic elements. They provide us with a comprehensive perspective to understand this unique cultural phenomenon, offering insights into the various dimensions that constitute the drag experience.

References

Ekins, R. (2013). *On male femaling: A grounded theory approach to cross-dressing and sex- changing.* In *Current Concepts in Transgender Identity* (pp. 181-205). Routledge.

Hirschfeld, M. (1910). *Die transvestiten: Eine untersuchung über den erotischen verkleidungstrieb mit umfangreichem kasuistischen und historischem material* [The transvestites: An investigation of the erotic drive for cross-dressing with extensive case and historical material]. Alfred Pulvermacher & Co.

Menkes, S. (2018, January 14). Gender neutrality becomes fashion reality. *Vogue UK.* Retrieved from https://www.vogue.co.uk/article/gender-neutrality-becomes-fashion-reality

Singh, S. (2023). *The rise of men's feminine fashion trend in 2023/24.* Retrieved from https://www.f-trend.com/

Steele, V., & Major, J. (2023, November 16). Fashion industry. *Encyclopedia Britannica.* Retrieved from https://www.britannica.com/art/fashion-industry

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ANALYZING FASHION EMOTION IMAGE EXPRESSION USING MIDJOURNEY: FOCUSING ON HOME WEAR EMOTIONS

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Introduction

The emergence of generative AI marks a transformative shift in the fashion industry. These AI programs, capable of instantly generating visual content from text-based instructions, are increasingly being integrated into fashion applications. LF's analysis suggests that employing generative AI like Midjourney in fashion design could lead to a reduction in costs and time by more than 500% compared to pre-adoption figures (Lee, 2023a). Although generative AI's current forte is image creation, its application in fashion design requires a deep understanding of the nuances produced by inputting various fashion-specific terminologies. Therefore, inputting specific fashion-related emotive words and items into Midjourney as prompts is crucial, analyzing the resulting images' expressive characteristics, and enhancing comprehension of fashion design terminologies suitable for Midjourney.

Literature Review

The utilization of AI in the fashion industry extends to data analysis, the creation of fashion images, and fashion design. Generative AI, such as Midjourney, can translate emotive terms into images. However, unlike ChatGPT, it does not fully grasp natural language, leading to a recommendation for more specific synonyms (Lee, 2023b). Midjourney performs optimally with detailed and explicit sentences (Jang et al., 2024). Consequently, the effectiveness of fashion designs created using Midjourney depends on selecting precise emotive terms. Fashion design is expressed through the combination of items that align with fashion emotions dictated by TPO (Time, Place, Occasion). The classification system for fashion emotions based on TPO, as proposed by Park and Choi (2020), is founded on seven categories derived from four dimensions of context: 'personal-social, everyday-extraordinary, indoor-outdoor, informal-formal' providing sub-emotive terms for each. Among these seven contexts, the emotion for home wear includes 13 sub-emotive terms, encapsulating fashion emotions suitable for comfortable and nearby outings. By applying these 13 sub-emotive terms to Midjourney prompts, indoor fashion images were generated, and the outcomes of image creation based on emotive terms were analyzed.

Research Method

Within the classification system by Park and Choi (2020), from the seven groups of everydayness, the 13 emotive words for Home-wear, corresponding to O1, were selected: Comfortable look, Cozy looking, Natural look, Naturalistic look, Primary look, Everyday look, Easy wear, Comfy look, Home wear, At-home dress look, Lightly wearable look, One-mile wear, Pajamas look. Fashion demand for 'comfort' is increasing, and this is not just a temporary trend, but reflects people's values and lifestyle (Lee, 2022). O1(Home-wear) was selected as the subject of this study because it is an emotion that has been steadily increasing in daily life areas such as indoor life as well as casual outings since the coronavirus pandemic. For item selection, cardigans (CD), jumpers (JP) as outerwear, knits (jersey, KN), and sweaters (SW) as inner layers, and skirts (SK) and pants (PT) as bottoms were chosen for their common use in comfortable, restful attire. By combining them, eight combinations were formed: CD+KN+SK, CD+KN+SK, CD+SW+SK, CD+SW+PT, JP+KN+SK, JP+KN+PT, JP+SW+SK, and JP+SW+PT. For each of the 13 emotive words, 40 images were created for each combination of 8 items, that is, 320 images for each emotive word, and a total of 4,160 images were used for analysis. Midjourny version 6.0 was used to create the image, and the prompt consisted of emotional words, model properties, item combination, human body size, camera style, location, resolution, and screen ratio. Among the prompts composed in this way, images were generated by altering only the emotive words and item combinations. Image analysis was based on the three elements of fashion

design: shape, color, and material, as well as silhouette and shape details, color and pattern, and material texture and flexibility.

Results & Discussion

As a result of analyzing the design properties of all generated images, it was observed that the predominant shape exhibited a relaxed, oversized silhouette utilizing wrinkles (99%), with colors predominantly in subdued shades (92%) of ivory, beige, and brown, showcasing variations in light and shadow. In terms of materials, there was a notable preference for the employment of comfortable, natural fabrics and solid colors (76%). These results demonstrate that the 13 emotive words, as sub-dimensions of home wear images within the fashion classification system, accurately reflect images of home wear suited for comfortable relaxation. A more detailed examination of the differences among images generated by the 13 emotive words reveals two distinct groups based on the degree of personal, everyday, indoor, and informal feelings. The first group, consisting of Comfortable look, Cozy looking, Comfy look, Home wear, At-home dress look, Pajamas look, more accurately reflects the characteristics of 'personal, everyday, indoor, informal' from the four dimensions of 'personal-social, everyday-extraordinary, indoor-outdoor, informal-formal,'. The second group, comprising Natural look, Naturalistic look, Primary look, Everyday look, Easy wear, Lightly wearable look, One-mile wear, is expressed with a emotion suitable for short, nearby outings, being 'personal, everyday, informal' yet distinct from the first group.

The error rate in item representation among the generated images was 1.2%, indicating that the items described in text were accurately depicted. A noticeable difference emerged between the cardigan-wearing group and the jumper-wearing group; outfits combined with cardigans were generated as images resembling more comfortable and unadorned home wear, predominantly using ivory, beige, and brown colors. In contrast, combinations with jumpers were more suitable for short trips outside rather than home wear, employing not only ivory, beige, and brown but also black, grey, yellow, and dark green colors. This difference is interpreted as a characteristic due to the outerwear nature of jumpers being more aligned with outdoor fashion items. Differences were also observed between pants and skirt outfits; skirts created more appropriate images for a comfortable look, whereas pants were predominantly styled in a comfortable jogger silhouette (72%).

Conclusion

The Midjourney images generated using the 13 emotive words and item combinations from the Home-wear contextual group overall exhibit similarities in silhouette, item form, and color, accurately reflecting the fundamental essence of home-wear: comfort, leisure, and an informal dress code. Upon a more detailed examination of the characteristics associated with the 13 fashion emotive words, they can be divided into two groups, suggesting a need for careful selection of fashion emotion terms when aiming for more nuanced fashion emotion segmentation. Specifically, variations in outerwear among the item combinations reveal differences in shape, color, and material. The refined expression of emotions in fashion design can be achieved by leveraging the differences in emotive words and item combinations used in Midjourney prompts, facilitating the derivation of more nuanced fashion images. Future research, incorporating additional Vest items for indoor wear or exploring item combinations for various emotive groups, is expected to propose more specific and effective prompts for fashion terminology, enhancing the expression of fashion emotions using Midjourney.

References

Jang, M., Choi, Y., Kim, D., & Min, J. (2024). *Become a generative AI expert in just one week.* Maeil Business Newspaper.

Lee, J. (2023a, September 7). The fashion industry increases the use of generative AI. *APN*. Retrieved from http://m.apparelnews.co.kr/news/news_view/?idx=207584

Lee, S. (2022, December 04). 2023 패션 트렌드는? 패션업계의 대세 키워드 '편안함' [What are the fashion trends? 'Comfort' is a popular keyword in the fashion industry]. *소비자 평가*. Retrieved from http://www.iconsumer.or.kr/news/articleView.html?idxno=25322

Lee, Y. (2023b). *Generative AI big 3*. Chackbase.

Park, N., & Choi, Y. (2020). A form attribute classification system for fashion items. *International Journal of Fashion Design, Technology and Education, 13*(1), 11–19. doi:10.1080/ 17543266.2019.1664641.

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A STUDY ON THE STEP-BY-STEP PROCESS OF FASHION DESIGN IDEATION USING MIDJOURNEY

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Introduction

The field of AI image recognition has evolved into image generation technology, offering designs that can even replicate the role of fashion designers. By 2023, the technology had advanced to the point where "AI Fashion Week" was held in New York, showcasing how current AI image generation technologies have developed through learning algorithms that understand the relationship between text and image data (Park, 2023). At the 2023 AI Fashion Week (AFW), 70% of participants utilized 'Midjourney' highlighting its prominence among various image-generation AI tools (Jung, 2023). Operating based on the Discord online community messaging service, Midjourney offers easy access and relatively free use. Images generated by Midjourney possess randomness, producing different images even with the same commands at different times (Park, 2023). This randomness in image generation is considered to offer positive approaches such as expansibility and serendipity at the idea conception stage. Focusing on the fashion design process, from setting concepts to deciding on detailed designs, this study aims to identify the usability and limitations of Midjourney at each stage and propose efficient methods for incorporating Midjourney into the fashion design process.

Literature Review

This study examines the theoretical research on the use of Midjourney in the stages of fashion design, focusing on prior studies and relevant literature. In discussing the stages of fashion design, Dejonge (as cited in Lee et al., 2024) outlines the process as problem posing, situation exploration, problem structure recognition, detailing, setting design criteria, development, and evaluation. Lamb and Kallal (as cited in Lee et al., 2024) categorize it into problem definition, initial idea stage, design refinement stage, sample development, and design evaluation stage. In previous studies, the fashion design process has been categorized into two main stages: design ideation and actual product development. In this study, the research was conducted by dividing the design ideation stage into trend determination, design ideation, and design elaboration. Midjourney is utilized based on the methodologies of creating generative AI images by Kim and Jang (2023), Midjourney usage techniques by Lee (2023b), and case analyses of Midjourney application by Lee (2023a). For the development of fashion design, inputs such as text, images, and links are used, and Midjourney's functions like imagine, describe, and vary are employed to generate images.

Research Method

The fashion design process is divided into trend determination, design ideation, and design elaboration. This study explores the pros and cons of using Midjourney for fashion design image creation in the design ideation, and design elaboration stages. Trend determination synthesized casual wear trends from '2024SS trends' searches on InStyle, Firstview Korea, and Vogue (US). The study employed Midjourney version 6.0. Midjourney basically uses text-based commands to create images, but at the ideation stage of fashion design, various results can be obtained by entering reference images or links to reference materials instead of text. Therefore, we compared the image creation results using text, images, and links in the prompt. Midjourny's image creation basically uses '/imagine,' but the 'vary' function is used to partially modify the created image, and '/describe' is used to input images and links to apply shape and material. During the design ideation stage, the emphasis was on variations in prompt input content. In the design elaboration stage, adjustments in both prompt input content and methods, along with the utilization of Midjourney's diverse functions, were employed to scrutinize the image creation process and outcomes, proposing strategies for utilizing them.

Results & Discussion

The research's design concept is 'Prep Layer' focusing on 'The new preppy look blending contrasting elements such as softness and hardness, masculinity with femininity, angular and airy'. Image creation in the design ideation stage utilized two methods: text prompt input and image upload. First, text prompt input involved directly entering searched trend information or extracting keywords from the trend information and combining them with emotive and design characteristics. Images generated by directly inputting trend information closely resembled the designs presented in the trend data, suggesting this method may not be suitable for aims requiring creativity or novelty. The prompt input using extracted keywords showed variations in the generated designs based on the order of the text input, with the placement of emphasized attributes at the beginning of the text reflected in the images. The second method involved uploading hand-drawn sketches or photos from trend information via '/describe', where hand-drawn sketches resulted in images presented in a hand-drawing style, suitable for portfolio use to express design concepts. Uploading images from trend information prioritized the color combinations of the uploaded image in the output design, indicating a strong influence of color on image generation.

The design elaboration stage involves fine-tuning or varying the designs generated in the concept stage through prompt input and using Midjourney's specific functions. Designs selected as representative through the concept stage can generate a series of designs with similar concepts automatically using Midjourney's 'vary' function, allowing for the development of a series of designs under the same concept. Mainly, 'vary(region)' enables changes to specific areas by setting regions and executing 'vary(region)', with the possibility of altering design attributes or adding/removing items based on the content added or modified in the prompt. Effective prompts require a precise understanding of design attributes. When executing 'vary(region)', presenting a link to a specific image can change the design's material. However, the display condition of the material presented through the link is applied as is, necessitating careful selection of linked materials. Entering specific and precise text prompts can generate designs more accurately. When a design was generated by inputting detailed design ideas in text into the prompt, the type of item (clothing), change in shape of the item (clothing), length and width, designation of color, etc. were well reflected in the image. Comparatively, patterns like checks or florals sometimes did not match the input exactly. As Midjourney's version evolves and prompts are applied more accurately, a precise comprehension of design attributes and sensory-rich and detailed text to explain the concept is essential for effectively using Midjourney in fashion design.

Conclusion

Fashion design using Midjourney can be effectively utilized in both the design ideation and elaboration stages. Prompt texts utilizing trend information can generate numerous designs quickly, and Midjourney features like '/describe' or 'vary' allow for desired changes in color, material, and items. The ability to immediately see a variety of design outcomes based on the prompts provided enables designers to clarify their conceptual design direction. However, the design outcomes can vary significantly depending on the text input into the prompt, and the expected design may not always be easily generated. Therefore, a precise understanding of design attributes and a clear concept description are crucial for effectively using Midjourney. Selecting a consistent design line based on the concept from the myriad of generated images is also an essential skill.

References

Jung, B. (2023, August 25). AI 가 만드는 패션계의 현재, 〈AI 패션 위크〉 [The current fashion world created by AI, 〈AI Fashion Week〉]. *heypop*. Retrieved from https://heypop.kr/n/64541/

Kim, W., & Jang, H. (2023). *It works! Creating photos and images with generative AI.* EasysPublishing.

Lee, D. (2023a). Study on generative AI comics –focusing on the 'Bestiary Chronicles'–. *Cartoon & Animation Studies, 72*, 93–155. doi.org/10.7230/KOSCAS.2023.72.093

Lee, Y. (2023b). *Generative AI big 3*. Chackbase.

Lee, Y., Kwon, Y., & Park, J. (2024). *Creative fashion design.* KNOU Press.

Park, K. (2023). Study on the feasibility of using AI image generation tool for fashion design development -Focused on the use of Midjourney. *The Journal of the Convergence on Culture Technology, 9*(6), 237-244. doi:10.17703/JCCT.2023.9.6.237

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VINTAGE CHARACTERISTICS DISPLAYED IN FASHION BRAND BODE

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Introduction

The concept of vintage or retro, stemming from a yearning and nostalgia for the past, has been a recurrent theme among various fashion brands over time. This retro trend has sparked contemporary interest in the old and familiar, fueling a sense of nostalgia and emotional connection to aged items. Retro fashion, traditionally popular among older generations for their nostalgia for past styles, is now gaining traction with younger audiences. These younger groups, not having firsthand experience with the past, are exploring retro fashion as a means to discover and redefine the cultural meanings of bygone eras (Jung, 2020). The term 'vintage' goes beyond just second-hand goods; it embodies the concept of borrowing and reinterpreting past imagery and ideas into modern products (Kim, 2018). While there is a multitude of existing research related to vintage as a stylistic trend or a formative element within contemporary fashion collections, this study investigates vintage characteristics found in Bode, a leading one of a kind fashion brand, contrasting the prevailing fast fashion trends. Bode is a New York-based menswear brand founded by Emily Adams Bode Aujla in 2016. The brand stands out for its unique approach to sustainability and craftsmanship, focusing on creating one-of-a-kind pieces, marking its status as one of the industry's rare success stories in terms of sustainability. Bode's outstanding collections has been recognized by prestigious awards and institutions: 2022 and 2021 CFDA Menswear Designer of the Year, 2020 Woolmark Prize, 2019 LVMH Prize Finalist and etc. This study aims to elucidate the critical role of Bode in leading the fashion industry towards more mindful, historically informed design practices, by examining how the brand's unique ethos not only adopts but also enriches vintage characteristics with its distinctive aesthetic and dedication to ethical fashion.

Literature Review

As the theoretical background of this study, the concept and historical flow of vintage fashion, and the characteristics of vintage fashion shown in prior studies were examined. Vintage fashion is defined typically encompassing fashion items and accessories from a specific period, generally acknowledged as the 1920s to the 1980s, and as designs dating back at least two decades from current fashion trends (Carey et al., 2018). The origin of vintage fashion lies in the fact that the lower class, who aspired to the fashion sensibility of the French nobles in the 18th century, adopted second-hand clothing. Entering the 20th century, the ethos embodied by vintage fashion began to undergo a subtle yet significant transformation. This shift was catalyzed by a fast-evolving societal landscape, marked by collective nostalgia for bygone eras and longing for the familiar comforts of the past. In the aftermath of World War II, vintage fashion emerged as an outlet for the expression of youthful dissent and nonconformity, embodying characteristics often associated with anti-fashion. The attention towards vintage fashion significantly escalated in the 2000s, driven by its rarity and diversity. Originally a visual expression and counter-culture movement, vintage fashion has been reevaluated by consumers for its environmental, recycling, and sustainability implications, highlighting a shift towards recognizing its role in promoting sustainable fashion practices (Cassidy & Bennett, 2012). In a cross-analysis of contemporary fashion brands' vintage collections, informed by prior studies, vintage fashion's distinct traits are categorized into Forms (silhouette, composition), Details (patchwork, applique, distressing, embellishments), and Material and Color. Drawing on aesthetic symbolism and theories, this analysis identifies seven key attributes: scarcity value, craftsmanship, authenticity, oldness aesthetics, playfulness, representation, and unexpectedness, succinctly capturing the unique aesthetic appeal and significance of vintage fashion.

Research Method

The research method of this study is to conduct a case study of Bode. The research scope includes all Bode collections from fall 2017 to the latest fall 2024 collection, covering its integration of 582 looks from 15 collections including RTW, one of a kind, suiting, senior cord line and etc. The cases gathered were thoroughly examined to identify the distinctive features of vintage design by analyzing the silhouette, material, color, and details of the apparel, drawing upon information from the selected brand's official website, relevant articles, and critiques of their collections. Through this detailed analysis, various categories were established based on the aesthetic qualities of vintage fashion. From these categories, specific expression techniques for each type were developed, providing a nuanced understanding of the different ways vintage design elements manifest.

Results & Discussion

The analysis of the Bode collection was centered on vintage formal characteristics—specifically, forms, details, materials, and color—underpinned by the theoretical framework established for this study. Furthermore, seven vintage aesthetic characteristics were examined in depth. Through a comprehensive comparative analysis of both vintage formative characteristics and vintage aesthetic characteristics, the research identified four distinct vintage characteristic keywords that are quintessentially representative of the Bode brand: Nostalgia, Craftsmanship, Sustainability, and Scarcity Value. Nostalgia is manifested through designs that incorporate personal anecdotes, textiles infused with history, and details such as images and lettering that draw inspiration from personal connections and historical contexts. Craftsmanship is a hallmark of the Bode brand, with a significant emphasis on handmade and handcrafted elements. Notably, the brand places a special focus on women's craftsmanship, which forms a core part of its ethos. Sustainability emerges as a critical element within Bode's operational philosophy, with the brand committing to material sustainability and transparency. This is achieved through various strategies, including the utilization of deadstock or recycled materials and sourcing materials globally, all while striving to maintain the uniqueness of design. Lastly, Scarcity Value encapsulates the essence of Bode, with the brand's approach to producing one-of-a-kind or limited edition lines. This is exemplified by collections that feature a limited production run and personalized custom designs through Bode's signature senior cord line, emphasizing the uniqueness and scarcity of its designs.

Conclusion

This study looked closely at how Bode's unique approach to integrating vintage characteristics within the fashion brand Bode, analyzing its collections through the lens of vintage formative and aesthetic characteristics. This study contributes to the academic field by enhancing the understanding of vintage fashion's role and representation in contemporary brands. It bridges gaps in existing literature by providing a focused analysis of how vintage characteristics are interpreted and presented in modern collections, offering a foundation for future research in fashion studies. Industrially, this research offers insights for fashion brands on the strategic incorporation of vintage elements to appeal to consumer nostalgia, sustainability concerns, and the desire for unique, artisanal products.

References

Carey, L., Cervellon, M., McColl, J., Stewart, A. & Yuen, Y. C. Y. (2018). Vintage fashion: a cross-cultural perspective. In: Ryding, D., Henninger, C., Blazquez Cano, M. (Eds.), Vintage luxury fashion (pp. 185-203). Palgrave Macmillan. https://doi.org/10.1007/978-3-319-71985-6_12

Cassidy, T. D. & Bennett, H. R. (2012). The rise of vintage fashion and the vintage consumer, Fashion practice, 4(2), 239-261. https://doi.org/10.2752/175693812X13403765252424

Jung, D. (2020). The emergence of retro fashion culture among generation z in korea. [Unpublished Doctoral dissertation]. Seoul National University.

Kim, G. (2018). A study on vintage style in contemporary fashion [Unpublished Master's thesis]. Hongik University.

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DESIGN DEVELOPMENT AND AESTHETIC DESIGN EVALUATION EXPERIMENT OF STRETCHABLE WORKWEAR FOR TWO-WHEELER DELIVERY WORKERS ON RAINY DAYS
-FOCUSING ON KOREAN MEN IN THEIR 20S AND 30S-

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Introduction

Work transactions through platforms enabled by digital transformation have exploded in the wake of COVID-19, and the number of workers involved has also increased rapidly. According to the Precedence research "2022 Restaurant Business Survey Results," the percentage of restaurants using delivery apps increased from 7.6% in 2018 to 11.2% in 2019 as the pandemic favored non-face-to-face communication. With the expansion of non-face-to-face communication even after the end of the pandemic, the transaction market value of food delivery services is expected to reach USD 59.8 billion in 2022, and it is projected to hit around USD 314.3 billion by 2032, registering a CAGR of 18.1% during the forecast period 2023 to 2032. It has been reported in the media that transportation for food delivery through delivery apps is mainly utilizing two-wheelers. According to the Ministry of Employment and Labor survey (2022), there are currently 2.92 million riders, working an average of 12 hours a day, which is 1.5 times higher than the average office worker. In a frenzied race to make as many deliveries as possible and receive good ratings, the majority of them work more than 8 hours. This complex work environment and long working hours expose them to physical fatigue, scrapes, bumps, falls, and other accidents, making it more necessary than ever to pay attention to the health and safety of delivery riders. However, little research has been done on apparel design for delivery riders. The workwear of delivery riders who work long hours plays an important role in influencing their performance, comfort, and mobility.

Recent field research suggests that delivery riders are uncomfortable with their current workwear, and that ergonomic discomfort is particularly affected by their safety-critical work patterns and frequent physical movements. In this situation, there is a need to develop new clothing that considers the comfort and performance of delivery riders. This study is expected to serve as a resource for identifying and reflecting delivery riders' inconveniences and improvements to their workwear, in addition to providing aesthetic design suggestions to increase riders' satisfaction with their workwear and enhance their activity and comfort.

Research Method

For research question 1, the researcher conducted a survey of 12 delivery riders to identify the risks of rainy day rides. Based on the basic survey of workwear in the previous study Song (2022) evaluation of wearing comfort and ease of working pants for improved mobility, we conducted a basic survey of discomfort among two-wheeler delivery riders. A total of seven items were asked, including three questions on demographics such as age, height, and weight, as well as questions on the experience of the motorcycle rider, uncomfortable situations when riding in the rain on a normal day, area of improvements, and satisfaction with the current rainy-day workwear.

For research question 2, to understand the material and design of current rainy day riders' workwear, we selected two domestic and foreign online shopping malls specializing in rainy day workwear (Amazon and coopang) and purchased a total of nine samples of workwear with different designs. We checked the products in the rainy-day workwear category in each shopping mall and found that all the products were similar in terms of material, using 100 polyester or 100 nylon, which are non-stretchy materials

For research question 3, a prototype was designed based on the purchased samples and the results of the preliminary survey. 12 people were interviewed to evaluate the subjective illusion. The 12 interviewees were selected using convenience sampling and snowball sampling. Finally, 12 men who met these criteria

were selected to participate in the clothing evaluation and in-depth interviews.to evaluate the subjective perception of each workwear according to movement, we used the previous study by Kim's (2009) study on top modifications to improve the functionality of prototype sportswear tops, we used the metric of top range of motion (ROM).

Results & Discussion

1. Problems with current commercialized workwear

In terms of problems with workwear on rainy days, 40% of respondents cited outdated designs, 35% cited material problems, 25% cited poor elasticity, and 25% cited lack of durability. All of the participants who responded to the survey were dissatisfied with the current design, and the main reasons for their dissatisfaction were design, material, and durability. First, design is a problem, and they would like to see aesthetically pleasing workwear with a length that is not related to body size and a plain, consistent design. Second, the material. The existing workwear made of 100polyest, which does not stretch, does not stretch, causing discomfort when moving. Third, the problem of durability. The work clothes worn on rainy days were not waterproof and durable despite being waterproof. As a result, the material became sweaty and wet, causing breathability problems, and rain leaked during delivery, leading to safety problems rather than improved visibility.

2. Develop a prototype to solve the problems of currently commercialized workwear.

Based on the surveyed discomfort and improvements, we developed a total of 6 products. The size is large, which is the average size based on the average height and weight of 12 people. n the survey, 75% of the participants said that they would like to have a stretchable waterproof fabric for reasons such as stuffiness and breathability, so the new prototype was developed with a combination of stretch materials. In this study, the stretch material was incorporated into a prototype using a stretch material containing spandex, which is a high stretch fabric, and a low stretch fabric without spandex but with a knitted texture.

3. The design that the wearer is most satisfied with among the developed prototype samples

The subjective perceptions were evaluated using a Likert scale and an independent sample t-test was conducted to compare the differences in the participants' satisfaction and subjective perceptions of the developed stretch workwear. We used the t-test because we thought it was a good way to find out the mean differences in subjective satisfaction and perceptions for each prototype. The t-test is used to find out the differences between each item, and the p-value (probability of significance) is calculated based on the t-value (t-statistic) and the degrees of freedom (sample-2). In general, a p-value lower than 0.05 is a statistically significant result, and we can conclude that there is a difference between each group. After surveying 6 people in their 20s and 6 people in their 30s about 6 products

Conclusion

The results of this study show that each participant was satisfied with the improved material and design of the two-wheeled delivery system, which was uncomfortable on rainy days. The level of satisfaction varied depending on the participants' personal characteristics, preferences, experiences, and areas of importance. During the course of this study, we found that references to stretchy materials were linked to both freedom of movement and comfort, as well as fit and mobility. As such, it is judged that it is necessary to develop a stretchable workwear for two-wheeled couriers to deliver on rainy days, as the courier's workwear is also related to safety. It is believed that the workwear developed through the results of this study can improve the convenience and safety of two-wheeled delivery workers on rainy days and will help improve the inconvenience of the current market. In terms of related industries, it is believed that it can be used as useful reference data to develop services that increase the satisfaction of non-face-to-face screen platforms more effectively.

Practical implications, limitations, and suggestions

Through this research, it was found that a rainy-day delivery rider's workwear can be developed to improve the wearer's comfort and increase aesthetic design satisfaction, which is expected to improve the delivery rider's work performance and reduce the risks and inconveniences of delivering during rainy-days. However, this study encountered some limitations as the experiment was conducted on young male riders, future studies should involve a wider age range. Additionally, because this study focused on comfort improvement and aesthetic design, durability and safety aspects were overlooked. Therefore, further studies that consider the durability and stability of the workwear are required. Field tests should be conducted to verify their effectiveness in real-world environments. Also, it is recommended that the experimental methodology should include systematic ergonomic testing to provide more accurate body sizes. Finally, we hope that this study will improve the working environment of delivery workers and serve as a basis for the development of improved workwear for delivery workers during rainy days.

References

Crown, E. (2005). Protection for workers in the oil and gas industries. *Textiles for protection*, 699–713

Ciesielski, B. (2017) Measuring the effects of structural turnout suits on firefighter range of motion and comfort. *Ergonomics* 60(7): 997–1007

Holmer, I . (2006) Protective clothing in hot environments. *Ind Health* 44, 404–13.

O'Brien, C. (2011) Methods of evaluating protective clothing relative to heat and cold stress: thermal manikin, biomedical modeling, and human testing. *J Occup Environ Hyg 8*, 588–99.

Song, W (2022) Improving ergonomic performance of work pants for delivery personnel based on skin deformation measurement, *Journal of Engineered Fibers and Fabrics*, 17: 1-12.

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AI INTEGRATION IN FASHION DESIGN EDUCATION: AN EXAMINATION OF AI-BASED TOOLS AND SUPPORT STRATEGIES

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Introduction

In recent years, artificial intelligence (AI) has made significant strides in the field of fashion design, advancing from image recognition and synthesis to image generation. Convolutional Neural Networks (CNN) have been utilized for style classification through image recognition, while Generative Adversarial Networks (GAN) are being employed for image generation. Moreover, diffusion models have enabled more realistic image synthesis in 2D or 3D rendering, aiding in visual representation. As AI-based tools continues to advance, there is a paradigm shift in traditional fashion design practices. Fashion design educators are confronted with the task of enabling students to effectively utilize AI technology and integrating these new tools into the evolving educational landscape. Recent initiatives in fashion design education aim to integrate AI technology into the design process, providing students with problem-solving skills to adapt to technological changes. However, prior research has not sufficiently scrutinized the scope of learner support provided by AI tools throughout the sequential stages of the fashion design process. This study investigates case studies of AI-based fashion design education and proposes ways to effectively utilize AI design tools to assist learners in the fashion design process.

Literature Review

With the continuous advancement of technology, AI has been applied in education, attracting significant attention from researchers and practitioners. The "artificial intelligence + education" system aims to create an intelligent educational environment and provide personalized education for stakeholders, including lecturers, students, and administrators (Yang & Bai, 2020). In the field of fashion design education, many studies have incorporated AI-based tools into classroom activities such as fashion product search, design analysis, automatic sketching, image mapping, and creation (An & Park, 2023; Harvey & Smal, 2021; Wu & Li, 2024). Moreover, AI integration occurs at various stages of the fashion design process, which involves analyzing internal data and fashion trends, forming concepts and ideas, generating and modifying designs, and finalizing products that reflect brand identity and seasonal concepts. Therefore, as the integration of AI technology becomes increasingly prevalent in fashion design education, it is imperative to examine how these tools can effectively support learners throughout the design process.

Research Method

First, a case study was conducted on the application of AI technology in domestic and international fashion design education over the past five years, selecting five cases of AI-based tools utilized in the fashion design process. Second, in-depth interviews were conducted with five university lecturers currently teaching fashion design, analyzing AI assistance for students in stages of the fashion design process, including (1) problem identification, (2) concept formation and design ideation, (3) design generation and motivation, and (4) design finalization. Finally, the discussion focused on how AI-based tools can effectively and efficiently support students in the fashion design process.

Results & Discussion

In fashion design education, certain AI-based tools serve specific roles. These tools include: (1) CST (Creativity Support Tool) employing CNN technology, (2) DeepDream, (3) Artbreeder, and (4) Midjourney, and (5) DALL-E, all utilizing GAN and Diffusion technologies for image generation and synthesis, with DALL-E additionally employing Large Language Model (LLM) technology to produce images based on

input text. While fashion design educators emphasize the importance of instructor assistance, particularly in planning and decision-making processes, AI-based tools primarily support tasks such as design generation, refinement, and prototype creation. Consequently, there arises a necessity for future AI-based fashion design tools to pivot towards facilitating tailored planning for students' concepts and providing objective decision-making materials through data collection and analysis. Moreover, recognition of the necessity for AI support from a systemic perspective to effectively manage design tasks and uphold project objectives throughout the fashion design process.

Conclusion

This study discussed the utilization direction of AI tools in fashion design education through the perspective of instructors. In future research, we plan to further investigate and compare the learners' perspectives on the use of AI-based learning tools, and consult with experts in the computer technology field to research the technological supports of AI design tools in fashion design education. Through this, we aim to support the practical development of AI design tools and innovation in fashion design education.

References

An, H., & Park, M. (2023). An AI-based Clothing Design Process Applied to an Industry-university Fashion Design Class. *Journal of the Korean Society of Clothing and Textiles, 47*(4), 666-683.

Harvey, N., & Smal, D. (2021). The generative tool: a design journey in fashion education. International Journal of Fashion Design, *Technology and Education, 14*(1), 28-36.

Wu, X., & Li, L. (2024). An application of generative AI for knitted textile design in fashion. *The Design Journal,* 1-21.

Yang, S., & Bai, H. (2020). The integration design of artificial intelligence and normal students' education. In Journal of Physics: Conference Series (Vol. 1453, No. 1, p. 012090). IOP Publishing.

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A COMPREHENSIVE EXPLORATION OF MONGOLIAN TRADITIONAL COSTUME DESIGN

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Introduction

Delving into the depths of Mongolian culture, this paper presents a comprehensive exploration of traditional costume design. We unravel the historical, cultural, and functional dimensions that have sculpted these garments, from their nomadic roots to contemporary adaptations. Through tracing the evolution, deciphering symbolism, exploring regional variations, and addressing contemporary influences and challenges, this study offers a nuanced understanding of Mongolian attire.

Mongolian traditional costume design serves as a testament to the profound connection between the nomadic lifestyle and the cultural identity of its people (Батнасан, Г. 1989). Rooted in history and intricately woven into the fabric of Mongolian culture, these garments transcend mere clothing, embodying narratives of resilience and cultural heritage.

The significance of Mongolian traditional costume design lies not only in its functional aspects, designed to withstand the rigors of a nomadic lifestyle and the extremes of the Mongolian climate, but also in its role as a vessel for cultural heritage. Each garment, meticulously crafted and adorned with symbolic elements, carries the weight of centuries of tradition, reflecting the resilience and adaptability of a people intimately bound to their land.

Mongolian clothes have to meet two criteria: to protect the body from cold and to provide functionality for horse riding (Woohyun Cho 2002). Due to the irregular shape and length of the material, it often has a cutting line at the waistline, following the anatomy of the human body (Katō 2002).

Mongolia's geographical location along the Silk Road significantly influenced the development of traditional costume design. The Silk Road was an ancient network of interconnected trade routes that facilitated cultural exchanges between the East and West. This historic trade network introduced new fabrics, designs, and decorative elements to Mongolian attire. For instance, the infusion of silk added a touch of luxury to clothing and brought intricate weaving techniques that harmonized with the nomadic aesthetic.

It is an important part of the Mongolian national culture, and a concentrated expression of a national material and spiritual civilization. The costumes carry the history, culture, aesthetics and customs of a nation and are an important cultural heritage of a nation (Wenjie Chang 2019). Among the numerous ethnic groups contributing to the cultural mosaic of Mongolia are the Torguud, Bayad, Zakhchin, Buriad, Kazakh, Dariganga, Uriankhai, and the predominant Khalkh. Eastern Mongolia, influenced by ethnic groups such as the Khalkha, Buryat, and Daur, boasts a rich tapestry of traditional costume styles.

Every element of Mongolian traditional costume carries profound symbolism, reflecting cultural, spiritual, and social identities. From color palettes to intricate patterns, each detail communicates stories of migrations, beliefs, and unity, preserving a meaningful legacy for generations to come.

Contemporary Influences and Challenges:

In recent years, however, the deel has evolved into a fashion item as Mongolian designers have reworked it in a style known as nomadic chic.

In the face of modernization and globalization, contemporary Mongolian designers navigate a dynamic landscape, blending tradition with innovation. Sustainable practices, cross-cultural exchanges, and technological advancements shape the evolution of Mongolian attire, ensuring its relevance on the global stage. Modern technology plays a transformative role in both the production and preservation of Mongolian traditional costume design. From CAD software to digital platforms for education and collaboration, technology serves as a bridge between tradition and the future, safeguarding cultural heritage for posterity.

As we embark on a comprehensive exploration of Mongolian traditional costume design, it becomes apparent that these garments are more than just pieces of clothing; they are living artifacts that bridge the past and the present, telling stories of migrations, spiritual beliefs, and the unity of a diverse population. Through this exploration, we seek to unravel the layers of complexity within Mongolian traditional costume design, celebrating the artistry, symbolism, and cultural richness that define this integral aspect of Mongolian identity.

Literature Review

In a comprehensive review of scholarship on Mongolian clothing, various scholars have contributed valuable insights from diverse perspectives. Badrah (year) delved into ancient Mongolian clothing patterns, while Nyambuu (2002), Batnasan (1989), and Sonomtseren (1985) explored the historical and ethnographic dimensions of Mongolian attire. Badamkhatan (2002, 2004) provided insights into multi-ethnic clothing characteristics, complementing Bayar's (2004) examination of 13th-century robe features depicted in stone monuments. Dorjsuren (1961) offered archaeological insights into ancient Hun period clothing and textile culture, while Tserenkhand (2005) focused on ancient Mongolian attire. Dungaamaa (2004) studied the weaving process of Mongolian robes, and Norjinkhorloo (2004) investigated weaving methods at universities. Additionally, Songino (1989, 1999, 2000) and Onermaa (2012) contributed to teaching methodologies for traditional clothing technology. Disan (1999), Oyuntungalag (2004), and Baasankhyu (2006) examined unique features of Mongolian ethnic group coats and clothing, with Sonomtseren (1992) providing insights into textile culture. Furthermore, Danish scientist Hanni Harold Hansen (1960) enriched the discourse with ethnographic perspectives.

Research Method

The research method integrates qualitative approaches such as fieldwork, ethnographic study, document analysis, and visual analysis. Through a thorough literature review and expert consultation, we contextualize their findings within existing scholarship and validate their interpretations. By synthesizing data gathered from diverse sources, the study offers a nuanced understanding of Mongolian traditional costume design, encompassing its historical evolution, cultural significance, regional variations, and contemporary transformations.

Results & Discussion

Through qualitative analysis of fieldwork data, document examination, and expert consultation, the study unveils the multifaceted cultural significance embedded within each garment. Findings underscore the resilience of traditional attire amidst contemporary influences, showcasing a dynamic interplay between heritage preservation and modern innovation. Furthermore, the discussion delves into the implications of globalized fashion trends on the perpetuation and adaptation of Mongolian traditional costume, highlighting both challenges and opportunities for cultural heritage sustainability. Overall, the comprehensive exploration offers valuable insights into the rich tapestry of Mongolian identity reflected in its traditional attire.

Conclusion

In conclusion, the rich tapestry of Mongolian traditional costume design reflects a cultural narrative intricately woven through centuries of nomadic life, Silk Road exchanges, and imperial conquests. Each element, imbued with symbolic significance, serves as a visual language communicating the wearer's identity and cultural heritage. Regional variations among ethnic groups underscore the diverse adaptations shaped by Mongolia's landscapes and historical interactions. Amidst contemporary transformations, the fusion of tradition with innovation, propelled by technology, ensures the enduring legacy of Mongolian attire on the global stage. As a living embodiment of cultural heritage, Mongolian traditional costume design transcends temporal and spatial boundaries, captivating and inspiring appreciation across generations and cultures.

References

Батнасан, Г. (1989). Монгол ардын хувцас. Улаанбаатар

Нямбуу, Х. (2002). Монгол хувцасны түүх. Улаанбаатар: Адмон принт

Үндэстний хувцас судлалын академи, Монгол костюмс төв. (2010). Дээлтэй Монгол эрдэм шинжилгээний хурлын эмхэтгэл. Улаанбаатар.

Wenjie Chang (2019). Protection and Inheritance in the Development of National Costumes. *5th International Conference on Arts, Design and Contemporary Education*

Woohyun Cho, Jaeyoon Yi, Jinyoung Kim (2015). The dress of the Mongol empire: Genealogy and diaspora of the Terlig. *Acta Orientalia Academiae Scientiarum Hung*, 68 (3), 269-274.

Katō, Sadako 加藤定子 (2002): Chūō yūrashia kodai ifuku no kenkyū: Rittai kōsei no kigen ni tsuite 中央ユーラシア古代衣服の研究, 立體構成の起源について [Study of ancient costumes in Central Eurasia]. Tokyo, Genryūsha

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A STUDY ON TEXT PROMPTS FOR HANBOK IMAGE GENERATION IN GENERATIVE AI: FOCUS ON CIVITAI

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Introduction

Image-generative AI, a computer system that autonomously generates images based on human language descriptions entered into a command window known as a prompt, has become increasingly prevalent. While anyone can easily generate images, achieving specific desired images is not as straightforward. The diversity of outcomes based on the commands entered into the prompt underscores the challenge of precisely implementing desired images. Prompt engineering, the task of entering suitable commands into the prompt to obtain optimal results, is emerging as a key skill for effectively utilizing generative AI. Meanwhile, in the recent Hanbok industry, models generated by image-generative AI have been selected as official Hanbok promotional models by Hanbok-related organizations. Additionally, companies offering specialized AI Hanbok image services have emerged for advertising and online shopping malls. AI Hanbok images hold significant potential in various fields including fashion/cultural marketing, design, and education. However, generating Hanbok images is not as straightforward as it may seem, and there is a lack of academic research in this area. Therefore, this study aims to investigate what content users input into the prompt to generate Hanbok images through text prompt analysis, serving as foundational research connecting Hanbok with image-generative AI.

Literature Review

In the field of fashion, prior research related to image-generative AI has encompassed various areas. Research has been conducted on design thinking, processes, and education utilizing image-generative AI. Studies have also focused on user experiences and roles, as well as technical analyses and use cases of image-generative AI. Additionally, there has been research aimed at advancing the technology and functionalities of image-generative AI.

Specifically regarding research on prompts in image-generative AI, there have been few studies. One notable example is the study by Kim et al. (2023), which analyzed user behaviors in prompt engineering based on information provided by prompt-generating websites. While Kim et al. (2023) suggested ways for users to engineer prompts to generate desired images, this study differs in its focus on understanding the content of text input into prompts for specific image generation. Therefore, this study distinguishes itself from existing research by examining the textual content inputted into prompts for specific image generation purposes.

Research Method

This study selected text prompts from Hanbok images shared on CIVITAI as the research subject. CIVITAI is a website where users of Stable Diffusion, an image-generative AI, share information on how images are generated. Users can access detailed information about the AI-generated images, text prompts, and other options (parameters), and can also download and utilize the trained models developed by users to generate specific images. Compared to other sites and image-generative AIs, the Hanbok images shared on CIVITAI are relatively well-implemented in terms of atmosphere and detail, representing authentic Hanbok rather than costumes from Japan or China. Additionally, with over 1,000 images available, CIVITAI has the largest collection of Hanbok images. Therefore, CIVITAI was deemed suitable for obtaining information for Hanbok image generation and was adopted for this study.

The research method is based on content analysis of case studies. As of January 28, 2024, a total of 156 positive and negative prompts related to 'hanbok' were collected by searching for the keyword on CIVITAI. The text prompts appeared in the form of English words, phrases, or sentences, and phrases or sentences

were classified into appropriate categories based on their meaning and keywords. The collected prompts were categorized and their characteristics were derived.

Results & Discussion

The results of the study categorized text prompts into two main categories: expressions related to costumes and expressions unrelated to costumes. Specifically, expressions related to costumes were further subdivided into styles, items, patterns/materials, colors, accessories, details, and others, while expressions unrelated to costumes were categorized into character descriptions, quality/image style, low rank adaptation of large language models[LoRA]/embedding, and others.

The main characteristics of prompts used for Hanbok images are as follows:

English keywords referring to the types of Hanbok costumes were limited. Among the expressions related to costumes in positive prompts, the items were mostly represented by terms like 'hanbok,' 'hanbok dress,' and 'Korean clothes,' while female costumes were sometimes expressed as 'jeogori,' 'skirt,' and male costumes as 'robe.'

Emphasis was more on character, quality, or image style expressions rather than expressions related to costumes. Both positive and negative prompts tended to focus more on expressions unrelated to costumes, particularly character descriptions, quality, or image style such as art style or art movement.

Hanbok LoRA was a significant factor in representing Hanbok images. The usage rate of Hanbok LoRA among the 156 Hanbok images was about 71.8%. Hanbok LoRA is a small-scale model that induces a specific Hanbok style. For example, applying LoRA trained with the attire of male nobles can effectively capture the attire of male nobles. Especially, to manifest the applied Hanbok LoRA during image generation, a trigger word needed to be included in the prompt, with 'hanbok' being the most common trigger word. This sheds light on the limited diversity in expressions of Hanbok costume items.

When discussing ways to use AI for effective Hanbok image generation and design based on prompt analysis, various Hanbok LoRAs should be developed to expand the types and expressions of Hanbok. It is time for collaboration between AI engineers who can develop LoRAs and Hanbok experts who can select high-quality Hanbok data sets and provide expertise. In addition, it is difficult to specifically request the desired image from AI with a limited Hanbok keyword, so English words that can express items, details, and accessories of Hanbok should also be established while developing LoRAs. Since commands to express image styles are popular prompts in image-generative AI, it is suggested to use them to get ideas for creative design development that combines Hanbok and art styles.

Conclusion

The categorization and characteristics of Hanbok image prompts derived in this study provide significant academic groundwork for prompt engineering. However, effective prompt engineering requires consideration not only of the content of text prompts but also of various other factors such as parameter adjustments, the order and weighting of specific keywords, the use of brackets and compound words, the combination of LORA models and keywords, and more. Subsequent research should discuss variables not addressed in this study to further enhance prompt engineering practices.

References

Kim, S., Kwon, Y., & Lee. K. (2023). #taggenerator: How an online community designs an interface for text prompt inputs using a NovelAI's diffusion model. *Proceedings of HCI KOREA 2023*, *Korea*, 642-647.

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A COMPARATIVE ANALYSIS OF COLOR ATTRIBUTES IN LUXURY FASHION BRANDS ACROSS CREATIVE DIRECTOR TRANSITIONS

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Introduction

The transition of creative directors of luxury fashion brands has recently become a significant issue. In the realm of luxury fashion brands, it is a recognized norm that the tenure of a creative director typically spans around five years. Such transitions are often prompted by a decline in the brand's sales performance (Choi, 2020). Given the escalating significance of creative directors within luxury fashion brands, a critical examination of their efficacy in steering brands to success becomes imperative. While there are various strategies for brands to innovate and change, we aim to explore the most intuitive factor of change, which is color. Color is one of the most crucial elements in fashion, instinctive, and intuitive, serving as a vital tool for expressing the image and visual aspects of collections. This study aimed to examine the color changes across seasonal collections of luxury fashion brands following changes in creative directors, to investigate the establishment and evolution of brand color identities.

Literature Review

The creative director is responsible for maintaining or developing the unique identity of the brand and managing overall tasks related to the brand (Park, 2010). Therefore, the role of the creative director is increasingly recognized as a key position that can have a significant impact on the overall image and sales of the brand. Traditional luxury brands such as Louis Vuitton, Gucci, and Celine have sought innovative changes in their image by hiring new creative directors. Among them, Gucci's image transformation is most notably evident. According to the Kering Group investor report, Gucci's sales surged by 41.9% to 8 trillion 117.3 billion won in 2017 compared to the previous year. The common characteristic among these cases is the transition in creative directors. Consequently, the importance of creative directors is rising in luxury fashion houses.

Luxury fashion houses have traditionally adhered to a model where only a minority could afford their products for decades. In the past, the main consumers of luxury fashion houses consisted of economically capable individuals in their 30s and 50s, but recently, the population in their late teens and 20s has emerged as the main consumers. Therefore, luxury fashion houses have had to rapidly and provocatively evolve trends to maintain brand sales. There are various aspects to revolutionize a brand's image, but among them, this study want to explore the most instinctual colors to understand the factors driving their transformation. Color is considered a fundamental element in fashion as it reflects the societal and cultural characteristics of the time, making it a significant tool in expressing the image and visual representation of collections (Han, 2009).

Research Method

This study centered its investigation on the top three globally renowned luxury brands, namely Dior, Gucci, and Chanel, as identified by Forbes rankings 2023. A duration of six years was meticulously chosen for each brand, encompassing three years under the tenure of the former creative director and three years under the stewardship of the new creative director following the creative director transition. Fashion show images, excluding those where precise color analysis was hindered by material characteristics, were collected for analysis, resulting in a total of 2,410 images. The method employed for analysis involved using the Multi Color Engine provided by TinEye (TinEye, n.d.), a color extraction tool, to extract color ratio palettes and Hex values per image for analysis. TinEye is a tool that analyzes the dominant colors of provided images in proportion, utilizing algorithms. The extracted color palettes were then grouped by brand collection, and color ratio palettes were extracted again through the color extraction site. Finally, the extracted Hex values

were converted to RGB and utilized for analysis using the Munsell conversion to obtain H V/C values. To facilitate a more intuitive understanding of the extracted colors, analysis was conducted based on the PCCS Tone, commonly utilized in the fashion industry.

Results & Discussion

This study aimed to gain insights into the overall color trends and identities of the brands by analyzing colors seasonally, thereby obtaining the brand's color characteristics influenced by creative directors. The results of this study are as follows:

Firstly, neutral colors accounted for over 20.00% of the overall palettes of all three luxury fashion brands. This corresponds with the argument that in luxury fashion brands, the ready-to-wear (RTW) segment primarily generates sales from neutral-colored items, reflecting a classic color scheme. This highlights the importance of neutral colors in luxury fashion collections.

Secondly, Dior originally used a lot of colors that emphasized femininity, but when Maria Grazia Kiuri came in, it was confirmed that it changed to a neutral image using achromatic colors. This is because Maria Grazia Kiuri, the first female creative director at Dior, which has long represented traditional femininity, melted her feminist sensibility into the collection and introduced genderless fashion in a purple blue (PB) and dark tones. This was judged to be related to her values and the trend of achromatic colors from genderless fashion, which had emerged since 2016.

Thirdly, after Alessandro Michele took over as creative director at Gucci, there was a prominent utilization of the brand's iconic colors, green(G) and red(R). Alessandro Michele actively used these symbolic colors during the 2016-2018 Gucci Spring/Summer collections, effectively conveying Gucci's identity to consumers through color. This interpretation suggests that the clear utilization of Gucci's symbolic colors helped solidify Gucci's image. However, under Frida Giannini's direction, there was a high proportion of purple blue (PB) and red purple (RP) usage instead of G and R.

Lastly, Chanel showed a high utilization of achromatic colors, including the Chanel's iconic colors black and white, and prominently featured the use of R. under Virginie Viard's leadership at Chanel from 2020 to 2022, coinciding with the COVID-19 pandemic, it is evident that the color palette of these collections was influenced. The 2020-2022 Chanel collections led by Virginie Viard generally conveyed a stable and a calm atmosphere, reflecting the popularity of neutral and stable tones suitable for indoor activities during the COVID-19 pandemic. It is speculated that Virginie Viard's color palette, showcasing a calm atmosphere, was influenced by the COVID-19 pandemic.

Conclusion

This study aimed to analyze and compare shifts in color palettes within collections of luxury fashion brands, focusing on the influence of creative directors, to investigate the construction and evolution of brand color identities. In the realm of brand color analysis concerning creative directors, most of the prior research has tended to concentrate on formative attributes, often conducting only rudimentary color analyses. Hence, this study holds significance in its meticulous examination of brand color analysis, providing a more comprehensive understanding of the subject matter. Building upon this, the study offers practical examples beneficial for domestic brands seeking to hire creative directors or undergoing rebranding initiatives. It serves as foundational material for such endeavors. Through this, brands in need of rebranding can actively lead the growth of their brand in the ever-changing fashion industry by developing designs and product plans based on a distinctive color identity, thus fostering differentiation. Furthermore, the study contributes to confirming the overall color atmosphere and tone influenced by creative directors in luxury fashion brands. It also provides reference examples for systematizing color planning for brands in need of rebranding from an industrial perspective, establishing fundamental data. Lastly, the study's exploration of color identity within luxury fashion brands holds significance, offering valuable academic research data for the field of fashion design.

References

Choi, Y. (2020, June 23) The 'Expiration Date' of Luxury Fashion Brand Creative Directors: Is It 5 Years? [명품 패션 브랜드 크리에이티브 디렉터의 '유통 기한'은 5년?]. HYPEBEAST. https://hypebeast.kr/2020/6/bernstein-study-luxury-fashion-creative-directors-five-year-expiration-date.

Han, S., & Cho, K. (2009). Practice of Fashion Color Planning -Focus on Color Images of the Bloomsbury Group Paintings for a Color Plan of Company D-. *Journal of Fashion Business*, 13(4), 21-36.

Park, J., & Lee, J. (2010). The Role of Fashion Creative Director. *Journal Korea Society of Visual Design Forum*, 28(0), 221-230.

TinEye. (n.d.). TinEye: Reverse Image Search. Retrieved from https://www.tineye.com

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DEVELOPMENT OF IMAGE EXPRESSION FOR FASHION DESIGN USING GENERATIVE AI

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Introduction

Artificial intelligence and machine learning technology is widely used throughout the creative industries. The impact of AI(Artificial intelligence) is reshaping the fashion industry. Generative AI, which can create content in form of images, videos and texts, is a new field for fashion and retail that promises to enhance creativity and business process. Generative AI has numerous applications in creation of new images and the technology is growing rapidly. In fashion, image plays a critical role in terms of inspiration, visual information and attraction. As fashion designers are constantly exploring for new ideas and images every season, the emergence of new innovative aid is emphasizing and enhancing fashion designer's creativity. The purpose of this study is to achieve three primary objectives. First, to collect and analyze various existing fashion images from the AI-based artists in order to identify its distinctive characteristics by categorizing them. Second, based on the analysis, the research aims to develop image creations using an AI tool, Midjourney, to examine its efficiency and usage for contemporary fashion field. Third, aims to discover the aesthetic value and signification of the fashion images created by AI tool. Through analyzing and developing diverse images for fashion, this study will enable Generative AI as a practical tool for fashion designers to enhance their creativity and ideation process.

Literature Review

AI can produce images, music, literature, or any other form of creative expression. AI image generation tools such as Midjourney, DALL-E and Stable Diffusion are widely used because it is useful to expand the original concept and brainstormed ideas quickly by creating multiple variations of visual images. Art work made with the assistance of Generative AI is a new type of genre which is called 'AI-art', and AI-based artists are presenting their works mainly through Social Networking Service such as Instagram. Moreover, some of the existing artists such as Cindy Sherman, Mario Klingemann and Eugenio Marongiue are expanding their work by using Generative AI tool by manipulating and transforming existing imagery. Likewise, the fashion industry including various fashion brands has been quickly embracing the usage of AI tools which allows designers to make informed decisions before physically producing clothes. AI can contribute to the fashion design process by providing data-driven insights, automating repetitive tasks, optimizing resource allocation, and enhancing overall efficiency and decision making.

Recently, the impact of AI have become increasingly prevalent in fashion academic studies. However, previous researches regarding AI focuses mainly on design processes, the applicability for fashion design and education(An & Park, 2023; Min & Jeong, 2023; Lee & Lee, 2021; Lee, 2023; Park, 2023; Seol, 2023), comparison between human and AI designs(Chung & Lee, 2023; Jung & Jang & Lee; 2023) and development of an AI based design system(Choi & Jang & Kim & Lee & Lee & Park, 2023). Due to its absence, this study aims to analyze and develop various image expressions for fashion design through generative AI tool and to examine its characteristics in categories to expand the efficiency for future creative fashion field.

Research Method

The method of the study is categorized in three sections. First, this study analyzed AI-based fashion image expressions appeared on Instagram to classify its characters. To examine the images the study conducted examples of 44 AI-based artists who are active in fashion categories and has more than 10,000 followers each. The total 4,396 images are analyzed by theme, concept, medium and composition. Second, based on the analysis, the images are categorized in 5 characteristics which are 'realistic',' hybrid', 'distortion',

'exaggeration' and 'fragmentation.' Third, based on the 5 characteristics, this study developed images by using AI tool, Midjourney with text and image prompts. Midjourney is one of the leading applications that offer highly advanced functionality in their creation of images which is best for creating artistic, visually compelling images. To generate images users use the '/imagine' command and type in a prompt, the Midjourney bot then presents a set of four images. A prompt is a short text phrase that the bot interprets to produce an image. Basic prompt can be as simple as a single word, phrase or emoji. Based on the basic prompt, this study designed 10 different prompt-structures with the combinations of texts, images and parameters. For the accuracy, it is examined with restriction of the texts, limited image and parameter input. Text and phrases are mostly self-creations or the phrases produced by Midjourney using the command '/describe'. Images that were used are from pinterest and self-made drawings or designs. Additionally, to examine the images for various mediums of fashion presentation, this study adapted previous image creations by subjects of fashion medium based on the previous prompt-structures. The categories are fashion photography, fashion illustration and drawing, flat-pattern, moodboard, fashion design templates, fashion exhibitions or fashion shows. Through combination of each prompt-structures and analyzed characteristics, this study examined 25 different case studies.

Results & Discussion

The characteristics of the images from the AI-based artists are shown as follows. The realistic type is defined literally by its realistic and detailed depiction of human figure and expression which is often shown as hyperrealism. The hybrid type's formative element is conducted by combination of different themes and sources which demonstrates an unique visual attraction. The distortion type is defined by a characteristic expression of humans by transshaping the features in new forms. The exaggeration types' is defined by emphasizing its distinctive elements, such as size, colors or textures. The fragmentation type's formative element is highlighting the human body by segmentation and decomposition.

The image developing process of this study is followed by the order of input, produce, feedback, modify, and repeat. As a result, this study produced 657 images from using the tool, overall 2659 images including the variations. The result of this study is as follows. The image creations showed four different characteristic which is 'experimental formulation', 'unexpectedness', 'diversity', and 'infinite creativity.' First, whether it is pre-planned or by coincidence, the experimental formulations were distinctively shown. By converging multiple text and images with commands, its form, color and material is incorporated to produce unique and experimental images. Second, although most of the case studies were pre-planned, the result is always unexpected. Images could be visually satisfying and useful for each subject or medium for fashion. However, there were some strange distortions such as double heads on a single body, a hand with six fingers, two hands coming out of one arm. This is because AI struggles to figure out the intricacies of human joints, proportions, and articulation. Third, as AI rendered multiple versions of variations which are especially useful for testing different design elements in fashion design developments. However, since the AI models learn from vast human-generated datasets, they tend to absorb the biased outputs, stereotypes pertaining to default information. Four, most of the images showed the expansion of imagination through visual creativity. As the creative process is based on constant experiment and experience, this infinite test from input to produce will be a useful training system for designers. To avoid the default from the tool, fashion designer's creativity has to be involved in every step of AI's creations.

Conclusion

The conclusion of this study is as follows. First, AI has shortened the path throughout the ideation process. This will help the designers to speed up their workability in tight fashion cycle. Second, AI is a useful interactive tool to emphasize and enhance the designer's creativity. Human could improve their creativity by planning forehead, decision making, selecting images, write a composition of word describing and storytelling. Third, AI could produce creative, vibrant, photogenic images through comparatively simple words, images and concepts. Based on the fact, AI could be a personalized fashion design solution for not only designers but to non-trained people. This will bring the individualization, democratization of design.

Despite its limitation of using a single Generative AI tool, Midjourney, this study is significant because it examines various image expressions for contemporary fashion design in multilateral way. For further studies, it is necessary to analyze different AI tools, comparing the similarities and differences. In addition, as the training data includes billions of copyrighted photos which could cause copyright issues of its usage, we need a new law to ensure that all designers are informed and properly compensated if their work and intellectual property is used by AI. To conclude, as fashion by its very nature is constantly changing and reinventing itself, Generative AI tool will be more efficient and valuable aid for future creative fashion field.

References
An H., Min P. (2023). An AI based Clothing Design Process Applied to an Industry-university Fashion Design Class. *The Journal of the Korean Society of Clothing and Textiles,* 47(4) , 666-683.

Choi W., Jang S., Kim H., Lee Y., Lee S., Lee H., Park S. (2023). Developing and AI-based automated Fashion design system : reflecting the work process of fashion designers. *Fashion and Textiles : International Journal of Interdisciplinary Research,* 10(1) , 1-17.

Chung K., Lee M. (2023). A Case Study of Human-AI Co-creation(HAIC) in Fashion Design. *Journal of Fashion Business,* 27(4), 142-162

Jung J., Jang S., Lee Y. (2003). Perception of Fashion Designer's Capability and Product Quality -Human vs. Human+AI vs. AI. *The Journal of the Korean Society of Clothing and Textiles,* 47(4) , 743-759

Lee C., Lee J. (2021).The Applicability of Artificial Intelligence Based Design Tools on Fashion Design Thinking . *The Journal of the Convergence of Culture Technology,* 9(6), 237-244

Lee W. (2023). Suggestions for the Use of Fashion images with Generative AI – Focusing on Application of AI Training Data and AI technology. *The Journal of Society of Visual Design Forum,* 71, 155-170.

Maghan Macdowell(2023, May 9). Generative AI in fashion and beauty. Retrieved February 12, 2024 from ttps://www.voguebusiness.com/gallery/gallery-generative-ai-in-fashion-and-beauty

Min J., Jung B. (2023). A Study on the Effectiveness of Chat GPT and Midjourney in Design Education – Focus on the Creation of Story Illustration. *The Journal of Brand Association of Korea, 21(3)* , 347-358

Nyima Jobe(2024, February 8) How AI is 'amplifying creativity' in the fashion world. Retrieved February 12, 2024 from https://www.theguardian.com/fashion/2024/feb/08/ai-london-fashion-week

Seol H. (2023). Research on the Use of Image-generating AI for Design thinking. – Focusing on beauty illustrations work. *The Journal of the Korea Society of Art&Design , 26(4)* , 225-240.

Park G. (2023). Study on the feasibility of using AI image generation tool for fashion design development - Focused on the use of Midjourney. *The Journal of the Convergence of Culture Technology,* 9(6), 237-244.

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DANAMIC DESIGN FOUNDATION TYPE OF SHAPE CHANGING FABRIC USING SHAPE MEMORY ALLOYS

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Introduction

In the field of fashion design, fabric plays a crucial role alongside elements like color and silhouette. Among various products, the introduction of new fabrics enables unique expressions and design innovations, distinguishing them from other products. Furthermore, advancements in cutting-edge materials or processing technologies, which integrate diverse technological elements, enable the generation of fresh design values through the reinterpretation of fabrics.

Lately, the adaptable qualities of smart textile materials have been offering new possibilities within the design field. Smart fabrics are mainly being developed using photochromic fabrics, piezoelectric fabrics, conductive fibers, shape memory polymer, and phase change fabrics. However, the majority of these studies focus on the development of technologies designed to bring about alterations in the mechanical characteristics of textile fabrics used in clothing. Consumers are inclined to buy clothing items that offer more than mere technical functionality, providing fresh visual and tactile experiences. In this context, there is a requirement to advance technology to enable the smart fabric to serve as a creative design element, delivering aesthetic satisfaction. Therefore, the objective of this study is to examine and classify dynamic movement elements within design cases, employing shape memory alloys, and to establish design as a foundational formative element through the incorporation of smart fabric with automatic shape-changing capabilities

Literature Review

Among the numerous studies on smart fabrics capable of automatic shape changes, shape memory alloys (SMAs), distinguished by their cost-effectiveness, operation through electricity and heat, robust strength, and significant deformation capacity, find widespread and active application in diverse fields. Specifically, owing to the dynamic attributes of shape memory alloys, which undergo shape alterations in response to temperature changes, they prove valuable as effective fabrics in the implementation of responsive systems through integration with emerging ICT technology. Shape memory alloys represent a category of smart materials that undergo a conversion of properties, retaining their initial shape and reverting to it when subjected to heating at a specific temperature, even after deformation[1]. Shape memory alloys retain their shape during the high-temperature austenite phase and undergo a transformation during the low-temperature martensite phase. Upon temperature elevation, they revert to the original austenite phase, inducing substantial stress while concurrently exhibiting the characteristic of restoring the initially memorized shape. The manifestation of unidirectionality (memory solely at high temperatures) or bidirectionality (memory at both high and low temperatures) depends on the specific features of the memorized shape. In the case of NiTi-based shape memory alloys (Ni-Ti, Ni-Ti-Co, Ni-Ti-Cu, etc.), the shape recovery temperature can be adjusted to suit the application field from -30℃ to 100℃ depending on the Ni content[2].

Examples of dynamic design applications across various domains involving shape memory alloys include products, architecture, robotics, kinetic installations, medical gloves, catheters, and temperature-controlled curtains or window openers. Representative examples of intelligent smart wear include firefighting suits with variable protection, shape memory shirts for wrinkle-smoothing, and experimental works by Hussein Chalayan[3]. Most of these cases utilize the dynamic characteristics of shape memory alloys for specialized functions, while their application as aesthetic formative elements in fashion design remains exceptionally rare. Hence, with technological advancements, consumer expectations are rising for systems that respond effectively and feature variable designs. The utilization of shape-changing designs incorporating novel movements can be regarded as a technology and design component that holds significant potential as a fresh formative element in fashion design. Therefore, the objective is to examine cases of design incorporating

shape memory alloys, specifically to have the realization process of diverse movements analyzed and categorized. Through this analysis, the aim is to establish shape change movements as a distinctive formative element in the field of fashion design.

Research Method

Design cases of fabrics that automatically change shape using shape memory alloys were collected, and the shape change movements were analyzed and categorized. To achieve this, cases utilizing shape memory alloys were identified from video data sourced through literature research and YouTube searches from September to December 2023, employing keywords such as smart textile, shape memory textiles, new shape-shifting smart textile, and thermal shape memory textile. The principles of operation and morphological alterations were analyzed and classified based on the type and direction of movement, as well as dynamic characteristics, drawing insights from literature and videos.

Results & Discussion

The dynamic design actions of fabric undergoing automatic shape change through the utilization of shape memory alloys were derived from variables such as speed, direction of force, and point of occurrence of force, and vertical, horizontal, non-directional, and radioactive motion direction variables. These were categorized into four distinct modes. The first, bending movement, is the most employed action, involving free or vertical bending. The second, folding movement, shares similarities with bending movement but stands apart by having a fold line extending beyond the bending range. It constitutes a distinct motion, characterized by complete folding. The third, wave movement, where the Shape Memory Alloys wire, initially straightened, contracts in a wave-like pattern toward one or two reference points. Following that is radial movement, characterized by a spring arranged in a radial configuration. This movement entails both horizontal spreading and vertical stretching motions in the radial direction.

Conclusion

This study aimed to establish design as a fundamental formative element by analyzing and categorizing the dynamic movement elements of design cases incorporating smart fabric that undergoes automatic shape changes using shape memory alloys. To achieve this goal, fabric design cases utilizing various shape memory alloys were collected. The shape change movements were analyzed and classified into bending, folding, wave, and radial movements. This effort aims to provide essential data for creating a variety of creative designs with shape memory alloys. The inclusion of automatic shape change movements as a new element in fashion design is expected to encourage innovative applications in this field.

References

Kim, S. & Park, J. (2014). Classifying the Kinetic Characteristics of the Dynamic Design Products Using Shape Memory alloys. Journal of Digital Design, 14(4), 655-663.

Park, J. & Yun, S. (2009). Basic Characteristic of Shape Memory Alloy and Its Application. *Journal of The Korean Society for Fluid Power and Construction Equipments,* 6(2), 34-39.

Kim, S. & Yoo, S. (2016). A Study on Design of an Automatic Switching Gear Using Shape Memory Alloy for the Development of Versatile Ventilation Intelligent Clothing. *Journal of the Korean Society of Design Culture,* 22(3), 59-66

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PHOTO-EDITING APP USAGE MOTIVATIONS

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Introduction

It is an undeniable truth that today's younger generation is inseparable from the presence of social media. Interactions with people are shifted from offline to online spheres, centralized within the screen of one's smartphone. As one of social media's definitive characteristics, visual-oriented features like personal photos and videos are a vital tool for controlling and managing one's impression, and hence the term 'selfie'. The definition of selfie is, "an image of oneself taken by oneself especially for posting on social networks" (Pounders, Kowalczyk, & Stowers, 2016). Through the 'selfie', users generally aim to share attractive pictures on social media to convey an ideal image of the self (Kapidzic, 2013). In the same vein, the process of framing oneself through selfies has led to a rapid proliferation in the use of photo-editing apps. However, current research focus on proving the link between selfie editing and negative body-esteem caused by self-objectification and internalization of hazardous beauty ideals, while fewer have taken a positive, or at least neutral approach on this topic. There remains much potential in investigating the role such editing plays in one's impression management, which in turn, highlights a need to comprehend user's motivations for using such apps through a more detailed inspection of the online environment and nuances of social media.

Literature Review

Social media is defined as social networking sites that enable its users to primarily construct a profile within a bounded system with users whom they share a connection. Research show that people tend to share their emotions to fulfill both the need for personal expression and the need to receive feedback on social media (Choi and Toma, 2014). Thus, the projections of identities online are inherently collaborative, as users not only manage 'self' impressions but also judge the impressions of other users, every interaction between users a cycle of consumption of information and feedback. Through this interdependence, individuals are also able to reflectively adjust their method of impression management to carefully curate their online selves (Hogan, 2010).

Leary and Kowalski (1990)'s motivation process, constituting of three interrelated factors, refers to the extent to which self presenting individuals are motivated to control other's perception of themselves. The first factor, social and material outcomes, means projecting right impressions will significantly increase the likelihood of obtaining one's desired outcomes, interpersonal or material. However, even in situations where no outcomes depend of impressions, individuals are still concerned with other's view of themselves. The fact that people are continually motivated to maintain and enhance their self-esteem, suggest a self-esteem maintenance factor. Individuals act to make impressions that will elicit responses to increase their self-esteem, even in the absence of feedback as self-esteem is still affected by one's own evaluation of oneself. Finally, a development of identity factor is apparent from people's engagement in impression management as a means of creating identities. "Acquiring a particular identity requires the execution of identity-related activities", and hence, individuals participate in 'self-symbolizing' behavior and to consolidate their self approved identity (Leary & Kowalski, 1990).

Research Method

A qualitative approach in terms of methodology was chosen, in which individual in-depth interviews of a total of twenty participants were conducted. Interview participants, both female and male between in their twenties and thirties, were recruited from South Korea, as prior research has suggested that people in Korea consider editing selfies before sharing them on their social media profiles as mandatory. Furthermore, this particular age group considered appropriate in revealing deeper reflections into one's

motivations for using editing apps. Giorgi's descriptive phenomenological method was used for data analysis as it effectively preserves the meaning of phenomena through interview participants' own subjective experience. *The entire research underwent IRB review (IRB No. 2206/002-008).*

Results & Discussion

Results of analyzed data revealed three categories within photo-editing app usage motivations: influence of social media, polishing one's appearance, online acculturation.

The first category is the influence of social media, which is comprised of the themes:

1. Power of social media: The rapid rise of social media has fueled the popularity of viral media content, in which as exposure to new methods of selfie editing online caused users to want to 'try out' the new trend, leading to editing app usage. 2. Social media exposure: An increased exposure to certain types of pictures could convince people to change theirs in the same direction while on another level, social media exposure could also refer to the exposure of the users themselves. Users are visible to people other than their friends and hence social media surveillance is another key factor of exposure.

The second category is polishing one's appearance, which is comprised of the themes:

1. Power of friends: A need to identify with friends was noted, especially if one considered oneself an outlier within the group due to disparities in appearance, resulting in desires to alleviate such discrepancy. 2. I'm so unphotogenic: Participants expressed frustration at how pictures were inadequate in accurately presenting the truly 'good-looking' person they are, claiming that the two-dimensional nature of photos inevitably emphasizes their flaws that tend to be less visible seen in three-dimension. 3. Controlling self-consciousness: Although the extent of concern varied, participants were in agreement that often pictures acted as an unwelcoming reminder of their physical dissatisfactions, pointing out such dissatisfaction could be minimized through the use of photo-editing apps. 4. Difficulties in taking good selfies: Difficulty in taking 'good' selfies was stated to be partially due to different angles of the camera resulting in varied appearances. Specifically, lens distortion was mentioned to cause not only the entire body, but also the face to appear abnormally stretched.

The third category is online acculturation, which is comprised of the themes:

1. Purposeful impression management: Impression management online does not consist of a one-time effort, but instead is a continued course of development. Results stress the importance of a consistent, edited image in not only creating, but also sustaining a focused image of oneself. 2. Affirmation from others: In the social media context, perception of an 'online status' determined by the number of likes or followers was emphasized. Thus, this number functions to convey a sense of confirmation to users on how appreciated they are. 3. Reflection of offline efforts: In real-life, people make investments to enhance their appearance. Editing selfies can be seen as a similar online 'means of grooming', or some even mentioned editing apps can substitute or be considered alternatives to certain real-life activities.

Conclusion

The transformation of interpersonal dynamics has been propelled by the increasing prevalence of online engagement, with social networking platforms serving as focal points in this evolution. Understanding the pivotal role these platforms fulfill is essential, as they not only facilitate communication and social bonding but also serve as tools for one's impression management.

References

Choi, M. & Toma, C.L. (2014). Social sharing through interpersonal media: patterns and effects on emotional well-being, Computers in Human Behavior, 36, 530-541.

Hogan, B. (2010). The Presentation of Self in the Age of Social Media: Distinguishing Performances and Exhibitions Online. Bulletin of Science, Technology & Society, 30(6), 377–386.

Kapidzic, S. (2013). Narcissism as a predictor of motivations behind Facebook profile picture selection. Cyberpsychology, Behavior and Social Networking, 16, 14–19.

Leary, M. R., & Kowalski, R. M. (1990). Impression management: A literature review and two-component model. Psychological bulletin, 107(1), 34.

Pounders, K., Kowalczyk, C. M., & Stowers, K. (2016). Insight into the motivation of selfie postings: Impression Management and self-esteem. European Journal of Marketing, 50(9/10), 1879–1892.

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FACTORS INFLUENCING SELF-PRESENTATATION ON SOCIAL MEDIA

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Introduction

In the past, face-to-face interactions were an essential prerequisite of self-presentation. During these times, the presentation of the 'self' was primarily based on personal appearances and character, such as the way an individual presents oneself through dress or situationally appropriate behavior (Tseëlon, 1992). However, as people spend more time online modes of interactions have shifted, with social networking platforms at the center of this change. While online spaces allow unrestricted experimentation with different domains of the self, the manner in which one presents him or herself essentially parallels the desires of be perceived in a certain way. Previous studies have examined the role of selfie as a representational image and tool for impression management, but there exists a gap in literature in understanding the significance of editing selfies in self-presentation. This current study aims to explore the various factors that impact social media users' desires be viewed in a certain way. Details into the behaviors associated photo-editing apps will be inspected to comprehend how such process shape one's virtual 'self' within the digital domain.

Literature Review

Marks and Nurius (1986) state that the 'self' is "the object of definition, expectation or evaluation", in which an individual's desired identity determines the outcome of possible selves. Possible selves are said to be ideal versions of the 'self' people hope to become, have the potential of becoming, or are afraid of becoming, a representation of specific individual needs, fears, imaginations. Possible selves are not only personal, but also largely social. They are a clear result of comparisons between the individual's thoughts and characteristics contrasted to that of other people, deriving from "the individual's particular sociocultural and historical context", in addition to the individual's "immediate social experiences" (Markus & Nurius, 1986). The social facets of the 'self' is further expanded in Goffman's (1956) theory, in which he claims that often people's engagement in activities is underlined by a strong inclination to control other's views of themselves. Self-presentation is, thus, a goal-directed, both conscious or unconscious process in which one tries to influence another's perceptions of a person, object, or event through the deliberate regulation of information in social situations (Goffman, 1956). People continue to develop a presence on social media, effectively constructing an online version of their self. This self-image is defined as the "total subjective perception of oneself, including the image of one's body and impression of one's personality, capabilities, and so one" (Bailey, 2003). As the most ubiquitous method of photographic self-presentation on social media throughout recent years, the selfie has established itself not only as a means of sociality but also as an efficient tool for personal autonomy. Selfies are public reflections of the way we view and present ourselves, an intriguing combination of inward and outward looking (Kozinets, Gretzel & Dinhopl, 2017). Editing selfies, also referred to as photoshopping or retouching, are a typical preparation process for users prior to uploading an image. Most people who employ editing techniques do so for a coordinated presentation of the self, correlating with their construction of identity and online social interactions.

Research Method

A qualitative approach was selected, in which a total of twenty individual in-depth interviews were conducted with active Instagram users in their twenties and thirties who with the experience of using photo-editing apps. Active use of social media was a perquisite important to ensure sufficient insight into the topic, and although there was an imbalance in gender, this was viewed to accurately reflect the actual user ratios of editing apps. Giorgi's descriptive phenomenological method was used as the frame for data

analysis as it effectively preserves the meaning phenomena this study wishes to understand through interview participant's own subjective experience. *The research was conducted upon receiving IRB. (IRB No. 2206/002-008).*

Results & Discussion

Results of analyzed data revealed five categories within influencing factors of self presentation: self autonomy factors, nature of social media medium factors, personal perspective factors.

The first category, self autonomy factors, is comprised of two key themes: sense of 'self' and manipulated 'self'. This study revealed three main components of one's sense of 'self' present in selfies. Firstly, the reflection of who I am, signifies how selfies are essentially a representation of the subject within the picture, constructing an online identity that is contingent upon their actual identity. Secondly, selfies are also reflection 'who I want to be'. This did not largely deviate from one's perception of his or her actual 'identity', referred to as an ideal image based on the best possible version of 'who I am' or 'who I can be'. Thirdly, the reflection of 'how I want others to view me' demonstrated a desire to control other's impression, as participants explained how the elements of a selfie and its editing collaboratively function to convey uniform image that one wishes for other people to perceive. The distinction between sense of 'self' and manipulated 'self' is that while the former is a reflection of how one thinks of oneself, the latter is a selective display of certain characteristics of an individual with the intent of emphasizing a desired feature. Another attribute of the manipulated 'self' was noted as prioritizing one's online identity to offline identity, supported by participant's intensified need to live up to their pictures in real life.

The second category, nature of social media medium factors constitutes of the themes: feature-based and audience-based. On Instagram, two key visual communication methods were identified. It has been explained that the specific features of stories and feed are very distinct in their purposes; the former is more immediate and inviting of interactions, as whatever you post can be viewed and responded to by other users. The latter is said to play a more influential role in one's first impression of the user, as while stories are short-lived, posts of feeds are permanent, unless removed by the user themselves. An interesting term brought up during interviews was 'feed-worthy', indicating whether a content was considered as meeting the criteria of something that is worth being posted on one's feed.

The third category, personal perspective factors, includes the themes: personal evaluation of attractiveness and personal taste. The criteria for attractiveness could be mainly categorized to those more subjective and others more associated with societal perceptions. A personal standard was one's self-perceived flaws, which were not apparent to others, but a source of irritation one's own self. The standard of attractiveness associated with societal perceptions were the influence of age and changing perceptions on one's personal assessments of him or herself. Participants commented on how their decisions on how to edit their selfies does not remain static, as changes in preferences altered what is relevant to their desired online image.

Conclusion

It is crucial to recognize the multifaceted role of social networking platforms, not only as avenues for interaction and socialization, but also as essential tools for projecting desired impressions and shaping one's personal identity. Selfies uniquely empower individuals to position themselves as the focal point of communication, allowing for the unrestrained expression of their sense of self through visually curated identities. The results of this study hold significant implications for understanding how individuals construct and navigate their online identities through editing apps within the social media context.

References

Bailey, J.A. (2003), Self-image, self-concept, and self-identity revisited. Journal of The National Medical Associated, 95 (5), 383-386.

Goffman, E. (2002). The presentation of self in everyday life. 1959. Garden City, NY, 259.

Kozinets, R., Gretzel, U., & Dinhopl, A. (2017). Self in art/self as art: Museum Selfies as identity work. Frontiers in Psychology, 8.

Markus, H. & Nurius, P. (1986), Possible selves. American Psychologist, 41, 954-969.

Tseëlon, E. (1992). Self presentation through appearance: A manipulative vs. a dramaturgical approach. Symbolic Interaction, 15(4), 501–514.

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Poster Session 4.
Textile Science & Technology

TRADITIONAL NOMAD ECO-MATERIALS AND MODERN APPLICATIONS

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Introduction

Eco-materials are natural, biodegradable, non-toxic and sustainable materials. An example of this material, sheep's wool felt, its characteristics, traditional and modern technologies of manual processing, applications, and opportunities to improve the properties of felt materials for clothing are written in this article. In modern times, people's lifestyles have changed, preferring to live healthy, proper, simple and comfortable lives. Felt is an eco-material that has been widely used by nomads and Mongolians, and it has been proven by centuries of experiments to be a natural, clean, recyclable and sustainable material. The fact that the traditional technology of felting developed by the nomads has now developed into an art and is enriched with new technologies shows that people's thinking recognizes that the creation and use of eco-products is a condition for more sustainable development. Researching the possibilities of making felt clothes, highlighting the technological and application requirements for it, the results of testing two materials for making clothes are reflected.

The main principle of the nomads' life is the principle of taking little by little from nature, using it productively, processing it in an environmentally friendly way and then using it again for a long time. The nomadic culture was and still is a form of living in harmony with the environment, in close connection with nature, wildlife and animal husbandry.

Felt material is formed during the process of spinning wool fibers by mechanical action. During this process, different fibers and other materials can be added to create a unique surface.

There is a high demand for products made from natural materials in the international market. Processing industries in Mongolia are developing well, but 90 percent of washed and combed wool is exported directly. We can produce finished products and export them with added value, which is important for the economy. As the art and technology continue to improve, nowadays felt is used to design everyday items, souvenirs, decorative items, and knowledge-infused innovations.

Types and uses of felt materials

Felt clothing is popular with consumers for its positive qualities such as lightness, softness, and good warmth retention, and is also attracting the interest of fashion designers and designers who are always looking for new things. It can be considered that this is due to the dominance of material design trend in 21st century clothing design and design. The thinner the felt, the more luxurious it will be, and felting mixed with materials such as multi-grain, fine thread, cocoon silk, and felting for durability create interesting new materials and create even more exotic fashion ideas. Felt can be used for clothing and accessories. According to the technology of making felt products, they are classified as flat (turagu, turban, pelt, scarf), voluminous (hats, shoes, bags), and solid (balls, sculptures, etc.).

It is important to correctly calculate the pattern, because the original shape of the volume felt product is usually used in it. The normal basic size of shoes, gloves and hats depends on the size of the feet, hands and head. Also, taking into account that shrinkage occurs during the felting process, add an additional amount of shrinkage (A) to the basic size. This is similar to calculating stitch placement on a soft sewing needle. For lamb and fine wool A = 1.5-2 cm. Therefore, before making felt products, if you test how the amount of wool shrinkage depends on the type of wool and the thickness of the wool, you will be able to make the desired design without losing the size.

The amount of this shrinkage depends on the type of wool, its physical and mechanical properties, and the amount of moisture and heat applied by the compressing force.

There are two categories for making clothes with felt: making clothes with closed felting, and making clothes with felting by preparing panels.

A. How to make closed felt clothes:
When making closed felted clothes, first prepare the felt and calculate the shrinkage percentage very well. Due to the closed felting, there are no seams.

Figure 1. Clothes made by felting

B. Garments to be made by knitting and felt quilting
When making clothes using the felt method, first prepare the felt using the flat method. Then draw the felt on the felt material, cut it and sew it. It will be more suitable for you to make it without sewing, so you can shrink the sewing area by wearing it on a mannequin

Figure 2. Garments made by knitting.   Figure 3. Felt quilting

There are certain requirements to control the quality of any product, which determines its competitiveness in the market.We used theoretical and comparative research and experimental methods in this research.
We made an experiment paying attention on the following matter: how can improve the quality and durability of felt products? In our country, two methods have been tested to make the felt stronger and to hold it without losing its shape. It includes:

1. Sew the felt: One technology that makes felt material last longer is felting. The durability was extended by sewing the square until it was filled with various national motifs
2. Pull the wool thickly to complete the contraction: Many disadvantages have been observed in making clothes by these methods. While researching the possibility of making felt thin and strong, the method of felting wool mixed with fibers and fibers was tested.

Diagram 1.
Percentage of shrinkage

Using this material to make clothes, the characteristics of use are highlighted and compared in a simple way. The heat retention quality of the above two types of felt clothing was relatively the same. It can be seen from this that in the production of felt material, mixing felt with other fibers and fibers shows the possibility of improving the quality, and it is important to choose the right moisture and heat treatment for it. If the felt material is not properly cleaned, the product will stretch and shrink in most cases.

Conclusion

While studying the historical development of felt products, Mongolians have used felt products widely and still use them widely. Felt is an eco-friendly material that can be recycled.

The technology of making clothes from felt material directly depends on the methods of felting wool. An eco-material with the properties of creating the desired shape is felt.

Based on the research, to improve the quality of felt for clothing, we tested the felting method using threads, and it was found that heat retention is relatively the same, and it is better in terms of surface and structural changes.

In the future, it is considered important to study the possibility of mixing wool with various materials to create felt material.

References

Badamkhatan.S (2012) Ethnography of Mongolia. Volume I, Ulaanbaatar.

Batchulun. L. (1999). Mongolian felt quilt. Ulaanbaatar.

Batchuluun.S. (2011) Tracing the Art and Cultural Trails of Nomads. Ulaanbaatar.

Songino.Ch (1989) Mongolian women's art. Ulaanbaatar.

Yadamjav.Ts (2004) Mongolian folk crafts. Ulaanbaatar.

Gantuya. P. (2003). Woolen woolen goods. Blacksmith-Mt.

Myra. D. (2000). Wool dyeing technology. Ulaanbaatar.

 Myagmar. L. (2006). Origin and development of Mongolian felt and felt products. Ulaanbaatar

Erdenetsetseg.B. (2011). Felt crafts. Ulaanbaatar.

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ANALYSIS OF MIDSOLE FOOT PRESSURE IN RUNNING SHOES WITH DIFFERENT 3D PRINTED BIONIC STRUCTURES

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Introduction

Presently, there is a notable interest in soft materials within 3D printing technology, warranting further exploration due to their exceptional performance in the realm of footwear technology (Clermont et al., 2023; Zolfagharian et al., 2021). Notably, recent studies have substantiated that the mechanical properties of meta-materials like bionic structure primarily hinge on their structural composition rather than their chemical makeup(Sun et al., 2020). This underscores a shift in focus towards understanding and optimizing the structural nuances of materials in 3D printing technology, particularly in the context of midsole design. To understand existing research on midsole design and foot pressure analysis with the rapid development of 3D printing technology and materials, there are control tests to study variables such as material and printing temperature, printing structure, etc (McCormic et al., 2013; Xu et al., 2017). This type of analysis is crucial for understanding how different shoe designs may affect comfort, performance, and injury prevention. Thus, this study delves into the intriguing possibility of different cushioning performances arising from the creation of a bionic structures like Tyson polygonal structure. This study proposed three types of shoe midsole design for running shoes applying Tyson polygonal of bionic meta-materials inspired by aquatic plants of nature. Further, we purposed to verify the performance of the midsole for running shoe applied Tyson polygonal. It was confirmed that bionic structures grant and enhance distinct cushioning outcomes for the midsole by plantar pressure test.

Research Method

In this study, we selected thermoplastic polyurethane (TPU, TPU-95A, eSun, China) filament with Shore 95 A for hardness and 1.75 mm for diameter. For manufacturing midsole with bionic structure, fused deposition modeling (FDM) 3D printer (Cubicon single plus 320C, Cubicon Inc., Korea) with 0.4 mm nozzle size was used. First, from the normal women's foot model of 230mm sizes, three types of shoe midsole design applied bionic structure (Regular Voronoi Diagram, Irregular Voronoi Diagram, Polygonal Bubble) were modeled using 3D modeling program (Rhino 7, Robert McNeel& Associates, USA) and saved to .stl format. And the modeling was converted to .g-code using slicing program (Cubicreator 4V 4.4.0, Cubicon Inc., Korea) and printed using FDM 3D printer. Printing conditions were nozzle temperature 225 ℃, bed temperature 65 ℃, printing speed 60 mm/s, infill density 100%, and infill pattern Zigzag. The manufactured three types of midsole applied bionic structure was subjected to a plantar pressure test. Twelve healthy female subjects were recruited to participate. For the test, the plantar pressure analyzer (Materialise, Belgium) and foot scanner (Alchemaker, Korea) were used to record the data and measure the plantar pressure, force, and stress distribution. The experimental conditions are as follows: number of sensors 4096; pressure range 1-127 N/cm^2; data acquisition frequency 300Hz. The plantar pressure test was conducted barefoot and wearing three types of midsoles. And when performing four movements as walking, running, and jumping, data from 10 areas (T1, T2-5, M1, M2, M3, M4, M5, MID, HL, HM) were compared and analyzed. The data was used by average and analyzed by two-way repeated measures ANOVA with the SPSS 27.0. All analyses of the significance level were set at $p < 0.05$. And this study was carried out in accordance with the recommendations of the University's Research Ethics Board (RIB 2-1040709-AB-N-01-202311-HR-048-03) with written and informed consent from all participants.

Results & Discussion

Plantar pressure test results were compared for each sample and motion. The comparative analysis results for each sample are as follows. There were significant differences in the peak plantar pressure between

barefoot and wearing three 3D printed midsoles: FF, T-zone, M1-4 zone, and barefoot and triple midsoles. In the T2-5 region, the mean differences between S1 and S2 and S3 were 36.905 (P=0.003) and 51.372 (P=0.007), respectively. In the MF, the mean differences between barefoot and three midsoles were -152.555 (P=0.009), -149.433 (P=0.001), and -93.926 (P=0.001), respectively. The mean difference between S2 and S3 was 55.507 (P=0.007), which was significantly different. In the HM area, the mean differences between barefoot and the three midsoles were -152.555 (P=0.009), -149.433 (P=0.001), and -93.926 (P=1.001), respectively, all of which were significantly different. The mean difference between S2 and S3 was 55.507 (P=0.007), which was significant. In addition, it was found that there was no significant difference between the M5 region and the HL region, barefoot and printed midsole samples. In contrast, there were significant differences between barefoot and the three groups in the T1, M2, M3, MF and HM. The difference between the peak force of S1 and S2 is mainly in T2-5 and M1. The differences in peak force between S1 and S3 were mainly in T1, T2-5 and M2. The significant differences in the peak force of S2 and S3 were mainly in the M3, MF and HM. There was no significant difference in the peak force between barefoot and the three samples in the M5 and HL. The comparative analysis results for each operation are as follows. The pairwise comparison of the peak foot pressure of the three motions were as follows: in the FF, there were significant differences between walking and running at T1, M1, M3, and M4. In the MF, the average difference between walking and running was -145.314 (P=0.002), the average difference between walking and jumping was -228.712 (P=0.001), and the average difference between running and jumping was -83.398 (P=0.045). The mean difference between walking and jumping was -113.184 (P=0.01) and -94.818 (P=0.001) in the hindfoot and HM, and -94.818 (P=0.001). In the HL, the average difference between walking and jumping was -112.924 (P=0.019), and the average difference between running and jumping was -68.690 (P=0.005). There was a significant difference in the peak pressure in MF among the three states of walking, running and jumping. Significant differences between walking and running were mainly reflected in the T1, M1, M3 and M4 regions. Walking and jumping are mainly reflected in the M1, M4, M5 and HL; The significant difference between running and jumping is mainly reflected in the HM and HL. For some plantar zones, none of them showed a significant change in plantar pressure. There was no statistically significant difference in the peak force between T2-5 and M2.

Conclusion

The results of this study show three types of shoe midsole design applied bionic structure has different mechanical effects on the foot. The bionic structure midsole significantly reduces plantar pressure compared to barefoot. When small mechanical effects need to be generated in all areas of the foot, Tyson polygon structure sample 1 was found to be the most suitable device; However, this is limited to the comparison of different samples. Therefore, when designing the midsole structure of a running shoe for athletes, it is necessary to determine the structural characteristics of the midsole, as even the same material can produce different mechanical effects depending on the printed structure, as our research has proven.

Acknowledgment

References

Xu, C., Wen, X.-X., Huang, L.-Y., Shang, L., Cheng, X.-X., Yan, Y.-B., & Lei, W. (2017). Normal foot loading parameters and repeatability of the Footscan® platform system. *Journal of Foot and Ankle Research*, 10(1), 30–30.

McCormick, C. J., Bonanno, D. R. & Landorf, K. B. (2013). Effect of custom and prosthetic foot orthoses on plantar pressure. *Journal of Ankle Research*, 6(1), 19-19.

Sun, X., Lam, W.-K., Zhang, X., Wang, J., & Fu, W. (2020). Systematic Review of the Role of Footwear Constructions in Running Biomechanics: Implications for Running-Related Injury and Performance. *Journal of Sports Science & Medicine*, 19(1), 20-37.

Zolfagharian, A., Lakhi , M., Ranjbar , S., & Bodaghi, M. (2021). Custom sole design and modeling, moving towards 3D printing. *International Journal of Bioprinting*, 7(4), 396-396.

Clermont, C., Barrens, Z. B., Esposito, M., Dominguez, E., Curlo, M., Wannop, J. W. and Stefanyshyn, D. (2023). Effect of midsole shear on running economy and smoothness of 3D printed midsoles. *Sports Biomechanics*, 22(3), 410-421.

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ELECTRICAL OUTPUT PERFORMANCE OF 3D PRINTED TRIBOELECTRIC NANOGENERATORS WITH VARIOUS TYPE OF CARBON MATERIALS/THERMOPLASTIC POLYURETHANE FILAMENTS

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Introduction

Triboelectric nanogenerators (TENGs), one of the sustainable self-generating devices, are flexible nanogenerator devices that generate electricity by triboelectric and electrostatic induction from mechanical friction motion, oscillatory motion, rotational motion, and expansion/contraction motion. TENGs are devices manufactured to facilitate friction between two different materials and utilize the electrostatic effect generated during friction. When they come into contact, the surfaces of the two materials become charged. Conversely, when they are separated, compensating charges accumulate due to electrostatic induction, and current flows through an external circuit. In particular, in the case of single electrode mode, it can be manufactured simply by using one electrode and one dielectric. Therefore, in this study, we attempted to manufacture by FFF 3D printed soft TENGs using three electrodes and two dielectric materials. The structure was manufactured in two types: solid and re-entrant. And the re-entrant had electrodes in two directions: 0° and 90°. The characteristic analysis sought to confirm the applicability of the TENGs electrode as a smart actuator for wearable devices by checking the capacitance, impedance, current density-electric field characteristics, and output voltage characteristics.

Research Method

In this study, three electrodes and two dielectric materials were used to manufacture 3D printed soft triboelectric nanogenerators. The electrode used filaments of three materials, TPU(eFlex, Shenzhen Esun Industrial Co. Ltd., China), GR/TPU(AIMPLAS, Spain), and CB/TPU(RECREUS, Spain), with a diameter of 1.75 mm. Polyester fabric(Dong Jin Co., Ltd., Korea) and PTFE film(Alphaflon Co., Ltd., Korea) were used as dielectric materials. PET double-sided tape was used as an adhesive to attach the electrode and dielectric. Next, FFF(Fused filament fabrication) 3D printing was applied to manufacture 3D printed metastructure-type electrodes using 3D printed carbon/TPU. The sample size was $50 \times 50 \times 1$ mm^3, and the solid structure and re-entrant structure were 3D printed. The 3D printing output conditions were TPU nozzle temperature of 230℃, GR/TPU and CB/TPU nozzle temperature of 250 ℃, bed temperature at room temperature, infill density of 100%, and infill pattern Zigzag. The manufactured electrode was attached to a dielectric with a size of 40×40 mm^2. Characteristic analysis confirmed capacitance, impedance, current density-electric field characteristics, and output voltage characteristics. The capacitance and impedance of the samples was measured using a HIOKI-IM 3570 high-precision impedance analyzer at a frequency of 1 kHz and a voltage of 1 V at room temperature. For current density-electric field characteristics, Keithley source meter 2410 (Tektronix Inc., Korea) was used. The sample was placed between two electrodes, and one cycle was measured with a maximum electric field of 10 V/cm. The output voltage characteristics were determined using the lab's own piezoelectric measurement device and DAQ data monitoring program. The output voltage value when 1.2 Hz was applied using an external load of 1 N was used.

Results & Discussion

For capacitance, TPU value ranged from 6.0×10^{-10} to 1.4×10^{-9} pF. In the case of GR/TPU, the solid electrode was about 1.2×10^{-8} pF, and the rest were in the range of 1.0×10^{-9} to 4.0×10^{-9} pF. For CB/TPU, the solid electrode was about 2.3×10^{-8} pF, and the rest were in the range of 1.6×10^{-9} to 1.0×10^{-8} pF. For impedance, as the frequency increases, it decreases to 0 from the range 1×10^5 to 3×10^5 Ω for TPU, 1×10^4 to 2×10^4 Ω for GR/TPU, and 1×10^2 to 1×10^5 Ω for CB/TPU. Therefore, it was confirmed that electrostatic capacitance and impedance were excellent in the order of CB/TPU > GR/TPU > TPU. As the structure, solid had better conductivity than RE. In the case of the RE structure, the capacitance at 0° was

confirmed to be larger. And when a dielectric was attached, the capacitance was found to be small due to the effect of the dielectric having insulator properties. The current density-electric field were confirmed to have non-conductor properties because the electric field and current density do not show a proportional relationship in the case of TPU. The electrodes of the piezoelectric elements of GR/TPU and CB/TPU showed a proportional relationship between electric field and current density. In the case of a piezoelectric element with a dielectric attached, the value was less than 0.001 nA/cm^2 at 10 V/cm. In the case of output characteristics, when 1.2 Hz was applied using an external load of 1N, the output voltage of the TPU piezoelectric element was not measured. For piezoelectric elements made of GR/TPU, the output voltage was measured to be 1.26 V for the solid structure and 0.62 – 0.74 V for the RE structure. In the case of piezoelectric elements made of CB/TPU, the solid structure was measured at 1.39 V and the RE structure was measured at 0.67 – 0.86 V, confirming that it can be used as a piezoelectric element.

Conclusion

This study was conducted as basic research to manufacture 3D printed soft TENGs. The 3D printed soft TENG manufactured using three electrodes and two dielectric materials had excellent electrical properties in the order of CB/TPU > GR/TPU > TPU, and the electrodes were confirmed to have excellent conductivity. When attaching a dielectric, it was confirmed that the capacitance was low, the impedance was high, and the current density was low due to the effect of the dielectric having insulator properties. However, both 3D printed soft TENGs made of GR/TPU and CB/TPU showed an output voltage of more than 0.6 V when compressed to 1 N. In particular, when dielectric PTFE was attached, the highest output voltage value was observed. Therefore, it was confirmed that it can be used as a TENGs.

Acknowledgements

References

Divakaran, N., Kumar, P. V. A., Mohapatra, A., Alex, Y., & Mohanty, (2022). S. Significant Role of Carbon Nanomaterials in Material Extrusion-Based 3D-Printed Triboelectric Nanogenerators. *Energy Technology*, 11(3), 2201275.

Kim, H., Lee, S., & Kim, H. (2019). Fabrication and electrical output performance of triboelectric nanogenerators composed of graphene coated textile electrode-dielectric material types. *Textile Science and Engineering*, 56(6), 350-359.

Kim, M., & Kim, H. (2023). Triboelectric nanogenerator of 3D printed textile structure for energy harvesting application. *The Journal of The Textile Institute*, DOI: 10.1080/00405000.2023.2201915.

Wajahat, M., Kouzani, A.Z., Khoo, S.Y. et al. (2022). A review on extrusion-based 3D-printed nanogenerators for energy harvesting. *Journal of Materials Science*, 57, 140–169.

Yang, B., Xiong, Y., Ma, K., Liu, S., & Tao, X. (2020). Recent advances in wearable textile-based triboelectric generator systems for energy harvesting from human motion. *EcoMat*, 2(4), e12054.

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IMPACT OF UV IRRADIATION ON TEXTILE FINISHING USING SPENT COFFEE EXTRACT

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Introduction

Researchers have explored several novel sustainable finishing agents derived from natural materials via eco-friendly procedures; these finishing agents can replace those currently used in textile production practices. However, natural dyes have commercial limitations owing to their low dye uptake during the dyeing process and low color fastness to light, temperature, and washing (Harsito et al. 2021). One such well-established technique is photochemical oxidation, in which ultraviolet (UV) radiation is used to eliminate organic contaminants from polymer surfaces and increase surface reactivity. This investigation attempted to enhance fabric processability during finishing or dyeing with spent coffee extract (SCE) using UV irradiation. Therefore, wool and cotton fabrics were subjected to a UV pretreatment, followed by finishing with SCE using an exhaustion method. Subsequently, the treated fabrics underwent comprehensive evaluations encompassing color appearance, mechanical properties, functionality, and other pertinent factors.

Research Method

Wool and cotton fabrics were then irradiated with UV light (wavelength: 254 nm) for 5 or 15 h. Each piece of fabric was immersed in a vessel containing a stock solution of the SCE (bath ratio = 1:20). A laboratory-scale infrared (IR) dyeing machine was used for finishing. The temperature was gradually increased at a rate of 3 °C/min to 100 °C and then maintained at 100 °C while the vessels were rotated at 45 rpm for 1 h. Next, the finished fabrics were thoroughly rinsed with deionized water and completely dried.

Results & Discussion

In this study, UV irradiation was conducted to pretreat textiles to improve their affinity toward natural dyes. This strategy was based on the hypothesis that UV exposure would enhance the reactivity of the fabrics, thereby strengthening the coloring and functionalization effects during wet processing. Both wool and cotton fabrics were subjected to UV irradiation, followed by treatment with a SCE. The treated fabrics were analyzed to evaluate the changes in color, mechanical properties, and functionality. In addition, the study confirmed that when SCE was used as a stock finishing solution, it contained active constituents and had a total phenolic content of 2.15 mg (gallic acid equivalents)/g, a total flavonoid content of 1.99 mg (catechin equivalent)/g, and an antioxidant capacity of 2.33 mg (ascorbic acid equivalent)/g. When the wool and cotton fabrics were finished with the SCE after UV irradiation, the coloring effect significantly strengthened with the increasing duration of UV irradiation, as evidenced by the increases in the a* and b* values and decreases in the L* value. In addition, the tensile strength of the fabrics decreased with increasing duration of UV irradiation. These color and mechanical changes were more extreme in the wool fabrics than the cotton samples. However, the cotton fabrics finished with the SCE after UV irradiation exhibited better antimicrobial properties than the corresponding wool samples. Conversely, the wool fabrics treated in this manner exhibited higher antioxidant capacity than the cotton fabrics. Therefore, it is reasonable to conclude that the coloring-related compounds present in the SCE contribute to its antioxidant capacity and have a stronger affinity toward wool proteins. Conversely, some of the compounds responsible for the antibacterial properties of the coffee extract appeared to be less related to coloration and instead exhibited a greater affinity toward cotton cellulose.

References

Harsito, C., Prabowo, A.R., Prasetyo, S.D., Arifin, Z. (2021). Enhancement stability and color fastness of natural dye: A review. Open Engineering, 11(1), 548-555.

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IN-SITU FABRICATION OF CONDUCTIVE METAL-ORGANIC FRAMEWORKS ON COPPER MESH

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Introduction

The increasing interest in healthcare has inspired the development of sensing systems for detecting harmful gases such as NH_3, SO_2, and volatile organic compounds (VOCs). Several methods have been suggested for gas sensing, including electrochemical, piezoelectric, and chemiresistive measurements. Among them, a chemiresistive sensor is the most widely used method due to its simplicity in electrode fabrication, low power consumption, and ease of integration with standard electronics. Chemiresistive responses translate chemical information through changes in electrical resistance induced by the movement of electrons between target analytes and the sensing material. As a sensing material, metal-organic frameworks (MOFs), composed of metal clusters and coordinated with organic ligands, exhibit great potential chemiresistive sensing applications due to their extensive surface area and tunability, which leads to superior sensitivity. MOFs are generally non-conductive because the organic ligands act as insulating components, and this issue was addressed by using graphene-like hexahydroxytriphenylene (HHTP) with 2D π-conjugation structure as an organic ligand of MOFs. The low solubility of such 2D conductive MOFs in common solvents complicates the drop-casting process onto interdigitated electrodes. Accordingly, this study aims to develop an in-situ synthesis method for Cu-HHTP MOF using a copper mesh as a substrate to facilitate bonding with organic ligands. The electrical resistance before and after SO_2 gas was evaluated to probe the potential applicability of Cu-HHTP as a gas sensor. This study is significant in that it involves the growth of MOFs directly on the substrate for detecting harmful gases.

Literature Review

As sensing materials, most MOFs possess high porosity and large surface area for the absorption of analytes; however, due to their low electrical conductivity, extensive research has been reported on achieving efficient charge transport [1]. For instance, Cu-HHTP, which has a planar graphene-like honeycomb lattice with open pores, can be endowed with conductivity through 2D π-conjugation, which is beneficial for high charge mobility [2]. Therefore, a chemiresistive gas sensor with Cu-HHTP was used, demonstrating enhanced conductivity through electrical resistance signals.

Research Method

To prepare Cu-HHTP on the copper mesh, the surface of the copper mesh was oxidized to grow $Cu(OH)_2$ nanowire. The copper mesh was immersed in a mixed aqueous solution of 2 M NaOH and 0.1 M $(NH_4)_2S_2O_8$ for 20 min. After the growth of $Cu(OH)_2$, $Cu(OH)_2$ on Cu mesh was immersed in a mixture solution of DMF and distilled water (v/v=10:1) containing 30 mg of HHTP. The reaction was conducted in 70 ℃ oven for 1 hr to obtain Cu-HHTP on Cu mesh. The sample was characterized by scanning electron microscopy (SEM) and X-ray diffraction (XRD) analysis. The electrical resistance of the developed material was measured using an electro-multimeter. The electrical conductivity before and after SO_2 was measured.

Results & Discussion

The morphology of Cu-HHTP on oxidized copper mesh was characterized by SEM. As a result of the oxidization of copper mesh, $Cu(OH)_2$ nanowires were vertically grown on the copper mesh with a height of around 3.8 μm (Figure 1a). A Figure 1b showed the flower-like Cu-HHTP crystals on $Cu(OH)_2$ nanowire.

Figure 1. SEM image of (a) Cu(OH)₂ on Cu mesh, (b) Cu-HHTP on Cu mesh, and (c) XRD patterns of Cu mesh, Cu(OH)₂ on Cu mesh, and Cu-HHTP on Cu mesh

To confirm the successful synthesis of Cu-HHTP, the XRD pattern was analyzed at each step of the reaction. Figure 1c exhibited the peaks at 23.9°, 34.2°, 39.8° and 53.5°, corresponding to the (021), (002), (130), and (132) crystal planes of Cu(OH)₂. The characteristic peak of Cu-HHTP at 4.8°, 9.6° and 28.0°, corresponding to the (010), (020), and (001) crystal planes of Cu-HHTP on Cu mesh demonstrates that Cu-HHTP was successfully synthesized on the copper mesh.

Table 1. Resistance and response of Cu mesh, Cu(OH)₂ on Cu mesh, and Cu-HHTP on Cu mesh

Sample	Resistance (mΩ)	Response (%)
Cu mesh	0.5	-
Cu(OH)₂ on Cu mesh	1.2	24.7
Cu-HHTP on Cu mesh	0.8	31.5

In each synthesis step, the electrical resistance was measured using an electrical multimeter. While the untreated copper mesh showed a resistance of 0.5 mΩ, the oxidized Cu(OH)₂ on Cu mesh showed higher resistance of 1.2 mΩ. Subsequently, the resistance was decreased to 0.8 mΩ as the Cu-HHTP was synthesized. This indicates that the incorporation of Cu-HHTP enhanced the conductivity. The resistive response was observed for Cu-HHTP material toward SO₂ gas. Cu-HHTP on Cu mesh showed an approximate 6.8% increase in the resistance compared to the Cu(OH)₂ on Cu mesh, showing the possibility of using Cu-HHTP as a SO₂ gas sensor.

Conclusion

In this study, conductive MOF Cu-HHTP was synthesized on copper mesh. The developed material showed high conductivity and possible application of the chemiresistive sensor against SO₂ gas. This approach suggests fabrication strategy for designing conductive MOFs on Cu mesh with improving sensing response.

References

Jo, Y. M., Jo, Y. K., Lee, J. H., Jang, H. W., Hwang, I. S., & Yoo, D. J. (2023) MOF-based chemiresistive gas sensors: toward new functionalities. Adv Mater. 35, 2206842.

Lüder, L., Gubicza, A., Stiefel, M., Overbeck, J., Beretta, D., Sadeghpour, A., Neels, A., Nirmalraj, P, N., Rossi, R, M., Toncelli, C., Calame, M. (2022) Conductive Hybrid Cu-HHTP-TCNQ Metal–Organic Frameworks for Chemiresistive Sensing. Adv. Electron. Mater. 8, 2100871.

Acknowledgments

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RESEARCH ON THE UTILIZATION OF FUNCTIONAL NATURALLY DYED FABRICS AS FASHION MATERIALS AND ECO-PRINTING APPLICATION

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Introduction

Recently, research and technology development on eco-friendly dyeing methods have been steadily progressing. In addition, research on "Eco-printing," which can effectively display the unique colors and patterns of plants on fabrics, has recently attracted attention. Eco-printing is a technique in which plant parts such as leaves and flowers are directly contacted with fabrics and then dyed by heat treatment. Unlike the existing method of dyeing by extracting salt solution from natural materials, this method goes one step further and directly imprints the shape of the plant as a pattern on the fabric. In this study, we examined the possibility of utilizing eco-printing on cotton fabric dyed with persimmon juicer as a fashion material and environmentally friendly health functional material.

Literature Review

Persimmon is native to Korea, Japan, and China, and is cultivated in Korea mainly in Jinyeong, Sangju, Cheongdo, and Jeju, and is used for food, dyeing, preserving, and processing (Huh et al., 2008). As dyeing with persimmon has been rediscovered as a dye for traditional dyeing, studies on the dyeability, color fastness evaluation, and effect on fabric attitude of cotton fabric dyed with persimmon juicer have been reported (Ko and Lee, 2003; Han, 2005; Han & Lee, 2010), and evaluation of persimmon juice dyed materials by hjuiceuman wear test (Park and Kang, 2014), but few studies have investigated the potential of cotton fabric dyed with persimmon as a fashion material and utilization as a health functional material.

Research Method

A 100% cotton fabric is dyed by applying Shin's (2009) dyeing method using astringent persimmons collected from early July to early October, eucalyptus leaves are placed on top of the dyed fabric, another piece of dyed fabric is woven to cover the dyed fabric, and the fabric are covered with plastic, rolled into a stick, secured with a bandage, and steamed in a steamer for 3 hours. After steaming for 3 hours, unroll, wash and dry. Dyed cotton fabrics printed with eco-printing should be tested for K/S value (Color-Eye 3100, Macbeth), antibacterial properties (Staphylococcus aureus, ATCC 6538, Klebsiella pneumoniae, ATCC 4352), deodorization (gas detector method), stretchability (cantilever method, KS K 0538), drapability (Cusick Drape Tester, KS K 0815 E method), and color fastness (Sunlight: KS K ISO 105-B02:2014, Washing: KS K ISO 105-C06:2010 A2S, Dry cleaning: KS K ISO 105-D01:2010, Perspiration: KS K ISO 105-E04:2013, Rubbing : KS K 0650-1:2017).

Results & Discussion

 K/S value of the cotton fabric dyed with persimmon was 6.89, and the surface color was slightly turbid and dark yellow red with color 4.0YR, brightness 4.3, and chroma 4.2. In addition, the dyed cotton fabric showed perfect antibacterial ability of 99.9% against Staphylococcus aureus and Pneumocystis carinii, and the deodorization rate was over 99%, confirming the functionality of the dyed cotton fabric. On the other hand, the stiffness of the dyed cotton fabric was three times that of the un-dyed cotton fabric, and the drapability was 85% before dyeing and 70% after dyeing, indicating that the dyed cotton fabric was less drapable than the un-dyed cotton fabric. The color fastness of the dyed cotton fabric showed good results of 3~5 for washing, 4~5 for dry cleaning, and 3~4 for perspiration.

Conclusion

Cotton fabric dyed with persimmon showed excellent antibacterial and deodorizing properties, confirming its applicability as a health functional material. In addition, as a result of the evaluation related to the

appearance of the fabric such as the stiffness and drape of the persimmon-dyed cotton fabric, it was confirmed that the persimmon-dyed cotton fabric was a stiff fabric compared to before dyeing and was suitable for fashion materials with a design that did not require drape. In addition, eco-printing was performed on the sensitized dyeing fabric to confirm the possibility of using it as a fashion material and an environmentally friendly health functional material.

References
Kim, G. (2020). Study on the Korean fashion industry. *The Journal of Fashion*, 15(3), 120-135.
Han, M. R. & Lee, J. S. (2010). Natural dyeing and dyed fabrics properties with persimmon juice. *Journal of the Korean Society for Clothing Industry,* 12(2), 224−232.
Han, Y. (2005). The Antibacterial Activities of Persimmon Juice and Persimmon Juice Dyed Cotton Fabrics. *Family and Environment Research, 43(3),* 119-129.
Ko, E. S. & Lee, H. S. (2003). Effect of dyeing by immature persimmon juice on the hand of fabrics. *Journalofthe Korean Societyof Clothing and Textiles,*27(8), 883−891.
Park, S. J. and Kang, I. (2014). Assessmentof Wear Comfort and the Developmentof One-piece Dresses with Persimmon Juice Dye-printed Fabrics. *Journal of the Korean Society of Clothing and Textiles,* 38(1), 73-86.
Shin, G. N. (2009). *Shin Gye-nam's natural dyeing,* Seoul: Hyemin Planning.

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CORRELATION ANALYSIS OF MATERIAL, PATTERN, AND CLOTHING PRESSURE FOR THE VALIDATION OF 3D VIRTUAL CLTOTHING PRESSURE PREDICTION SYSTEM

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Introduction

The factors influencing clothing pressure include characteristics of the material and clothing construction methods, such as fabric properties and fabric strain in clothing. The complex interaction of body contour shapes, the relationship between the human body and clothing dimensions, and fabric strain variables collectively influence pressure application (Brubacher et al., 2021). In other words, various elements such as material strain characteristics, irregularities in body shape, and structural variables in clothing intricately affect and interact with each other in the context of clothing pressure. Despite the complexity, several studies have been conducted to address the challenges of measuring clothing pressure and to predict it effectively. In the past, many researchers derived formulas based on the application of Laplace's Law when predicting clothing pressure. Recently, methods using numerical analysis for 3D virtual simulations to represent pressure distribution have been proposed. This study aims to analyze the relationship between material properties, pattern dimensions, actual clothing pressure data, and virtual clothing pressure data to verify the 3D virtual clothing pressure distribution system developed by the authors.

Research Method

The 3D virtual clothing pressure distribution system was developed as follows (Jeon and Lee, 2023): The strain of the mesh and the distance between the avatar and the costume were measured by the vertex coordinate distance by measuring the Euclidean distance equation. In addition, the internal forces of the garment were calculated to reflect its material characteristics, and the forces were 3D vector-projected in the direction of the body to reflect the curvature information of the wearer's body shape. On the basis of the vertex, the strain of each adjacent facet was multiplied by Young's Modulus, fabric thickness, and faces to obtain the internal force of the garment. Then it was vector-projected in the direction of the body and divided by the charge area to calculate the 3D digital garment pressure value. For the validation of the virtual pressure data obtained through this system, a total of 10 garments were produced using five types of tricot fabrics with different reduction rates, two patterns. Sleeveless fitted tops were developed, and the material properties of each fabric, including thickness, stretch properties, density, Young's modulus, and weight, were measured. Also the test included tensile strength (N), elongation (%), shearing rigidity (G, gf/cm・degree), shearing hysteresis at 0.5° (2HG, gf/cm), shearing hysteresis at 5° (2HG, gf/cm), bending rigidity (B), bending hysteresis of bending (2HB), compression linearity (LC), compression energy (WC, mN・cm/cm^2), and compression energy resilience (RC, %). The 10 sets of experimental clothing were worn on a mannequin, and the actual clothing pressure was measured at 5 points (AMI-3037, AMI Techno, Co., Ltd, Japan). Simultaneously, virtual pressure was obtained from the developed system at the same locations. Pearson's correlation analysis was conducted for all variables using SPSS 22.0.

Results & Discussion

The correlation analysis results between actual clothing pressure and material variables showed the following relationships: In the shoulder area, there was a negative correlation with stretch% course. For the back waist, there were positive correlations with density wale and course, and negative correlations with stretch% course. Additionally, positive correlations were observed with Tensile strength wale, G wale and

course. In the front neck area, positive correlations were found with Young's Modulus wale and course, Tensile strength wale, and G wale and course. Furthermore, negative correlations were noted with stretch% wale. Additionally, Thickness showed a positive relationship. Regarding the bust area, positive correlations were observed with density wale and course, Young's Modulus course, Tensile strength course, B wale and course, and RC. However, negative correlations were found with stretch% course and Elongation course. These results demonstrate the complex interplay between material variables and actual clothing pressure in different areas of the garment. The side waist demonstrated a significant positive correlation with density course. Examining variables with Pearson's correlation coefficients of 0.5 or higher, the back waist showed positive correlations with Young's Modulus, the front neck had positive correlations with density, the bust exhibited negative correlations with stretch % wale, Young's Modulus wale, the front waist also showed negative correlations with stretch % course, and positive correlations with Young's Modulus course. Analyzing the relationship with patterns, it was observed that the back waist and front waist areas had a high negative correlation. Additionally, excluding the bust and side waist, correlations with coefficients above 0.5 were notably high for tensile strength, elongation, shearing rigidity, and bending rigidity in other areas. This suggests that clothing pressure is generally influenced by the mechanical properties of the material. Analyzing the relationship with patterns, it was observed that there was a strong negative correlation in the back waist and front waist areas. And also correlations between patterns and materials were found for Tensile strength course (negative), stretch % wale (positive), B wale and course (negative), G wale and course (negative), and Thickness (negative). This underscores the interconnectedness of patterns and material characteristics in influencing clothing pressure. In the case of virtual clothing pressure, consistent with the statistical analysis, significant correlations were observed in the shoulder area with stretch % wale (negative), Young's Modulus wale and course (positive), and a strong negative correlation in the front waist and pattern. Variables with Pearson's correlation coefficients of 0.5 or higher were predominantly weight (positive), density course (positive), stretch % wale and course (negative), Young's Modulus wale and course (positive) across most clothing pressure measurement areas. The correlation with patterns also showed a high negative correlation in the back waist and bust areas. Finally, upon reviewing the relationship between actual clothing pressure results and virtual clothing pressure results, it was observed that the back waist, bust, and front waist exhibited significant correlations at the level of Pearson's correlation coefficient around 0.8, indicating a substantial correlation. Additionally, there was a high correlation at the level of 0.6 for the shoulder area and 0.5 for the front neck.

Conclusion

The actual clothing pressure measurements and virtual clothing pressure generally exhibited similarity in their relationship with material properties. However, some variables numerically reflected in the virtual clothing pressure results showed a close relationship. Additionally, while the actual clothing pressure indicated a clear negative correlation with the waist and a somewhat weak correlation with the convex bust area, adjustments in the form of vector projection for the bust area were added in the virtual clothing pressure prediction to more realistically reflect the actual clothing pressure results. This addition is expected to further enhance the reliability of the system.

References

Brubacher, K., Tyler, D., Apeagyei, P., Venkatraman, P., & Brownridge, A. M. (2023). Evaluation of the accuracy and practicability of predicting compression garment pressure using virtual fit technology. *Clothing and Textiles Research Journal*, *41*(2), 107-124.

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PERFORMANCE EVALUATION OF THE NEW KOREAN CIVIL DEFENSE UNIFORM AT SIMULATED WORKING CONDITIONS: TEXTILE MATERIAL PROPERTIES AND WEAR TRIALS

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Introduction

The lime-colored Korean civil defense uniforms, commonly known to us, were first developed and introduced in 2005. The availability of these uniforms for easy online purchase led to challenges in maintaining consistency in design, color, and functionality among commercially available options. Moreover, the lime-colored uniforms lacked essential features necessary for ever-evolving civil defense activities, posing difficulties for actual civil defense personnel in their operations. This study reevaluates the materials of these old civil defense uniforms to improve the essential safety functions required during civil defense operations, particularly in post-disaster recovery efforts.

Research Method

An in-depth scenario analysis was conducted to understand civil defense volunteers' working conditions and potential occupational hazards. Based on this analysis, we chose important functionalities of textile materials to protect civil defense volunteers, especially during flood recovery and forest fire recovery: water repellency, flame resistance, water resistance, tensile strength, stretchability, and launderability. First, textile materials' lime-colored civil defense wear properties were measured per the relevant ISO or KS standards to understand the status quo. Out of the currently available textile materials, we selected a few candidate materials and measured their functionalities for the ideal civil defense uniforms for specific disaster recovery scenarios. Wear trials using the prototypes of new civil defense uniforms at simulated working conditions gather user feedback on new uniform designs and textile material choices. Measurements include anthropometrics (subject height and weight) and range of motion (ROM). ROM is determined from 17 job-specific motions selected based on the previous study. The subjects will be asked to perform the motion and respond to the questionnaire using a 5-point Likert scale.

Results & Discussion

Experimental results suggested that lime-colored civil defense wear requires improvements in consistency in all safety functions but seriously lacks water repellency, flame resistance and stretchability. In contrast, the recently introduced green-colored civil defense uniform showed improved water repellency and stretchability. However, this green-colored uniform still lacks essential safety functions such as flame resistance and water resistance, making it insufficient for protective workwear for volunteers who respond to disaster situations. By looking at the designs and material compositions of various workwear, emergency services' firefighting gear, and military uniforms currently utilized in disaster response scenarios, we selected potential textile materials for new civil defense wear, particularly for disaster recovery situations. We propose that the flood recovery uniforms have high visibility, water repellency, and water resistance, while the wildfire recovery uniforms must have good flame resistance and tensile/tear strength. With prototype uniforms developed, wear trials will be conducted at simulated working conditions, i.e., hot and humid conditions for flood recovery and dry weather with a lot of lifting movements for wildfire recovery situations.

Conclusion

Our study proposes field activity-optimized civil defense uniforms, considering economic feasibility and safety performance, aiming to develop protective gear that meets real-world demands. Hopefully, this study can provide guidelines for protective gear and uniforms to ensure the comfort and safety of the wearers for specific occupational hazards.

Acknowledgment

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PERFORMANCE COMPARISON OF SILK FABRICS BETWEEN SILK LIKE FABRICS FOR HANBOK MODIFIED WITH DIFFERENT CROSS-SECTIONAL SHAPE -FOCUSED ON THE MECHANICAL PROPERTIES, HAND AND DRAPABILITY-

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Introduction

The interest of people around the world and the MZ generation in Hanbok is an opportunity to increase the added value of the Hanbok industry. It is important to research and develop various fabrics for Hanbok based on the 2000-year history of textiles and the aesthetics of Korean traditional textiles. Rediscovering traditional fabrics and recreating modern fabrics considering practicality and functionality based on the convergence of new yarn technology and new fabric evaluation technology will enable high added value in the traditional cultural industry.

Clothing products express their unique aesthetics not only through silhouette or design, but also through the mechanical properties of the textile. The drapability of fabric is a three-dimensional deformation of the fabric caused by its own weight and gravity, and is an important factor that determines the appearance of clothing, such as color, gloss, and texture. Among the morphological characteristics of fibers, the cross-sectional shape is an important factor that affects the appearance characteristics of the fabric, such as drapability. In the early days, the cross-sectional shape of the typical fiber manufactured by synthetic fiber producers was circular, but these days, it is produced with a cross-section of a different shape for various reasons such as performance, comfort, pilling tendency, bulkiness, texture, and processing.

In this study, to develop a high-quality functional silk-like fabrics including the external and emotional characteristics of the Hanbok fabrics, satin damask fabrics with Hydrangea and Insect Pattern were woven from various cross-sectional shaped poly(ethylene terephthalate) (PET) filaments. The effects of the cross-sectional shape on the mechanical properties, hand, and drapability of the developed silk-like fabrics were investigated. The performance similarity between the silk fabrics and the silk-like fabrics using yarns with different cross sectional shaped filament were compared and evaluated.

Literature Review

The cross-section shape of a synthetic fiber produced by the melt-spinning method can be easily varied by changing the spinneret hole shape. Modifications of cross-section allow to design surface properties in yarns and fabrics.[1] The first attempt was made to mimic the gloss of silk fibers by changing the cross-section to a triangular shape.[2,3]

Various noncircular fibers have been developed to add performances and esthetic property to fibers leading to a change of surface properties. Fibers with noncircular cross-sectional shape take the properties different from those of fibers with circular cross-section. Tensile, thermal and thermomechanical properties of filament yarn depending on the cross-section type were studied by DSC and TMA method. The effects of the changes in the fiber cross-sectional shape on the tensile, thermal, and thermomechanical properties of PET filament yarns were studied. [4.]

Research Method

Seven types of satin damask fabrics made of PET filaments and silk filaments of the various cross-sectional shapes were woven. The satin damask reproduces the hydrangea and insect-patterned satin weave of the jacket excavated from Hong Woo-Hyeon's tomb in the late 17th century of the Joseon Dynasty. The cross-sectional shapes of PET filaments used to manufacture silk-like fabrics were octagonal SDY(Spin Draw Yarn), flat SDY, C-shaped hollow DTY(Draw Textured Yarn), flat DTY, circular DTY and cross-shaped

DTY. Regular octagonal SDY was used as the warp, and six types of PET filament yarns with different cross-sectional shapes were used as the wefts. The mechanical properties and hand value were measured using KES FB system. The stitch strength of the fabric was evaluated according to KS K ISO 13935-2 and the drapability was evaluated according to KS K ISO 9073-9.

Results & Discussion

The hand values including KOSHI, NUMERI and FUKURAMI of fabrics were calculated from the mechanical properties. The similarity (%) between the properties of the silk fabrics and those of the silk-like fabrics was evaluated, in terms of the mechanical properties, hand, T.H.V. and drapability. Silk-like fabrics have 80% level of similarity to silk fabrics, in KOSHI, NUMERI, FUKURAMI, T.H.V. and drapability. Especially, the silk-like fabrics which were woven using C-type hollow fiber DTY and cross-shaped DTY as wefts show at 90% level of similarity to silk fabrics in T.H.V.

Conclusions

In this study, to develop a high-quality functional silk-like fabrics including the external and emotional characteristics of the Hanbok fabrics, 6 silk-like Hanbok fabrics were woven by yarns with various cross-sectional shaped filaments. The mechanical properties, hand, and drapability of the developed silk-like fabrics were measured. The similarity between the silk Hanbok fabrics and the silk-like Hanbok fabrics was analyzed. Consequently, the silk-like fabrics show 80% of similarity to silk fabric, in KOSHI, NUMERI, FUKURAMI, T.H.V. and drape properties. The silk-like fabrics using HSC(octagonal /C-shaped hollow yarns) and ACS(octagonal /cross-shaped antibacterial yarns) revealed the highest similarity to silk fabric, in T.H.V. Through this research, silk-like fabrics could be well developed with 80% level of similarity to silk fabric in the mechanical properties, hand, and drapability.

References

Badrul Hasan, M. M., Dutschk, V., Bru¨nig, H., Ma¨der, E., Ha¨ussler, L., Cherif, R. Ch., and Heinrich, G. (2009). Comparison of Tensile, Thermal, and Thermo-Mechanical Properties of Polyester Filaments Having Different Cross-Sectional Shape, *Journal of Applied Polymer Science,* 111,

Matsui, M. (1994). In Advanced Fiber Spinning Technology; Nakajima, T., Ed., Woodhead Cambridge.

Tyagi, G. K., Saini, A., Tyagi, A., Khandelwal, M., Ishtiaque, S. M. (2002). Influence of fibre cross-sectional shape on dye uptake and mechanical properties of polyester OE rotor-spun yarns, *Indian J Fiber Text Res,* 27, 11.

Warner, S. B. (1995). Fiber Science; Prentice-Hall, New Jersey. 805–812.

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NATURAL FERMENTATION DYEING USING SPENT MUSHROOM SUBSTRATE OF SHIITAKE

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Introduction

The production of domestic edible mushrooms relies on artificial media. In particular, shiitake mushrooms are rapidly shifting from wood cultivation to bag sawdust cultivation. The resulting by-product, spent mushroom substrate (SMS) of shiitake, is becoming a concern and emerging as an environmental pollution problem. Studies are now being conducted to explore the potential uses of SMS as a valuable substance, such as organic compost, insect feed, and environmental restoration cover soil. However, there have been no studies showing that it has been used as a natural dye resource, Therefore, in this study, the validity of SMS of shiitake as a natural dye for silk fabric dyeing was examined. The colorant solution extracted from SMS through hot water and fermentation was used as the dye bath. The optimum fermentation conditions were established by evaluating the dye uptake and color characteristics according to various factors, such as fermentation temperature, fermentation period, and yeast concentration. It was then compared with the dyeing properties of the hot water extraction. In addition, the effects of repeat dyeing and mordanting were investigated. Also, colorfastness, antimicrobial activity, and deodorizing property were evaluate.

Literature Review

The shiitake mushroom sawdust media is mainly composed of oak, which is rich in tannins. This makes it a suitable natural dyestuff for obtaining brown and black colors. Furthermore, SMS is fermented to some extent and contains mushroom mycelium, so it has very favorable conditions for natural fermentation dyeing. And sawdust media contains rice bran or wheat bran as a nutrient source. The rice bran added to this medium also acts as a fermentation agent, making it very useful as a natural dyestuff using the fermentation method. The annual production of SMS, as a by-product of the mushroom industry, is over 200 million tones, most of them are being discarded without special use. Green tea, sappan wood, persimmon, ecklonia cava, and various herbal ingredients are used for fermentation dyeing. There has been an increasing trend in using natural dyes for fermentation. Therefore, using SMS as a natural dye can be expected to have effects such as application of fermentation dyeing, expansion of the color space of brown and gray, and development of sustainable natural dyeing materials. In the future, more research is needed for the practical use of fermentation dyeing.

Research Method

A scoured 100% silk fabric was used. SMS was provided by domestic shiitake mushroom farmers. The SMS was used after being crushed and dried. Commercially available baker's yeasts were used as additives. Naturally prepared iron solutions, as well as synthetic mordants such as $FeSO_4 \cdot 7H_2O$ and $Al_2(SO_4)_3 (NH_4)_2$, were used as mordant agents. Hot water extraction was performed in a liquor ratio of 1:10 at 100°C for 60 minutes. The fermentation extraction was conducted at different fermentation temperatures (10, 22, 32, 60°C) and fermentation periods (1, 3, 5, 10, 15 days). The fermentation according to the addition of yeast was performed at 32°C with different yeast concentration (0.5~4%, w/v) and addition method. Dyeing was carried out in a liquor ratio of 1:40 at 80°C for 60 minutes using an automatic laboratory dyeing. Repeat dyeing was performed up to 5 times under optimal extraction conditions. Pre-mordanting and post-mordanting were carried out at a liquor ratio of 1:40 in 1~5%(w/v) at 60°C for 30 minutes. The dye uptake (K/S value) and color characteristics (H V/C values, CIE $L^*a^*b^*$ coordinates) of the dyed fabrics were measured by using a colorimeter. The fastness for washing, dry cleaning, rubbing, light, and sweat were evaluated by the standard test method. Additionally, the antimicrobial activity and deodorizing properties of the fabrics dyed hot water extract were reviewed.

Results & Discussion

The optimal fermentation period was the on 5th day at the fermentation temperatures of 10°C and 60°C, and the 3rd day at 20°C and 32°C. In the same fermentation period, the higher the fermentation temperature, the higher the K/S value was obtained. The highest K/S value of the fabric dyed with fermented extract was 2.37(60°C/15days), which was lower than the K/S value of 3.12 of the fabric dyed with hot water extract(100°C/1hr). Therefore, we examined the effects of adding yeast at 32°C. There was only a slight increase in the K/S value at a yeast concentration of 0.5% (w/v), but regardless of the addition method, the K/S value continued to decrease as the yeast concentration increased, so there was no synergistic effect due to the addition of yeast. As the dyeing was repeated, a higher K/S value was obtained, a* and b* values continued to decrease, and the Munsell color was produced deeper and darker Y color closer to the YR color, for all fabrics dyed with hot water extract and fermentation extract. Additionally, It was produced in YR color in more than 3 times of repeated dyeing of hot water extraction. All of them showed maximum absorption wavelength of 400nm. The mordant improved the K/S value and the post-mordanting method more efficient than the pre-mordanting method in increasing the color yield, regardless of the mordant type and mordant method. In particular, the color yield and color characteristics of the fabric mordanted with iron solution at a concentration of 3% were similar to those of the fabric mordanted with Fe synthetic mordant, indicating the efficiency of iron solution mordant. The change in K/S value and color characteristics due to Al mordant were not significant. Fastness to washing and dry cleaning were excellent in grades 5, fastness to wet rubbing and acidic perspiration were high in grades 4-5, but fastness to sunlight and alkaline sweat were low in grades 3-4. Both the repeat dyed fabric and iron solution mordanted fabric had improved fastness to light and alkaline perspiration. In particular, iron solution mordanted fabric had better fastness to sweat than those mordanted with Fe. The bacterial reduction rate for *staphylococcus aureus* of fabrics dyed with hot water extract was excellent at 99.7% and bacterial reduction rate for *klebsiella pneumoniae* was at 96.7%, and the deodorization rate was also excellent at 92%..

Conclusion

From the above results, it was confirmed that the most effective method is to perform hot water extraction without additional fermentation process or yeast addition. In addition, repeat dyeing at different extraction temperatures was effective in obtaining not only a variety of yellow colors, but also deep and vivid colors. Compared to synthetic Fe mordant, iron solution mordant was found to be useful as an eco-friendly natural alternative. The colorfastness, antimicrobial activity and deodorizing performance of the fabrics dyed with hot water extract were also excellent. This indicates that it's worthwhile to utilize SMS as a natural dye in the future in terms of environmental protection and sustainability.

Acknowledgement

References

Koo, C.-D., Lee, S.-J., Lee, H.-Y., Park, Y.-W., Lee, H.-S., & Kim, J.-S. (2014). Changes on physio-chemical properties of oak sawdust during fermentation. *Journal of Mushrooms*, 12(3), 209-215.

Park, Y. M., & Cho, J. H. (2013). Fungi-rice bran based fermentation of *coptis chinensis* and *curcuma longa root* and its influence of silk dyeing. *Fashion & Textile Research Journal*, 15(4), 635-641.

Sung, H.-J., Pyo, S.-J., Kim, J.-S., Park, J.-Y., & Sohn, H.-Y. (2018). Physico-chemical, nutritional, and enzymatic characteristics of shiitake spent mushroom substrate (SMS). *Journal of Life Science*, 28(11), 1339~1346

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AN ECO-FRIENDLY MICROENCAPSULATION OF CITRUS UNSHIU OIL AND THEIR APPLICATION TO COTTON AND NYLON FABRIC FOR AROMA RELEASING AND ANTIMICROBIAL ACTIVITY

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Introduction

In textile fields, consumers are becoming highly concerned about human health and environmental sustainability. Natural essential oils as human-friendly and sustainable resources have been taken interests as functional additives to textiles by microencapsulation. Furthermore, microencapsulation based on biopolymers has been the subject for sustainability on functional textiles in recent years (Peng et al., 2023). It is considered as worthwhile to synthesize microcapsules using bio-based polymers to contain functional natural oil. Therefore, this study was attempted to characterize microcapsules prepared with chitosan and gum Arabic for containing citrus unshiu oil and to investigate comfort properties and antimicrobial activity of cotton and nylon fabrics treated with the microcapsules under various conditions in order to develop a novel bio-functional textile.

Literature Review

The literatures dealing with microcapsules for textiles highlight a need for more efficient microencapsulation and application techniques for textiles to develop intelligent functional textiles. As for citrus unshiu oil, it has been attempted to be encapsulated in melamine-formaldehyde microcapsules, to be loaded on some textiles including cotton, lyocell, and polylactic acid, and finally to investigate aroma releasing of the oil, comfort properties as well as bio-active functions like antimicrobial activity of the treated fabrics (Lee et al., 2012; Lee & Yi, 2013). However there any studies have been rarely reported for citrus unshiu oil encapsulated into biopolymer-based capsules yet. Chitosan is considered an emerging biopolymer as an encapsulating agent for textile applications due to its biocompatibility, low toxicity, antibacterial activity, and low cost (Valle et al., 2021) and is also used extensively in textiles for antibacterial, coloration, UV resistance, thermal stability, and so on (Massella et al., 2019). Some of citrus species such as sweet orange (Julaeha et al., 2022) and lime (Tariq et al., 2023) have been reported as applied to textiles by their essential oil into chitosan-based microcapsule. However any research has been rarely found dealing with microcapsules of chitosan-based polymers containing citrus unshiu oil for functional textiles. In this context, citrus unshiu oil needs to be attempted for being encapsulated in chitosan-based polymer for more eco-friendly textiles

Research Method

1. Preparation and Characterization of Microcapsule

For manufacturing microcapsules, 15ml of citrus unshiu oil was added in 15ml of chitosan-arabic gum solution (1% (w/v) chitosan+2%(w/v) Arabic-gum) stirred in advance at 800rpm for 15 min. The emulsion containing the citrus unshiu oil was stirred for 2hrs to form microcapsules by coacervation technology and thereafter were dried in a spray dryer (Buchi Labortechnik AG, Flawil, Switzerland) under the condition of inlet drying air temperature of 185℃ into powders. The morphology of the microcapsules was examined by SEM (TESCAN, Brno) and their thermal characteristics their particle size distribution was measured by a particle size analyzer (Beckman coulter, USA).

2. Treatment of Cotton and Nylon/PU Fabrics with Microcapsules

A cotton woven (plain, 112.40 g/m2, 0.32 mm) and a nylon/PU tricot (0.52mm, 179.6g/m^2) were chosen to be post-treated respectively with chitosan-Arabic gum microcapsules containing citrus unshiu oil by traditional pad-dry-cure (dry: 80℃, 5min / cure: 130℃, 3min). Concentrations of microcapsules in bath were varied from 5%~40% (owf) while those of an acrylic binder were from 2%~10%. After curing the treated fabric was rinsed with water and dried in air temperature.

3. Aroma Releasing Properties and Antimicrobial Activity

Volatile characteristics of treated fabrics were examined using an electronic nose (Heracles II, Alpha Mos, France) by using principal component analysis (PCA). Antimicrobial activities of treated fabrics were evaluated by a quantitative measurement (KS K 0693:2006) in which the bacteria used were Staphylococcus aureus (S. aureus, ATCC 6538) and Klebsiella pneumoniae (K. pneumoniae, ATCC 4352).

Results & Discussion

1. Characterization of Microcapsules and Their Loaded Fabrics

Microencapsulation of citrus unshiu oil with chitosan-Arabic gum was successfully performed in terms of mean particle size (1.025 μm) and thermal stability by TGA resulting the weight loss at 215°C, 284°C, 319°C, and 439°C respectively. By SEM photos, citrus unshiu oil microcapsules were shown as loaded on cotton woven and nylon/PU tricot and their amount loaded seemed to increase with microcapsule concentrations.

2. Aroma Releasing Properties of Microcapsule-Loaded Fabric

By electronic nose analysis, microcapsules-loaded cotton and nylon/PU fabrics were found by GC-MS as releasing aromatic compounds related with citrus such as α-pinene and limonene while untreated ones little. The intensity of volatile release from treated fabrics seemed to increase proportional to microcapsule concentrations by principal component analysis. This result indicated that the citrus unshiu oil in microcapsules loaded on fabrics might be released out when the fabric surfaces were rubbed to each other and electronic nose could be utilized for other fragrant textiles to measure aroma intensity quantitatively.

3. Antimicrobial Activity of Microcapsule-Loaded Fabric

Antimicrobial activity of both cotton woven and nylon/PU tricot treated with the microcapsules was evaluated by using S. Aureus and K. Pneumoniae according to laundry repetitions. Bacterial reduction rates against S. Aureus were higher than 90% for all treated fabrics (5%~40%, owf) while those against K. Pneumoniae were for fabrics treated with higher than 30% of microcapsules. After 10-repetition of laundry, cotton woven treated by 40% (owf) of microcapsule concentrations showed gradual decrease of bacterial reduction rates down to 50%, which was assumed because some of microcapsules on fibers took off by laundry. This result leads to the implication it needs to improve laundry durability of microcapsule-treated textiles in a future study.

Conclusion

This study was carried out to prepare ecofriendly chitosan-Arabic gum microcapsules containing citrus unshiu oil and to investigate their aroma release properties and antimicrobial activity when they were loaded on fabrics for bio-functional textiles. As results, thermally stable microcapsules with mean size of 1.025 μm were obtained by spray drying technique and they were shown to release volatile aroma on both cotton and nylon/PU fabrics proportional to their load amounts. Antimicrobial activity against S. Aureus of the treated fabrics were excellent for all of microcapsule concentrations. However durability against repeated laundry was requested to be improved. The results could be helpful for value-added applications of eco-friendly bio-based microcapsules for textiles.

Acknowledgements

References

Julaeha, E., Nurzaman, M., Wahyudi, T., Nurjanah, S., Permadi, N., & Anshori, J. A. (2022). The Development of the Antibacterial Microcapsules of Citrus Essential Oil for the Cosmetotextile Application: A Review. *Molecules*, *27*(22), 8090.

Lee, A. R., Sarmandakh, B., & Yi, E. (2012). Mechanical properties, comfort, and bio-function of PLA knits treated with microcapsules of Citrus Unshiu's essential oil. *Textile Science and Engineering*, 49(3), 181-188.

Lee, A. R., & Yi, E. (2013). Investigating performance of cotton and lyocell knit treated with microcapsules containing Citrus unshiu oil. *Fibers and Polymers*, 14, 2088-2096.

Massella, D., Giraud, S., Guan, J., Ferri, A., & Salaün, F. (2019). Textiles for health: A review of textile fabrics treated with chitosan microcapsules. *Environmental Chemistry Letters*, *17*, 1787-1800.

Peng, X., Umer, M., Pervez, M. N., Hasan, K. F., Habib, M. A., Islam, M. S., ... & Cai, Y. (2023). Biopolymers-based microencapsulation technology for sustainable textiles development: a short review. *Case Studies in Chemical and Environmental Engineering*, 100349.

Tariq, H., Rehman, A., Kishwar, F., & Raza, Z. A. (2023). Micellar synthesis of lime oil-loaded chitosan microstructures for the sustainable development of antibacterial cellulosic fabric. *Cellulose*, *30*(17), 11177-11194.

Valle, J. A. B., Valle, R. D. C. S. C., Bierhalz, A. C. K., Bezerra, F. M., Hernandez, A. L., & Lis Arias, M. J. (2021). Chitosan microcapsules: Methods of the production and use in the textile finishing. *Journal of applied polymer science*, *138*(21), 50482.

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WHAT IS THE 'ICE BROCADE 氷錦' OF 'SERES' SILK PEOPLE

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Introduction

The knowledge of Seres who brought silk brocade at Herodotos' time was as oriental scholar Henry Yule (1820-1889), "Sericara inhabited by the Seres is vast and densely populated. To the east it is bordered by the great sea, and to the west it extends almost to the borders of Imaus and Bactria. Since the residents are truly enlightened people with a mild and gentle temperament, they refrain from conflicts with people from neighboring countries and are reluctant to have intimate relationships. However, they are not stingy in selling their products such as silk including raw silk yarn, furs, and iron of high quality" (Cheong, 2013). A famous poem in ancient records praises the beautiful silk brocade of Seres. "The barbarians of Seres weave richly dyed silk from the desert lands, and their mastery is astounding. A field of shining flowers spreads out over the silk fabric". Notice the silk brocade were exported with the products of fur and good quality of iron together. Then who were the educated people who sold the good irons, beautiful silk brocade with animal fur without stingy at the trade? Looking at the description of their personality, it was said that they were gentle and enlightened persons. We looked into who Seres was, who was wealthy in the East, produced high-quality iron and fur, and woven beautiful, high-quality silk brocade, and why this was called "ice brocade".

Literature Review

The word 'silk' did not exist in ancient world, silk was called as 'Ser' or 'Seres'. The people from the Far East who brought silk in the 5th and 6th centuries BC were called Seres, and the land where Seres lived was called Serica or Sericara (Nagasawa & Yokohari, 2001). Silk Road was actively used by Seres, not ancient China, and silk was exported to Rome, North Africa, Persia, and West Asia (Miyaji & Motamedi, 1979). Silk produced in Seres is a fabric called 'Geum 錦 Jin' with various colors and splendid patterns. Geum fabric of Seres is dense and stiff brocade, different from thin and drape 'China silk 絹帛' of plain structure. Dong-Yi 東夷 people in the Far East weaved Geum fabrics, and even ordinary people enjoyed colorful Geum clothes in their special days(後漢書 東夷列傳 高句麗條).

Research Method

We studied Seres' silk Geum through previous research related to silk brocade fabrics and literatures. The area where ancient silk brocade was produced was examined through ancient literature, and the area where wild silk fiber was produced was investigated using literature and maps. The clues were collected from the old books: Sikyung(詩經), Seokyung(書經), Subyuki(拾遺記), Seokyungjapki(西京雜記), the internet & the geography maps of specialty products. 'Seres' name were told as Xiongnu(匈奴)'s language, their relationship to Gojoseon were studied based on the kinship of Kim's ancestor pedigree and Xiongnu through Goguryeo history overview(高句麗史抄·略) & Jumong kyung(쪎牟鏡).

Results & Discussion

'Geum' silk brocade was invented in the 11th century BC at Shandong(山東) (Huang & Chen, 2022/2016). By the direction of color thread, Geum can be divided into warp Geum and weft Geum, and warp Geum was invented much earlier(about 1,700 years) with the advanced weaving technologies, thus warp Geum is important in the view of world weaving technology history. Geum in old literature usually refers to warp Geum. According to the ancient books, Gojoseon(東夷) people made gorgeous (warp) Geum at home and exported them (Min, 2000). The record of 'Guol bi jik pae' (厥匪織貝) from Seokyung

(書經禹貢) means 'Barbarians Thieves weaving Shells. And 'Pae Geum Mun Ya' (貝錦文也) from Sikyung (詩經毛傳) means that 'Shells are fancy (warp) Geum' by Syllogism. This tells that Jina(支那) of ancient China didn't weave Geum in that time, but so called barbarian Gojoseon weaved Geum (Kim & Na, 2022).

The JakJam (作蠶) silk fibers of wild silkworm on oak trees, or CheonJam (天蠶, silkworm from heaven) was around the Yalu River or Yap River (鴨(綠)江) ("綢 Ju", 2022). JakJam worms were larger and the silk thread is superior in quality and stronger than that of GaJam (家蠶) cultivated house worms or SangJam (桑蠶) mulberry-tree worms. The price of JakJam silk was several times more expensive, traded at a high price because of the large size of the moth and the strength of the thread, and the threads made from the JakJam were used as strings for string instruments in ancient time (Chu, 2017). When viewed under a microscope, the wild silk fibers are 3~4 times larger in cross section than general silk fibers and have flat shape.

Wild silkworms were located wide in the south of Siberia and Mongol desert from near Balhae bay in BC 2nd century(Good, 1995). By China map - Agricultural Products – in 1950, it is indicated that JakJam silks are specialty of Shandong & Liaodong Peninsula, and mulberry silks located at other three places, in Hangzhou(杭州), Runan(汝南)and Chengdu(成都).

Figure 1. Jakjam (作蠶) and their distribution of Dong-Yi

| cross section and side view (sericulture vs. wild silkworm) | JakJam silkworm on oak tree | The map of 全國農產圖 showing Jakjam | U-Yi崛夷 & Rae-Yi萊夷 |

In the mountain of WonGyo (員嶠), there were Ice silkworms(氷蠶), natural five-colored cocoons when harvested the cold frost. In the later days, people dyed silk fibers in five colors and weaved Geum following the tradition (拾遺記) ("錦", 2022). It is recorded that Ice Geum of 5 colored was weaved using Ice silk silkworms JakJam. WonGyo mountain is located in Shandong(山東) peninsular in old map.

Geum brocade is relatively thick and stiff because of multiple layers of warp colored yarns. And the Jina people did not prefer stiff fabrics because they preferred drapery and slim silhouette. According to Theory of Salt and Iron 『鹽鐵論』, 'the upper class wears 'Yok Su Ra Hwan(縟繡羅紈)', and the middle class wears 'So Je Bing(ice) Geum(繰綈冰錦)'. The upper class of the Jina people preferred the drapery silk fabrics with large-patterned embroidery on transparent leno or thin silk fabric. While 'So(繰)' means undyed unrefined plain silk fabric and 'Je(綈)' means a bit thick and rough silk fabric, and 'Ice Geum(氷錦)' was a stiff brocade made of Jakjam fibers with the repeated jacquard pattern, not preferred by the upper classes.

Dong-Yi(東夷) people of Rae-Yi(萊夷) and U-Yi(崛夷) in Shandong peninsular was recorded as 'barbarian' by Sino-centrism ideology(春秋筆法) of the Jina people, and Jina historian Ha Gwang-ak (何光岳) considered Shandong area was the center of Gojoseon in his book 'History of Dong-Yi Wonryu (東夷原流史)'. 'Guol Bi Yom Sa' (厥匪壓絲) meant 'wild silk of barbarian and bandit', 'Guol Gong Chil

Sa' (厥貢漆絲) meant 'barbarians tribute lacquer and silk fibers' by Seokyung 『UGong』. Based on the natural silkmoths in Shandong area and the jade silkworm relics, it is certain that the first silk started at Dong-Yi (Min, 2000). Jade silkworms found in the Hongshan(紅山) culture proved that the production of silk fabrics was possible around BC 4,500 ~ BC 3,000.

Gojoseon was united of 9 large countries (Shim, 2014), Sejong Sillokjiriji(世宗實錄地理志) told that Gojoseon were of Joseon, Sira, Go(gu)ri, Buyeo, Okjeo and YeMaek, etc. 'Sæ (새)' means 'bird or new' in Korean, noticing that bird was the totem of Dong-Yi and Soho tribe(少昊). Silla(新羅) was 'Sere', and 'Sæ' sound was changed in phonics: Sæ < Sai < Sal < Sara (Choi, 2013). Silla had been called by many names written with same phonetics: Sira(尸羅), Saro(斯盧), Sarah(斯羅), Seona(徐那), Seora(徐羅), Seoya(徐耶), Seobeol(徐我), Seorabeol(徐羅我), Sinro(新盧), Sarak(四樂), Seorak(說樂), Sinryang(新良), Jinryang(眞良), Gyerim (鷄林) and Jilin(吉林) ("Silla", 2017). They used all the same pronunciation as 'Sera', bird country(새나라). 'Ro, Ra' means 'man, nation or country ', so Silla means 'prospering newly, or new country' (Shim, 2014). The family name 'Kim' were the Xiongnu descendant by the tombstone script(大唐故金氏夫人墓銘-金日磾). And Soho GeumChun(少昊金天) was the progenitor of the Silla Kim clan, and founded a country by metal technology, established government office with bird's name (帝王世紀).

Gojoseon, the first dynasty of Korea started to weave silk brocade Ice Geum with colored yarns at the area of Shandong & Liaodong, and the patterned Geum were stiff and gorgeous enough to export to the West through the Seres people with good iron and furs. Notice that Dong-Yi people possessed advanced technology in iron processing. Iron was produced in Jin-Khan (辰韓), and Ye(濊), Wae(倭) and Ma-Khan (馬韓) bought iron from them (後漢書 東夷傳) (Oh & Kim, 2018). And 'Saro' was developed through the 'iron' exports (三國志 魏書 東夷傳) (Okauchi, 2008/2016). Beautiful patterned animal furs were the specialty of Bal GoJoseon, the Chuk mountain(斥山) of Shandong(管子). Goguryeo had the famous Saekdong of 5-colored Geum(五色錦) as well as white Geum(高麗白錦). 'Gogureyo weave Geum, purple Ikat Geum is best, next is 5-colored, and the next is cloud pattern. and also produce white Po and blue Po especially beautiful'(翰苑 蕃夷部 高(句)麗條).

Conclusion

Seres was influenced by the Hongshan culture as a one state among Gojoseon. Seres had exported Ice Geum brocade(氷錦), fur, and high-quality iron to the West through the Silk Road in 5-6th century BC before the Han Dynasty. Ancient Korea weaved the stiff and gorgeous Ice silk brocade colorfully using wild silkworm JakJam fibers. We hope this study shed light on the true history of the Silk Road and contribute to the research on the silk trade culture between East and West.

References

Chu, C.-H. (2017). *Chaotang Choson*: Looking for nomadic mongolian roots. Seoul: HyeAn.

Cheong, S.I. (2013). *The encyclopedia of Silk Road*. Seoul: Changbi.

Good, I. (1995). On the question of silk in pre-Han Eurasia. *Antiquity*, 69(266), 959–968.

Huang, N. & Chen, J. (2016). *7000 years of Chinese silk history*. (H.Y. Lee, Trans.) Paju: Korean Academic information Co. Ltd.

Nagasawa, K. & Yokohar, K. (2001). *SilkRoad: The history of dyed silk fabric*. Tokyo: Kodansha.

Min, K.J. (2000). *Study on Korean traditional textile history*. Seoul: Hanrimwom.

Miyaji, A., & Motamedi, H. (Eds.). (1979). *Wonders of the World's Museums 19*: Tokyo: Kodansha.

Kim, J.S. & Na, Y.J. (2022). Triangulation proves Geum brocade with the horizontal loom of Gojoseon, *Fashion and Textiles*, 9(32).

Shim, B. K. (Ed.). (2014). *The lost ancient history the restored (Go)Joseon*. Seoul: Barunhistory.

Choi, C.-T. (2013). A study on the name of a country Silla. *The Journal of Linguistics Science*, 64.

Oh, D. S., & Kim, Y. H. (2018). *I'm going to the Museum*. Daejeon: Sangsaeng Publishing Company.

Okauchi, M. (2016). *Silk Road archaeology* (C. Park, Trans.).Gwacheon: ZININZIN. (Original work published 2008)

中華人民共和國 新地圖(1950). 全國農產物圖, 光華 輿地學社 編製

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STUDY ON THE SWELLING KINETICS OF CELLULOSE BASED SUPERABSORBENT POLYMER CROSSLINKED WITH HUMIC ACID

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Introduction

Superabsorbent polymers (SAPs) exhibit enhanced swelling capacity through various mechanisms. These include additional ionic cross-linking, a porous structure with undulations, high flexibility of polymer chains, a significant number of hydrophilic groups, and ample free volumes between polymeric chains. SAPs, characterized by cross-linked hydrophilic networks, possess the ability to absorb and retain substantial amounts of water or aqueous solutions.

The applications of SAPs span across diverse fields, including agriculture, hygiene products such as disposable diapers and feminine napkins, packaging materials, medical products like surgical pads, as well as specialized uses like chemical sensors, drug delivery systems, and water-blocking taps.

Interest in natural polymer-based SAPs has surged due to their biocompatibility, biodegradability, and nontoxic nature. Natural polymers offer promising advantages over synthetic counterparts in terms of reduced potential for harmful effects, making them particularly appealing for biomaterial applications.

In this investigation, novel carboxymethyl cellulose (CMC)-based superabsorbent polymers (SAPs) were synthesized with varying levels of carboxymethyl-functionalization. These SAPs were crosslinked with humic acid and further modified with starch. The impact of humic acid content on the properties of SAPs was explored using techniques such as X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), and scanning electron microscopy (SEM). Swelling kinetics of the produced SAPs were analyzed using the Fickian diffusion model and Schott's pseudo second-order kinetics model. Additionally, the biological safety of the SAPs was evaluated through cytotoxicity testing using the MTT technique in vitro. Mouse fibroblast L929 cells were employed to assess cell vitality in the presence of SAPs.

Furthermore, computational docking analyses were conducted to investigate the interactions between SAPs and the DNA Gyrase enzyme. This comprehensive approach facilitated a detailed examination of the potential molecular dynamics and binding affinity between SAPs and the DNA Gyrase enzyme, providing valuable insights into their interactions in silico.

Literature Review

Polysaccharides, such as CMC (sodium carboxymethyl cellulose), serve as significant bio-based sources for SAPs. CMC, derived from ß-D-glucose polymer, undergoes heterogeneous etherification with chloroacetic acid to form the polymer, boasting higher purity compared to natural fibers. Due to its biocompatibility and biodegradability, CMC finds applications in medicine, biotechnology, pharmaceuticals, cosmetics, and the food industry.

Starch, another commonly used polysaccharide for SAP production, consists of amylose and amylopectin. Amylose is a linear polymer of α-(1-4) glucose units, while amylopectin contains periodic branches of α-(1-6) links. Derived from various plants, starch is biodegradable and renewable. Cross-linking agents like boric acid, glutaraldehyde, and epichlorohydrin are often utilized in SAP production, although their hazardous nature limits their suitability for biomaterial applications.

Humic acid (HA), a bio-degradation product extracted from leonardite, lignite, and peat, offers a cost-effective and environmentally friendly alternative. HA exhibits chelating activity, good ion exchange, and forms stable complexes with polyvalent cations. Its high content of oxygen-containing functional groups, including carboxyl, phenol, hydroxyl, enol, and carbonyl structures, contributes to its versatility. Combining HA with hydrogels yields promising solutions such as delivery systems and biodegradable sorbents for various applications, showcasing its potential in eco-sustainable materials.

Research Method

Carboxymethyl Cellulose (CMC) was purchased from Lihong fine chemiclas (China, FVH9 model, DS=0.9-1.0, Mw=90,000). Daemyung FM (Korea, product number 2017723552) provided the starch, which was a food grade powder derived from tapioca with a purity of more than 100%. Daejung chemicals & metals (Korea, product number 4243-1425) supplied humic acid. Sodium chloride (NaCl) was purchased from JUNSEI (GR) Chemical Co., LTD (Korea, Mw=58.44, CAS no. 7647-14-5). The cytotoxicity of the SAPs has been investigated by evaluating the viability of cells in the presence of SAPs using an MTT assay. A 96-well plate reader (BioTek, USA) was used to detect absorbance at 490 nm. Moreover, computational docking analyses were conducted to investigate the interactions of SAPs with the DNA Gyrase enzyme. The three-dimensional structure of the DNA Gyrase enzyme from Escherichia coli (PDBID: 6YD9) was retrieved from the Protein Data Bank website (http://www.rcsb.org). To identify the binding pockets of the enzyme, the CASTp 3.0 web server was employed. All reagents were analytical grade and did not require further purification. The deionized water was used throughout the work.

Water absorbency of SAPs was determined using the tea-bag technique in 0.9 wt% NaCl solution or distilled water. Swelling kinetics were assessed by measuring water absorbency at various immersion times. Reswelling Capability: SAPs' reusability was evaluated by measuring water absorbency after drying and subsequent re-immersion in distilled water multiple times. Cell viability in the presence of SAPs was assessed using the MTT assay with mouse fibroblast L929 cells. SAPs were analyzed using FTIR spectroscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM), thermogravimetric analysis (TGA), and differential scanning calorimetry (DSC) to study chemical properties, morphology, and thermal behavior. Computational docking analyses were conducted to investigate interactions between SAPs and the DNA Gyrase enzyme, providing insights into molecular dynamics and binding affinity.

Results & Discussion

FT-IR analysis identified chemical bonds and functional groups in SAPs. Peaks in starch and CMC-Na spectra indicated hydrogen-bonded hydroxyl groups, C-H stretching, and characteristic peaks for carbonyl groups. Increased humic acid content in SAPs resulted in decreased -OH peak intensity and shifted carbonyl peaks, suggesting physical crosslinking via hydrogen bonding interactions. XRD analysis of SAPs revealed typical crystalline peaks and an amorphous nature of NaCMC. Increasing HA concentration led to reduced peak intensity at $2\theta = 20°$, indicating crosslinking and decreased crystallinity due to ester functionalities and hydrogen bonding, as observed in SAPs. TG and DTG curves revealed slower decomposition rates for CMC and SAPs compared to starch. Three phases of weight loss were observed, indicating moisture loss, dehydration, and decomposition of CMC and SAPs. SAPs showed higher weight loss in the third stage compared to CMCs, with varying T_{max} values indicating differences in thermal stability. SEM analysis revealed smooth surfaces for CMC and starch, while SAPs with HA displayed rough particle textures due to increased surface roughness and crosslinking. Higher HA content led to the formation of a cross-linking network between CMC and starch, resulting in polymer film-like structures. The tea-bag method assessed HA-cross-linked SAPs' swelling behavior, showing an initial high absorption rate reaching equilibrium after 24 hours. Increasing HA content enhanced swelling ratio due to interaction between HA's negatively charged functional groups and SAPs' ionic groups.

SAPs demonstrated comparable or superior swelling capacity to other published superabsorbent polymers. Swelling in 0.9% NaCl solution was lower due to reduced repulsive forces and osmotic pressure differential compared to pure water. Absorption kinetics of HA-cross-linked SAPs were analyzed using Fickian diffusion and Schott's pseudo-second-order kinetics models, revealing initial rapid swelling followed by slower growth to equilibrium. Fickian diffusion predominated in initial swelling phase (n<0.5), while relaxation of polymer chains influenced non-Fickian diffusion (0.5<n<1). Schott's model accurately represented entire swelling process, with increasing HA content accelerating swelling.

SAPs exhibited excellent reswelling ability, maintaining high water absorbency even after multiple swelling cycles. Humic acid-crosslinked SAPs retained 90-92% of initial water absorbency after three swellings, indicating potential for prolonged service life and cost-effectiveness in practical applications.

Cytotoxicity assessment of SAPs revealed low harm compared to positive control. However, HA addition showed negative effects initially, with increased biocompatibility observed at specific HA content, indicating potential biocompatibility of HA-based hydrogel with low cytotoxicity.

The structure of DNA Gyrase, notably 6YD9, elucidates its pivotal role in bacterial DNA regulation and its significance as a drug target. Insights from studying DNA Gyrase aid in combating antibiotic resistance and may lead to novel therapeutic approaches. The ligand interaction with DNA Gyrase highlights its potential as a promising antibacterial inhibitor, crucial for drug development.

Conclusion

In conclusion, the study aimed to develop an environmentally friendly superabsorbent polymer (SAP) by cross-linking humic acid with CMC grafted with starch. The results indicate successful cross-linking of CMC by humic acid, resulting in SAPs with high thermal stability and compressive strength. FTIR analysis confirms a crosslinked structure of starch and CMC with carboxylate functional side chains. TGA analysis effectively investigated grafting data and polymer weight loss. SAP4 exhibits superior equilibrium water absorption capacity compared to other SAPs, particularly in distilled water and 0.9% NaCl solution. Increasing humic acid concentration enhances swelling capacity. Swelling kinetics analysis reveals Fickian diffusion behavior, except for SAP2, where n = 0.5262, indicating rapid polymer chain relaxation. SAP4 demonstrates excellent reswelling performance, retaining about 92.86% after three cycles. Cytotoxicity tests show SAP hydrogel to be less cytotoxic than the positive control. Ligand interaction with DNA gyrase suggests potential as a bacterial activity inhibitor. Overall, the introduction of bio-based components yields SAPs with strong crosslinking and high water absorption, promising eco-friendly SAP products.

References

Prasad, C., Park, S. Y., Lee, J. S., Park, J. J., Jang, Y., Lee, S. W., ... & Choi, H. Y. (2023). Modeling and investigation of swelling kinetics of sodium carboxymethyl cellulose/starch/citric acid superabsorbent polymer. *International Journal of Biological Macromolecules*, 253, 127013.

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ENHANCED PIEZOELECTRIC PERFORMANCE OF POLY(VINYLIDENE FLUORIDE) NANOCOMPOSITE FIBERS LOADED WITH SILVER NANOWIRE AND ZINC OXIDE FOR ENERGY HARVESTING

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Introduction

Energy harvesting devices that convert different energy sources such as solar energy, wind energy, thermal energy, and kinetic energy into electrical energy have attracted much interest in the field of wearable electronics and self-powered monitoring devices. Piezoelectric energy harvesting that generates electricity from mechanical sources via electromechanical coupling has been recognized as an ideal solution for low-power-consuming electronic devices. Recently, inorganic piezoelectric powders and conductive fillers have been incorporated into piezoelectric polymers to improve the electrical output performance of organic piezoelectric materials, such as poly(vinylidene fluoride) (PVDF). Yang and Lee (2023) examined the piezoelectric performance of piezoelectric devices made from polypyrrole-deposited PVDF/ZnO nanocomposite fiber webs with different ZnO contents. Their output voltage varied with the ZnO nanoparticle contents. In this study, we investigated the effect of adding silver nanowires (AgNWs) as a conductive filler material on piezoelectric performance. We fabricated a stack structure-type piezoelectric energy harvester using polypyrrole-deposited PVDF/ZnO/AgNW nanocomposite fiber webs and examined the piezoelectric performance.

Literature Review

Zhang et al. (2019) dispersed AgNWs on a glass plate using a spin coater and then poured PVDF solution on top to fabricate a composite film, which was used to develop wearable electronics. Dudem et al. (2018) fabricated a PVDF film containing barium titanate and AgNWs, which was used to develop an energy harvester. However, most piezoelectric materials containing AgNWs are made as composite films because it is difficult to evenly disperse AgNWs. Moreover, AgNWs deposited on soft substrates are highly coarse and can be easily destroyed even by touch, making them unsuitable for use in wearable electronics (Chen et al., 2019; Xiong et al., 2016). To effectively utilize AgNWs in wearable electronics, such as energy harvesters, they must be evenly dispersed within and not exposed to the surface of the material they are contained in. Therefore, in this study, AgNWs were encapsulated within nanofibers so that they were evenly dispersed within and not easily exposed to the surfaces of specimens.

Research Method

To prepare the spinning solutions, 5 wt% ZnO nanoparticle powders were dispersed in solvent solution (N,N-dimethyl formamide (DMF)/acetone (6/4 (v/v)). After that, 0.5 g, 1.0 g, or 1.5 g of AgNWs solution was added to the solvent solution. Finally, 17.5 wt% of PVDF powder was added to complete the spinning solution. PVDF/ZnO/AgNW nanocomposite fibers were fabricated using a horizontal electrospinning machine (needle gauge 20 G, feed rate 1.5 ml/hr, voltage 18 kV, and working distance 15 cm). Field emission-scanning electron microscope (FE-SEM) analysis was conducted to examine the fiber morphology, and transmission electron microscopy (TEM) and Energy Dispersive Spectrometer (EDS) were used to analyze the nanocomposite fiber's internal morphology. Fourier transform infrared spectroscopy (FT-IR) was used to analyze the β-phase crystallinity of the PVDF nanocomposite fiber. Polypyrrole was used as a polymer-based electrode for the piezoelectric device. It was synthesized by oxidative polymerization using iron (III) chloride solution and ammonium peroxydisulfate mixture (7:3, v/v) as an oxidant, and 2, 6-naphthalenedisulfonic acid, disodium salt as a dopant. The electrical conductivity of the polypyrrole layer was evaluated by measuring its sheet resistance. The piezoelectric device consisted of two stacked units, in each of which two PVDF/ZnO/AgNW nanocomposite fiber webs sandwiched between two electrode layers made of polypyrrole-deposited PVDF/ZnO/AgNW nanocomposite fiber web. A dielectric layer made of

polyester film was inserted between the units. The output voltage of the piezoelectric device was measured by dropping a 500 g weight onto it.

Results & Discussion

FE-SEM and TEM analysis revealed that ZnO and AgNWs were stably encapsulated inside the PVDF nanofibers. The morphology of the PVDF/ZnO/AgNW nanocomposite fibers showed continuous fibers without beads regardless of AgNWs content. However, as the AgNWs content increased from 0.5 g to 1.5 g, fiber diameter increased from 538 ± 120 nm to 595 ± 19 nm and fiber diameter became more uniform. FT-IR showed that the β-phase crystallinity of pure PVDF nanofibers was 58%, but it increased to 88% in PVDF nanofibers containing 5 wt% ZnO and 89% in nanocomposite fibers containing both ZnO and AgNWs. β-phase crystallinity did not differ by AgNWs content. The electrical sheet resistance of the polypyrrole layer remained stable in the range of 269 ± 206–471 ± 247 Ω/sq. The maximum output voltage of the piezoelectric device using pure PVDF was 1.4 V while it increased to 11 V when 5 wt% ZnO and 1.5 g AgNW solution were added. The peak-to-peak voltage (V_{p-p}) value was 3.7 V_{p-p} in the energy harvesting device using pure PVDF nanofiber web and increased to 21.6 V_{p-p} when 5 wt% ZnO and 1.5 g AgNW solution were added.

Conclusion

In this study, PVDF/ZnO/AgNW nanocomposite fibers were fabricated, and polypyrrole, a conductive polymer, was deposited on the nanofiber web surface as an electrode. Then, a piezoelectric device was fabricated, and its output voltage was examined against different concentrations of AgNWs. The results showed that piezoelectric performance was positively correlated with AgNWs content. These results imply that the addition of AgNWs improves the electron transfer and charge storage capabilities of PVDF (He et al., 2022). In addition, we proposed a method for the stable integration of silver nanowire, a material with low dispersion, poor durability, and a propensity to corrode in the air, into an energy harvesting material. These results suggest that AgNWs help improve piezoelectric performance, and the piezoelectric device fabricated herein can be applied as a wearable energy harvesting system.

References

Chen, H., Li, M., Wen, X., Yang, Y., He, D., Choy, W. C., & Lu, H. (2019). Enhanced silver nanowire composite window electrode protected by large size graphene oxide sheets for perovskite solar cells. *Nanomaterials*, *9*(2), 193.

Dudem, B., Kim, D. H., Bharat, L. K., & Yu, J. S. (2018). Highly flexible piezoelectric nanogenerators with silver nanowires and barium titanate embedded composite films for mechanical energy harvesting. *Applied Energy, 230*, 865–874.

He, Y., Wang, H., Sha, Z., Boyer, C., Wang, C. H., & Zhang, J. (2022). Enhancing output performance of PVDF-HFP fiber-based nanogenerator by hybridizing silver nanowires and perovskite oxide nanocrystals. *Nano Energy, 98*, 107343.

Xiong, W., Liu, H., Chen, Y., Zheng, M., Zhao, Y., Kong, X., ... & Jiang, L. (2016). Highly conductive, air-stable silver nanowire@ iongel composite films toward flexible transparent electrodes. *Advanced Materials, 28*(33), 7167-7172.

Yang, H., & Lee, S. (2023, October 25). Fabrication of Polypyrrole-deposited Poly(vinylidene fluoride)/Zinc Oxide Nanocomposite Fibers and Development of Fiber-based Piezoelectric Energy Harvesters [Poster presentation]. The Fiber Society, Philadelphia, USA. https://www.thefibersociety.org/ConferenceInformation/PastConferences/tabid/104/Default.aspx

Zhang, L., Wang, Y., Gui, J., Wang, X., Li, R., Liu, W., ... & Guo, S. (2019). Efficient welding of silver nanowires embedded in a poly(vinylidene fluoride) film for robust wearable electronics. *Advanced Materials Technologies, 4*(2), 1800438.

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THE EFFECT OF MODERN AUTOMATIC 'DADEUMIJIL' PROCESSING ON THE MORPHOLOGY AND SURFACE PROPERTIES OF RAW SILK FABRIC FOR HANBOK

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Introduction

Silk is one of the oldest animal-based natural fibers in human history and has been used in high-quality Hanbok materials for a long time. Silk has a unique luster, but this luster is achieved through scouring, and after scouring, silk has the characteristic of becoming softer and thinner. However, representative adjectives required for hanbok expressed by those in the hanbok field included smoothness and stiffness, and a survey on daily hanbok preferences among graduate students majoring in clothing science and clothing-related company employees showed that smooth materials were preferred for daily hanbok. Additionally, based on research results showing that synthetic fibers, blended fibers, and silk fabrics are stiffer than cotton-based fabrics in terms of mechanical properties, making it easier to maintain a box-shaped silhouette, it can be confirmed that stiff materials are used in Hanbok. Stiff silk is a raw silk fabric that has not been degumming and has the disadvantage of poor durability as sericin is easily removed by high-temperature wet processes such as bleaching or dyeing. Sericin fixation processing, which is a method to compensate for the shortcomings of raw silk fabric, causes environmental pollution because it uses toxic substances such as formalin and glutaraldehyde. Therefore, we attempted to maintain the stiffness of silk and create a smooth surface through mechanical processing rather than chemical sericin fixation processing, and to confirm the effect of processing through changes in the surface. 'Dadeumijil' is the process of beating washed clothes with a bat to straighten out wrinkles and smooth them out. This is a method of placing the fabric on a 'Dadeumijil' stone and then striking it with a bat by hand. 'Dadeumijil' not only improves strength by evenly arranging the fibers, but also removes wrinkles, making the fabric smooth and shiny, and is known to improve the thermal insulation effect by filling the gaps between the fibers. In this study, we attempted to quantitatively examine the changes in the morphology of raw silk fabric for Hanbok through automatic 'Dadeumijil' processing, a modern version of traditional 'Dadeumijil'.

Research Method

The samples used in this study were eight types of raw silk fabrics. The warp yarn was used 2-ply 21-denier yarn, and the weft was 21-denier 6-ply yarn. When the warp density was 120 threads per inch, the weft density was 65, 75, 85, and 95 threads per inch. When the warp density was 300 threads per inch, the weft density was 55, 65, 75, and 85 threads per inch. For the 'Dadeumijil'process, a 'Dadeumijil' machine manufactured by Namyang Yeomjik Co., Ltd. was used. The ' Dadeumijil ' machine uses 12 bats to pound a sample wrapped around a circular roller with a diameter of 30cm at a constant speed while rotating once for 30 minutes. The 'Dadeumijil' process was carried out for 30 minutes at a time, and the number of processing times was changed to 1, 2, and 3 times and compared with the raw silk. The surface reflectance, luminance, cover factor, and SEM of the raw fabric and post-processed samples were measured. The surface reflectance was measured using a color meter at light source D65, observation field of view of 10°, and maximum absorption wavelength. Brightness was measured using a luminance meter. Surface reflectance and luminance were measured by overlapping 14 layers of samples so that the samples were not reflected. Cover factor refers to the covering degree of yarn in a fabric or knitted material. After taking a surface photo using a stereomicroscope, the ratio of the area of the yarn to the area of the fabric was calculated using the Image J program. The surface structure and morphology were confirmed using SEM long-emission scanning electron microscopy.

Results & Discussion

The surface reflectance of the samples with a weft density of 120 was 55.36% before 'Dadeumijil' processing, 61.25% after one processing, 61.79% after two processing, and 61.58% after three processing. After processing 'Dadeumijil', it increased by an average of 6.18% points. The surface reflectance of the sample with a weft density of 300 was 56.47% before 'Dadeumijil' processing, 60.05% after one processing, 60.62% after two processing, and 59.48% after three processing. After processing 'Dadeumijil', it increased by an average of 3.58% points. The surface reflectance increased after finishing processing in all samples, but only a slight difference of about 1.39% points was seen depending on the number of processing times. Additionally, compared to the samples with a weft density of 120, the increase in surface reflectance of those with a weft density of 300 was small.

The luminance of the samples with a weft density of 120 was 66.08 cd/m^2 before 'Dadeumijil' processing, 69.17 cd/m^2 after 1 processing, 67.57 cd/m^2 after 2 processing, and 68.37 cd/m^2 after 3 processing. After processing 'Dadeumijil', the samples increased by 2.29 cd/m^2. The luminance of those with a weft density of 300 was 65.79 cd/m^2 before 'Dadeumijil' processing, 69.71 cd/m^2 after 1 processing, 69.49 cd/m^2 after 2 processing, and 70.00 cd/m^2 after 3 processing. After processing 'Dadeumijil', it increased by an average of 3.95 cd/m^2. Brightness also increased in all samples after processing 'Dadeumijil', but no increase was observed with the number of processing times.

The cover factor value of the samples with a weft density of 120 was 0.57 before 'Dadeumijil' processing, 0.61 after 1 time of processing, 0.68 after 2 processing, and 0.72 after 3 processing. As the number of processes increased, the cover factor value increased by about 0.10 on average. The cover factor value of the samples with a weft density of 300 was 0.81 before 'Dadeumijil' processing, 0.86 after one processing, 0.87 after two processing, and 0.86 after three processing, with an average increase of about 0.05 after processing. In all samples, the cover factor increased after processing, confirming that the structure became denser through 'Dadeumijil' processing. For the samples with a weft density of 120, the cover factor value increased depending on the number of processes, but for those with a weft density of 300, there was no effect depending on the number of processes. Additionally, the increase in cover factor value for the samples with a weft density of 120 was greater than those with a weft density of 300.

As a result of SEM photo analysis, it was confirmed that the surface became slightly flat after processing 'Dadeumijil'. However, as the surface is not damaged and there is no significant difference in the surface structure and morphology before and after processing, it is believed that there is almost no physical damage caused by 'Dadeumijil' processing.

Conclusion

Surface reflectance, luminance, and cover factor increased after processing 'Dadeumijil'. Therefore, it was confirmed that the fabric's surface became smooth and dense. However, the increase rate according to the number of 'Dadeumijil' processing did not appear significant, so it was judged that sufficient processing was possible with only one processing. Through this experiment, it appears that modernized mechanical finishing processing of raw silk fabric for Hanbok can replace the effect of chemical sericin fixation treatment to some extent.

References

Son, H. N., & Ryu, H. S. (2007). The hand of spring/fall fabrics for'saenghwal hanbok'. *Journal of the Korean Society of Clothing and Textiles*, 31(9_10), 1453-1464.

Moon, M. H. (2003). A Study on the Evaluation of the Hand Value of Korean Fabrics using the Artificial Neural Network. *Korean Journal of Human Ecology*, 12(1), 63-73.

Park, G. Y. (2009). The sericin fixation of raw silk fabrics by fixing with the mixture of melamine and formalin. *Textile Science and Engineering*, 46(1), 30-34.

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A DECADE OF SHIFTING CONSUMER LAUNDRY NEEDS THROUGH TEXT MINING ANALYSIS

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Introduction

In Korea, the progressive shift toward a more tropical climate has gradually eroded the once-clear demarcation of the four seasons. This environmental change has expanded the range of clothing options, which in turn has led to more diverse consumer laundry requirements. Additionally, sociocultural shifts, such as the changing composition of family units, have resulted in a broader array of laundry needs compared to the past. This emphasizes a growing consumer demand for tailored laundry services, prompting the need for innovation within the industry.

Despite the apparent necessity of understanding changes, there's a glaring lack of research regarding recent consumer demands related to laundry. Consumer laundry behaviors and attitudes significantly shape the link between the environment and fashion, making this especially vital in the context of sustainability. Thus, there is an unequivocal need for a study utilizing social data on consumer laundry behavior and needs from the past decade.

This research is established on an extensive examination of various digital social engagement platforms (essential online groups and Twitter) data collected from 2014 to 2023, encompassing consumer behavior related to 'laundry' in South Korea. The analysis aims to answer three major questions: what subjects do consumers talk about concerning laundry, how has it changed over 10 years, and what are the core unchanging needs and evolving needs of consumers regarding laundry?

Research Method

The data collated spans a decade, from 2014 to 2023. It draws its basis from keywords related to 'laundry' practices. The primary information channels selected were the major community platforms, and Twitter, after ruling out the retweets. It incorporates synonyms of 'laundry', including 'wash'. Words that have divergent meanings than the original intention of 'laundry', such as 'money laundering' were carefully excluded to maintain the focus on the intended meaning.

Text mining involves extracting significant insights and identifying patterns from various textual data sources. This practice extends over numerous platforms and documents, thoroughly examining content to capture the essence of the available information(Salloum et al., 2017). A certain metamorphosis occurs when human speech is transmuted into machine-readable language. This transformation sequence is referred to as Natural Language Processing(NLP). By unraveling the intricate intertwining of texts, one can, henceforth, extrapolate the crux of the research, the pivotal keywords(Callon et al., 1983). The seminal phase involved implementing Latent Dirichlet Allocation(LDA) topic modeling, thereby extracting the prominent themes related to consumer laundry discourse over this ten-year span. How these themes have morphed over the decade was observed. By this method, the intent was to offer solutions to the research question.

Results & Discussion

The application of laundry-related keyword analysis and LDA topic modeling yielded the following outcomes. Prior to the execution of the LDA topic modeling analysis, a coherence evaluation was undertaken. The findings revealed that when the number of topics was nine, the coherence score measured 40.96, the highest potential score. As such, they are distilled into nine topics. The individual topics, derived based on the pertinent words, are: 1) Hand washing, 2) Laundry Recommendation, 3) Garment laundry, 4) High-end item laundry, 5) Laundry for storage, 6) Laundry services, 7) Season-dependent laundry, 8) laundry for sharing, and 9) Potential laundry pitfalls.

Considering the various contexts, these subtopics were further clustered into four principal categories. Consequently, it was determined that consumers separate their laundry into four distinct groups influenced by who performs the laundry and where, the target objects for laundering, the methodology employed, and the rationale behind it. These divisions were traced back over the past ten years through an analysis of the percentage occurrence of significant phases, centered around key terms and associated words, providing valuable insight into the evolving trends.

Hinted at by dual tendencies, perceptions around laundry practices have been concurrently shifting among consumers. On one aspect, conventional methods such as a hand-wash have seen a waning interest. Concurrently, there has been an upward increase in the adoption of laundry services. Yet, persistent consumer demand for handwashing and water-based washing indicates an unfulfilled necessity, suggesting an opportunity yet to be seized by technological progression or service propositions.

The discourse context was principally bifurcated into two outlining themes, contingent on the nature of items being laundered - ordinary items and high-value or luxury goods. The looming peril of potential damage from improper washing protocols has distinctly carved out a unique strand of dialogue related to high-end items. Coinciding with the augmenting sales of luxury apparel, dialogues in SNS about this laundry have been incrementally rising over the past decade.

Conversations around laundry practices have discernibly transformed since the bourgeoning of laundry-related start-ups circa 2020 in Korea. The inference drawn suggests that as more individuals partake in these outsourced washing services, discourses around potential errors shrunk significantly. Paradoxically, discussions on laundry suggestions experienced a moderate uptick, indicating that consumers sought to become knowledgeable before choosing a way of washing.

As consumers started deliberating their motivations behind laundry practices, the excavated data revealed a steady growth in those who launder clothes for sharing purposes (vintage, resale, certification, local communities). The occurrence of dialogues about laundry for long-term storage or season-based purposes experienced a marginal deceleration following the pandemic period.

Given the incessantly metamorphosing laundry sector, periods of inertia, and unresolved demands, the research underscores the exigency for businesses to not only accommodate the evolving technological needs but to adeptly adapt to the latent and unaddressed consumer needs, making this aspect equally paramount.

Conclusion

Historically, academic research has largely overlooked the changing consumer behaviors and needs concerning laundry practices. However, with growing emphasis on sustainability and continuous technological innovation, it is critical to conduct a thorough investigation in this area. This study aims to fill that gap by providing a detailed analysis of the factors influencing laundry behaviors over the past ten years.

Undeniably, macro factors have significantly influenced how laundry is perceived and performed. Among these, the escalating concerns on climate change, increasing proliferation of single-person households, alterations in living conditions engendered by global pandemics, and the rise of eco-consciousness stand out as most influential. Simultaneously, the advent of smart home appliance technology, proliferation of start-ups offering laundry services, and the expansion of coin laundromat businesses have collectively reshaped the traditional understanding and practices of doing laundry.

The geographical focus of this study, however, remains confined to Korean consumers. While this narrows the scope and limits the generalizability of the findings, it does not undermine the global relevance and significance of the issue being investigated. The global fashion industry, in its relentless pursuit of sustainability and adaptation to climate change, is profoundly connected to laundry practices and hence, presents the need for further exploration of this subject. The findings from this study underscore the necessity for extending the research focus to include consumers from diverse cultures and regions, which would yield a more globally representative understanding of evolving laundry practices. Thus, the academic advancement offered by this study sets the stage for further investigation that calls for a wider

geographical inclusion and a concomitant understanding of the global impact of changing laundry behaviors.

References

Callon, M., Courtial, J. P., Turner, W. A., & Bauin, S. (1983). From translations to problematic networks - An introduction to co-word analysis. Social Science Information, 22(2), 191-235.

Salloum, S. A., Al-Emran, M., & Shaalan, K. (2017). Mining social media text: Extracting knowledge from Facebook. International Journal of Computing and Digital, 6(2), 73-81. doi:10.12785/ ijcds/060203

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MANAGEMENT OF TEXTILE WASTES AND THEIR SUSTAINABILITY: A REVIEW

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1. Introduction

Currently, the consumption of textile products is increasing due to increasing production and changing consumption patterns; however, consumers often discard garments even though they have an undamaged and usable lifespan. These situations have increased environmental concerns regarding textile waste. Therefore, many textile waste management approaches, including reuse, recycling, and energy recovery through incineration or landfill, have attracted attention. Textile waste is now considered a valuable resource with potential for reutilization. Considering the high renewable energy value of fiber materials, their use as an alternative fuel for textile waste can be a potential method from a sustainability perspective. Herein, we review studies and statistical data on resource recovery from textile waste in detail and comprehensively. Our aim is to provide current waste management strategies and suggest potential sustainable areas in the fashion and textile industries.

2. Reutilization methods for textile waste

2.1. Reuse, redesign, and remanufacture

Reusing, redesigning, and remanufacturing involves using clothing "as is" during its primary lifespan or slightly modifying it for continued use when needed. Textile reuse involves expanding the purpose and service of textile products by transferring ownership via processes such as leasing, trading, exchanging, borrowing, and inheriting. Second-hand stores, flea markets, and charitable organizations make it easier to reuse textile products. Recently, second-hand trading has attracted considerable attention, particularly among the younger generation, as a practical approach to resource circulation, economic efficiency, and scarcity mitigation (Fig. 1). This has led to significant growth in second-hand trading platforms such as Let Go, ThredUp, and Daangn market (Turunen et al., 2024). Although reuse is the most desirable approach to achieving sustainability, it is only beneficial when the reuse phase is significantly extended. Redesign and remanufacturing, or other reutilization methods, involve disassembling and remaking used or discarded clothing. However, because of disassembling used clothing is not only time-consuming but also labor-intensive, it has not been widely used in industrial settings (Janigo et al., 2017).

Fig. 1. Second-hand clothes shopping sees slight uptick in 2022 (Fleck, A. 2023).

2.2. Recycling

Textile recycling refers to the mechanical, chemical, or thermal processing of discarded textile waste before or after use for application in new textile or non-textile products. This reduces the production of new fibers

and avoids additional downstream processes in the lifecycle of textile products, thereby minimizing the impact on the environment. The production of recycled polyester fibers from PET bottles is an area where recycling technology has been successfully industrialized. Despite the higher cost of additional processes, including collection, sorting, and washing, compared to virgin polyester fibers, market demand for recycled polyester fibers is steadily increasing. However, challenges include concerns that it does not contribute to reducing clothing waste and that used PET bottles are limited, disrupting the ecological cycle of the PET bottle industry. Therefore, textile-to-textile recycling technologies are warranted to regenerate textile fibers from discarded textiles. Currently, the material-to-material recycling rate of clothing waste is less than 1% of clothing produced (Ellen MacArthur Foundation, 2017), primarily due to the complexity of textile waste components, limited quantities of recyclable waste, and inefficiencies in the classification system. Therefore, researchers in Europe and the United States are actively pursuing research and systems development for classification technology and the development of recycled regenerated fibers (Fig. 2), with a focus on natural fibers and textile made from cotton–polyester blend (Rengel, 2017).

(a)   (b)

Fig. 2. Textile recycling to separate cotton–polyester blends; (a) UK Worn Again and (b) U.S. Circ (Rengel, 2017).

2.3.   Energy recovery from textile waste

Incineration is the process of burning waste. If controlled, it can be employed as an energy recovery process. Incineration of textile waste does not require separate sorting of clothing, and is therefore the most convenient approach for consumers to dispose of discarded textile materials. Nunes et al. (2018) analyzed cotton fiber waste generated in the textile industry as a resource for thermal energy production. They confirmed that the calorific value of cotton fiber waste is 4,013 kcal/kg, which is similar to that of wood pellets used as fuel (Table 1). Furthermore, the calorific value of acrylic-based biochar is considerably high, ranging from 5,700 to 7,200 kcal/kg depending on the mixture; therefore, it has similar properties to anthracite coal (Cay et al., 2018). In addition, Gr3N (2018) reported that the heat value of polyester is 5,685 kcal/kg; this is higher than the value of coal (5,429 kcal/kg) under their test conditions. The high calorific values of these fiber materials demonstrate their potential as alternative fuels. Energy derived from textiles is environmentally friendly and economical as it has the advantage of substituting fossil fuels and reducing greenhouse gas emissions, fuel costs, and textile waste disposal costs. Landfilling is another major method, with the methane gas generated accounting for 40–60% (by volume) of landfill gas emissions. While it is possible to capture and utilize methane as an energy source, when released into the atmosphere, it can serve as a potent greenhouse gas with a global warming potential 25 times greater than CO_2 (Karanjekar et al., 2015).

Table 1. Laboratory characterization of the analysed textile waste briquettes (Nunes et al., 2018).

Parameter	Result
HHV (a.r.)	4,013 kcal/kg
LHV (a.r.)	3,702 kcal/kg
Oxygen content (d.b.)	52.80%

Carbon content (d.b.)	40.28%
Hydrogen content (d.b.)	6.01%
Nitrogen content (d.b.)	0.365%
Moisture (a.r.)	6.22%
Volatiles content (a.r.)	80.26%
Fixed carbon (d.b.)	13.86%
Ashes content (d.b.)	0.52%

HHV – High Heating Value; LHV – Low Heating Value; a.r. – as received; d.b. – dry basis.

3. Conclusion

The primary focus of our review is to explore textile waste management from the sustainability perspective. With increasing recognition of climate issues and the importance of a circular economy, the demand for reuse and recycling is increasing. As a result, second-hand markets are thriving, and various recycling technologies are being promoted. However, excessive amounts of clothing waste and the absence of textile-to-textile recycling technology and a resource circulation system make waste management through reuse and recycling difficult. Therefore, large amounts of waste are ultimately disposed of in landfills or incinerated. However, uncontrolled incineration and landfilling are considered harmful to the environment due to the production of greenhouse gases. In contrast, recovering resources from textile waste into alternative textile-derived fuels can be an environmentally and economically beneficial method due to the high renewable energy value of fiber materials. Therefore, the controlled and loss-free collection of textile waste maximizing sustainable waste management, depending on the condition of the clothing waste, is crucial. Research directions in these fields can be developed toward more sustainable treatments with lower impacts on human health and the environment.

References

Turunen, L. L. M., & Gossen, M. (2024). From preloved to reloved: How second-hand clothing companies facilitate the transaction of used garments. *Journal of Sustainability Research*, 6(1), e240002.

Janigo, K. A., Wu, J., & DeLong, M. (2017). Redesigning fashion: An analysis and categorization of women's clothing upcycling behavior. *Fashion Practice*, 9(2), 245-279.

Ellen MacArthur Foundation. (2017). A new textiles economy: Redesigning fashion's future. Retrieved from https://archive.ellenmacarthurfoundation.org/assets/downloads/A-New-Textiles-Economy.pdf

Rengel, A. (2017). Recycled textile fibers and textile recycling. Retrieved from file:///C:/Users/%EC%9D%B4%EC%A7%80%EC%9C%A8/Downloads/study-on-recycled-textiles-and-textile-recyclability-ch.pdf

Nunes, L. J.R., Godina, R., Matias, J. C.O., & Catalão. (2018). Economic and environmental benefits of using textile waste for production of thermal energy. *Journal of Cleaner Production*, 171, 1353-1360.

Cay, A., Yanik, J., & Hanoglu, A. (2018). Assessment of acrylic based textile wastes as energy source. *Aegean International Textile and Advanced Engineering Conference*, 459, 012036.

GrN3. (2018). Retrieved from https://gr3n-recycling.com/

Karanjekar, R. V., Bhatt, A., Altouqui, S., Jangikhatoonabad, N., Durai, V., Sattler, M. L., Hossain, M. D. S., & Chen, V. (2015). Estimating methane emissions from landfills based on rainfall, ambient temperature, and waste composition: The CLEEN model. *Waste Management*, 46, 389-398.

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INTERNAL STRUCTURE ANALYSIS OF CONDUCTIVE COMPOSITE THREADS USING X-RAY COMPUTED TOMOGRAPHY

- FOCUSING ON CHANGES IN THE TWISTING CONDITIONS OF CONDUCTIVE YARN -

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Introduction

E-textiles are conductive fiber-based materials designed to have the properties necessary to create electrodes, sensors, and circuits to traditional textile products. It is in the form of a fiber and has excellent flexibility, breathability, and wearability, so it is mainly applied in smart wear. To manufacture E-textiles, a method of plating or coating conductive particles on non-conductive yarn is mainly used, and the conductive yarn produced by this method is twisted into several strands and used as sewing or embroidery yarn(Chen et al., 2021). While this has the advantage of having excellent conductivity because the conductive particles are exposed on the surface, the conductive particles easily fall off due to friction caused by the movement of the needle, causing a decrease in durability and performance (Jung & Lee, 2018). In this study, to compensate for these disadvantages, conductive composite threads were developed by changing the 1st and 2nd twist combination through a twisting process of non-conductive yarn and conductive yarn coated with silver particles. In addition, when analyzing the internal structure of existing fiber aggregates using an optical microscopy, confocal microscope or FE-SEM, it must be performed through cross-section cutting. In this process, not only are the fiber strands subject to tension, but their positions also shift, making the cut surface inconsistent. Analyzing these cut surfaces has the disadvantage of being easily deformed and thus different from the actual internal structure(Baby et al., 2021). Thus, in this study, to confirm the actual internal structure of the fiber aggregate of the manufactured conductive composite thread, non-destructive tomography is possible for fiber aggregate analysis, and X-ray Computed Tomography(X-ray CT), an analysis technique that can be combined to visualize as a three-dimensional image, was applied. Through this, fiber aggregate of the conductive composite thread was visualized, and the number of twists and twist length of the conductive yarn was calculated using the fiber strands. By applying X-ray CT, it is expected that more accurate analysis of the internal structure of fiber aggregates and design of fiber structure will be possible.

Research Method

Table 1 shows the materials used in this study. Samples were manufactured using two types of silver-coated conductive yarns (Soitex, Korea) of each fineness and one type of PET yarn (Sunghong, China). Using those materials, three types of samples were produced according to changes in the 1st and 2nd twist combination (Table 2). For twisting, non-conductive yarn and conductive yarn were simultaneously fixed to a jig of twisting machine (TY370, TexTex, China), and an initial load of 5 cN was applied. Afterwards, the 1st twist was given a right-side twist, 'S', and the 2nd twist was given a left-side 'Z' twist. At this time, the samples were manufactured with the twist number of the 1st and 2nd twists being 500 TPM, respectively. The morphology of the manufactured samples was analyzed using an optical microscope, and the linear resistance was analyzed using a two-point probe multimeter. In order to visualize the internal structure of the fiber through X-ray CT, it was performed at a resolution of 0.5 μm/pixel. A strand of the measured fiber assembly was selected, and 7,000 spatial coordinates were obtained and plotted on a graph on the x, y, and z axes. Through this, helical structure of each fiber strand and the twist characteristics of the conductive yarn were analyzed.

Table 1. Specification and sample code of used materials

Type	Sample code	Specification
Conductive part	Ag PA70D	Ag coated PA, 70d
	Ag PA140D	Ag coated PA, 140d
Non-conductive part	PET	PET *FDY, 75d

*FDY: Fully draw yarn

Table 2. Conditions of twist factor for manufacturing samples (Pre-load: 5 cN)

1st twist				2nd twist				Sample code
PET		Ag PA		PET		Ag PA		
linear density	ply	linear density	ply	linear density	ply	linear density	ply	
75	1	70	1	-	-	70	1	PET-Ag PA70/Ag PA70
75	1	70	1	1st twist PET-Ag PA70, 2ply				PET-Ag PA70/PET-Ag PA70
75	1	70	1					
75	2	-	-	-	-	140	1	PET2P/Ag PA140

Results & Discussion

As a result of the morphology, it was confirmed that PET-Ag PA70/Ag PA70 and PET2P/Ag PA140, in which Ag PA was exposed through the 2nd twist, had more exposed conductive parts compared to samples manufactured with PET-Ag PA70 pair. The internal structure of the conductive composite thread was confirmed through non-destructive measurement using X-ray CT. After measuring the coordinates by tracing one strand of conductive yarn in each sample, a 3D graph was obtained as shown in the Table 3. Through the graph, the twist direction and number of twists were measured based on 1 turn. In case of the twist direction, it was confirmed that it showed an "S" twist, although it was different from the ideal helical structure. It will be possible to quantitatively analyze the mechanical and electrical properties of the conductive composite thread according to the twist conditions by analyzing the twist length and shape through coordinates.

Table 3. Results of X-ray CT analysis of fabricated conductive composite threads

Type	Sample code		
	PET-Ag PA70/ Ag PA70	PET-Ag PA70/ PET-Ag PA70	PET2P/ Ag PA140
X-ray CT			
Plotted 3D graph			

Conclusion

This study was conducted to develop conductive composite threads that can be sewn and embroidered for application to smart wear. To analyze the structure of the fiber assembly of manufactured conductive composite threads, non-destructive analysis was performed through X-ray CT analysis rather than analysis through existing cut surfaces. X-ray CT was used to visualize the internal structure of the fiber assembly of three samples manufactured by twisting process, and the various twist characteristics were measured by ext

racting the coordinates and tracing one strand of fiber on a 3D graph. Accordingly, it was confirmed that b acktracking was possible. By quantifying the twist shape and twist angle per 1 turn through the X-ray CT analysis method, it is expected to be applicable to the development of conductive composite yarns with ex cellent durability and conductivity in the future.

References

Baby, R., Mathur, K., & DenHartog, E. (2021). Nondestructive quantitative evaluation of yarns and fabrics and determination of contact area of fabrics using the x-ray microcomputed tomography system for skin-textile friction analysis. *ACS Appl. Mater. Interfaces.*, *13*, 4652-4664.

Chen, M., Wang, Z., Li, K., Wang, X., & Wei, L. (2021). Elastic and stretchable functional fibers: A review of materials, fabrication methods, and applications. *Adv. Fiber. Mater.*, doi: 10.1007/s42765-020-00057-5.

Jung, I., & Lee, S. (2018). Durability evaluation of stainless steel conductive yarn under various sewing method by repeated strain and abrasion test. *J. Korean. Soc. Cloth. Text.*, *42*, 474-485.

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USER EVALUATION OF HUMAN-TOUCH SMART ARMBAND FOR TELE-HAPTIC COMMUNICATION

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Introduction

The demand for immersive virtual experiences is on the rise, fueled by users' desire for new realities and the industry's innovative technology integration. With the advancement of Extended Reality (XR) and the growing prevalence of non-face-to-face interactions, there is a need for new communication modes capable of remotely conveying emotions and offering tactile experiences similar to the 'human touch' (Elor et al., 2021). In the pursuit of realistic interactive experiences, tactile interaction facilitated through computers is considered a form of social interaction. Technologies such as gloves or vests are being developed to directly interact with the user's body, offering a genuine sense of touch (Delazio et al., 2018). Our previous study (Choi & Yoo, 2023) introduced the 'SPA-touch' haptic armband equipped with nine touch tips for emotional tactile gestures. In this study, we examined the practicality and wearability of the human-touch armband via user experiment.

Research Method

We conducted a perception study with 10 participants, testing soft pneumatic actuators integrated into the Human Touch Armband. The actuators, known as "SPA touch," measured 7 cm × 7 cm and were 0.3 cm thick, crafted from fabric and silicone with nine touch points for individual inflation. To minimize external influences, participants wore the armband on their left arm and followed touch mode definitions while using eye masks, earplugs, and white noise. Each participant completed a 28-item questionnaire during the survey, which lasted about 1 hour and 30 minutes per participant.

A. Touch Mode Awareness Experiment

We tested the perception of soft pneumatic actuators in the Human Touch Armband with 10 participants. Wearing the armband on their left arm, participants followed touch mode definitions while minimizing external influences with eye masks, earplugs, and white noise. The survey, lasting about 1 hour and 30 minutes per participant, included a 28-item questionnaire.

Fig.1 3 basic touch gestures and 3 emotional gestures

B. Assessing Emotional Transmission Suitability

In this process, participants evaluated the proposed emotional gesture modes of "Patting" and "Caressing'" using a Likert 5-point scale, as suggested by the researchers. A total of 12 items assessed the suitability of each touch mode in conveying specific emotions. To enhance realism, three patterns (duration, intervals, variations in repetition) were presented, guiding participants to choose conditions that best matched their intended emotions.

C. Wearability Assessment of the Human Touch Armband.

The questionnaire comprised 9 items. Ratings were given on a Likert 5-point scale except for the open-ended question.

Results & Discussion

A. Touch Mode Awareness Experiment
The study found that in basic touch mode, "Touch" and "Double Touch" had 100% accuracy, while "Drag" had 60%. In emotional touch mode, "Hug" had 100% accuracy, and "Patting" and "Caressing" each had 70%.

Table.1 Percentage of correct responses in recognition experiments for touch mode

Category	Touch	Double Touch	Drag	Patting	Hug	Caressing
All	100%	100%	60%	70%	100%	70%
Female	100%	100%	60%	80%	100%	60%
Male	100%	100%	60%	60%	100%	80%

B. Assessing Emotional Transmission Suitability
"Patting" received a high score of 3.8, followed by "Hugging" at 3.5 and "Caressing" at 3.4. All modes received positive feedback, with women giving higher suitability ratings than men in "Patting" and slightly higher ratings in "Caressing." Non-parametric Mann-Whitney U-test results showed no significant differences between men and women in tactile stimulation perception for "Patting" ($U=4.500$, $p=0.058$), "Hugging" ($U=11.500$, $p=0.811$), and "Caressing" ($U=8.000$, $p=0.309$) at $p<.05$.

C. Wearability Assessment of the Human Touch Armband.
The Human Touch Armband, constructed from soft fabric, offers a comfortable and frictionless experience akin to wearing a wristwatch. It ensures a personalized fit with adjustable sizing using Velcro. Table 2 summarizes average scores for questionnaire items, reflecting positive responses.

Table 2. Armband wearability questionnaire question organization

Category	Questions	Avg	Avg
Functionality Utility	The mapping of emotional attributes to tactile stimulation modes seems appropriate.	3.8	4
	Tactile stimuli expressing a single emotion showed consistency.	3.7	
	I think it could be used for emotional transmission.	4.6	
Convenience	The weight of the armband does not restrain or cause discomfort to the body.	3.9	3.9
Comfort	Tactile stimuli are not overly intense or unpleasant.	4.3	4.3
Safety	It does not seem to cause harm to the body.	4.5	4.5
Satisfaction	Satisfied with the tactile stimuli using the Human Touch Armband.	4.0	3.75
	Overall satisfied with the wearing comfort of the armband.	3.5	
Intention to Use	I would be willing to try using an armband with these features if it is released.	4.0	4.0

Conclusion

In this study, we present a novel communication system fostering emotional interaction between humans and haptic devices. We assess the wearability and performance of the developed Human Touch Wearable Armband. The results affirm that this armband, incorporating fabric-based soft pneumatic actuators, is a practical and effective smart wearable. It adeptly conveys touch sensations through tele-haptics, extending tactile experiences in Extended Reality (XR). The Human Touch Wearable Armband, as suggested in this

study, holds potential applications in various contexts where remote touch for emotional communication is essential, such as connecting distant family members and partners.

References

Elor, A., Song, A., & Kurniawan, S. (2021, March). Understanding emotional expression with haptic feedback vest patterns and immersive virtual reality. In 2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (pp. 183-188). IEEE.

Delazio, A., Nakagaki, K., Klatzky, R. L., Hudson, S. E., Lehman, J. F., & Sample, A. P. (2018). Force jacket: Pneumatically-actuated jacket for embodied haptic experiences. Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, 1–12. https://doi.org/10.1145/3173574.3173894

Choi, H., & Yoo, S. (2023). Development of human-touch smart armband for tele-haptic communication using a fabric-based soft pneumatic actuator. Fashion and Textiles, 10(1), 31.

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AN OPTIMIZED MICROENCAPSULATION OF SEA BUCKTHORN FRUIT OIL USING MELAMINE-FORMALDEHYDE

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Introduction

Sea buckthorn (*Hippophae rhamnoides* L.) fruit oil has been used in areas of food, medicine, and cosmetics owing to its physiological functions such as anti-inflammatory and antioxidant activity reported through many in-vitro studies (Koskovac et al., 2017; Zeb, 2004), but there are few reports on its application to textiles. Microencapsulation is an efficient technology to entrap the volatile functional substances as core material into the wall polymers and the microcapsules could be loaded on textiles so that the core substance is released out of the microcapsules on the surface of textiles. In this context, sea buckthorn fruit oil is expected to be efficiently utilized for bio-functional textiles by microencapsulating. Therefore, this study was purposed to investigate bio-activities of SB oil and to optimize the condition of microencapsulation of SB oil with melamine formaldehyde using response surface methodology.

Literature Review

Extracts of sea buckthorn have been applied as functional additives for textiles by some of technologies such as dyeing, pad-dry-cure, electrospinning, and microencapsulation. Hot water extract of SB leaves were treated to fabrics by dyeing (Badmaanyambuu, 2021) while their ethanol extract was finished to fabric by pad-dry-cure method (Yogendra Kumar et al., 2016) for investigating antimicrobial activity and other skin health functions. As for oil of sea buckthorn, microencapsulation has been performed by coacervation method with whey protein isolate (WPI), and carboxymethyl cellulose (CMC) (Roman et al., 2021) while with chitosan-Arabic gum another microcapsules of SB has been prepared successfully for textiles (Badmaanyambuu, 2021). Especially Badmaanyambuu & Yi (2023) reported the optimal conditions for preparing chitosan-Arabic gum microcapsule containing sea buckthorn fruit oil using coacervation method for finishing textiles by response surface methodology. However a traditional wall material, melamine formaldehyde has not been yet attempted for microencapsulating sea buckthorn oil.

Research Method

1. Materials

Natural sea buckthorn oil extracted by expression method was purchased from a Mongolian company ((Us-Erdene, Mongolia). As for wall material, melamine ($C_3H_6N_6$; Daejung chemicals, Korea)and formaldehyde(HCHO; for molecular biology, solution 37% in H_2O, Daejung chemicals, Korea) were used to synthesize melamine-formaldehyde.

2. Characterization of Sea Buckthorn Fruit Oil by GC-MS

Gas chromatography/mass spectrometry (GC–MS) was used to identify the constituents of sea buckthorn fruit oil (Isotermal for 5min at 40°C, 10°C/min from 40°C to 250°C 5min at 250°C).

3. Evaluation of Bio-active Properties of Sea Buckthorn Fruit Oil

Skin cell viability using MTT assay in that HaCat was incubated at 37 °C for 24hr in each plate containing sea buckthorn fruit oil and the OD of the dissolved formazan dye was recorded at 570 nm using a microplate spectrophotometer. As for in-vitro anti-microbial activity, KS K 0693:2016 was employed using Staphylococus aureus (ATCC 6538) and Klebsiela pneumoniae (ATCC 4352).

4. Optimizing Microencapsulation of Sea Buckthorn Oil by Response Surface Methodology

To figure out optimum conditions for preparing microcapsules, response surface methodology was used in that by Box-Behnken design, sea buckthorn oil rate (wt%), melamine rate (wt%), formaldehyde rate (wt%), and stirring duration (min) were optimized as independent variables, that is, microencapsulation conditions by investigating microencapsulation yield (MY,%), particle size (μm), and diameter distribution (Span) as

dependent variables. For manufacturing microcapsules, O/W emulsion of sea buckthorn fruit oil (20.69, 25.23, 29.77 wt%) and an emulsifier was added to solution of melamine (1.55, 1.62, 1.69 wt%) and formaldehyde (2.32, 2.47, 2.62 wt%) and thereafter the mixture was stirred at 50°C for 8hr to let microcapsules formed by in situ polymerization .

Results & Discussion

By GC-MS analysis, five main constituents including 2-methyl-, 3-methylbutyl ester, n-Hexadecanoic acid, Ethyl 9-hexadecenoate, ethyl ester, and Linoleic - 105 - acid ethyl ester were identified according to chromatographic peak areas indicating the total identified fraction accounts for more than 90%, which was supported by a previous study (Socaci et al, 2013). In test of cell viability by MTT assay the oil was confirmed as having no toxicity by showing rarely increase of cell viability even up to 1wt% of sea buckthorn fruit oil, which means the oil would be safe to human skin. The oil exhibited excellent antimicrobial activities with 99.9% of bacterial reduction rate against Staphylococcus aureus while being poorly antimicrobial against Klebsiela pneumoniae with 46.4% of reduction rates, which implies the oil could be effective to protect human skin against Staphylococcus aureus if it is released out of microcapsules on textiles next to skin.

By response surface methodology prediction models for each dependent variable were established. For example, as for 21.71% of maximum value for microencapsulation yield (MY,%), 25.23(wt%) of sea buckthorn fruit oil, 2.45(wt%) of formaldehyde, 1.69(wt%) of melamine, and 5 min of stirring duration were suggested as optimum conditions. It was also suggested that the optimized conditions for minimum Span were 29.77(wt%) of sea buckthorn fruit oil, 2.62(wt%) of formaldehyde, 1.69(wt%) of melamine, and 5 min of stirring duration, respectively, which has the highest R^2 value among the prediction equations.

Conclusion

This study was performed to prepare optimized melamine-formaldehyde microcapsules containing sea buckthorn fruit oil. Prior to optimization, sea buckthorn oil was identified as for its main constituents by GS-MS and it has little toxicity to skin as well as excellent antimicrobial activity against Staphylococcus aureus, which implies its potential to bio-functional natural resource to skin via textile. With melamine-formaldehyde in situ polymerization was attempted to entrap sea buckthorn fruit oil through response surface analysis. The optimum conditions for each parameter of microcapsules including microencapsulation yield, particle size, and diameter distribution (Span) were suggested by estimating prediction models having sea buckthorn oil rate, melamine rate, formaldehyde rate, stirring duration as encapsulation conditions. These results could be helpful to design bio-functional textiles with sea buckthorn fruit oil by microencapsulation.

Acknowledgment

References

Badmaanyambuu, S. (2021). *A Study of skin health functional textiles by treatment with Sea Buckthorn extract*. (Unpublished doctoral dissertation) Jeju National University.

Badmaanyambuu, S., & Yi, E. (2023). Optimization of microencapsulation parameters for sea buckthorn fruit oil with chitosan-Arabic gum. *Textile Science Engineering*, 60(1), 22-34.

Drozińska, E., Kanclerz, A., & Kurek, M. A. (2019). Microencapsulation of sea buckthorn oil with β-glucan from barley as coating material. *International Journal of Biological Macromolecules*, 131, 1014-1020.

Koskovac, M., Cupara, S., Kipic, M., Barjaktarevic, A., Milovanovic, O., Kojicic, K., & Markovic, M. (2017). Sea buckthorn oil—A valuable source for cosmeceuticals. *Cosmetics*, 4(4), 40.

Roman, D., Condurache, N. N., Aprodu, I., Enachi, E., Barbu, V., Bahrim, G. E., ... & Râpeanu, G. (2021). Insights of sea buckthorn extract's encapsulation by coacervation technique. *Inventions*, 6(3), 59.

Socaci, S. A., Socaciu, C., Tofana, M., Rați, I. V., & Pintea, A. (2013). In tube extraction and GC-MS analysis of volatile components from wild and cultivated sea buckthorn (Hippophae rhamnoides L. ssp. carpatica) berry varieties and juice. *Phytochemical Analysis*, 24, 319-328.

Yogendra Kumar, M. S., Raghu, T. S., Varghese, F. V., Indu Shekar, R., Kotresh, T. M., Rajendran, R., ... & Padaki, V. C. (2016). Application of seabuckthorn (Hippophae rhamnoides L.) leaf extract as antimicrobial finish on aramid fabric. *Journal of Industrial Textiles*, 45(5), 1115-1127.

Zeb, A. (2004). Important therapeutic uses of sea buckthorn (Hippophae): a review. *Journal of Biological Science*, 4(5), 687-693.

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Special Poster Session
: Technology for Sustainable Clothing Care

CAUSES OF MICROFIBER EMISSIONS DURING THE WASHING PROCESS

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Introduction

Materials such as polyester (PET), nylon, and polypropylene (PP) are commonly observed in the form of microfibers used in clothing. After degradation, microplastic or nanoplastics are so small that their removal from the environment is almost impossible. The loss of microfiber due to fiber production has not been well studied, but it is expected to account for a significant portion of overall microplastic pollution. In fact, fiber production has been argued to produce as many microfibers as fiber usage, and there is a possibility that 10-15% of fiber mass may be lost in the form of microfibers during the production process (First Sentier MUFG, 2022). Clothes maintenance (washing and drying) is also a cause of microplastic pollution, as microfibers are separated from textiles due to chemical and mechanical wear during washing and drying processes. Therefore, thorough research is needed on the fiber and clothing industries that produce vast amounts of microfibers (Hann et al., 2018; Nguyen et al., 2019). It is known that microfibers are released into the environment when synthetic fibers are washed at home, but there is little research on whether microfibers detected in washing machines originate from the washing process or from manufacturing and wearing processes, making it difficult to devise precise measures. In this study, we aimed to devise an efficient method using artificial neural networks to quantitatively analyze the microfibers generated during the manufacturing, wearing, and washing processes of clothing. Through this approach, we sought to identify the causes of microfiber emissions by comparing the number of microfibers formed during simulated manufacturing, wearing, and washing processes.

Research Method

Samples were collected from 100% polyester polar fleece garments. Samples used in the manufacturing and washing processes were cut into 10 cm × 10 cm, with five pieces for each experiment and repeated three times. For the wearing process, samples were cut to fit the size of the simulation device, 22 cm × 27 cm, and repeated three times. The detected amount of microfibers was recalibrated based on 420g. To collect microfibers generated during the manufacturing process before consumers purchase and wash the clothing, an ultrasonic washing machine (WUC-D22H, DAIHAN Scientific Company, South Korea) was utilized. To mimic consumer conditions, the samples were washed at 40°C for 60 minutes using 12 liters of water, following a standard washing cycle. A simulation device (ASA-7129, ASIA Testing Machines Company, South Korea) was fabricated to collect microfibers emitted into the air during the wearing process. Launder-O-Meter was used to simulate the washing process with a rotation speed of 50 rpm. To analyze the effect of water volume, 625 ml, which is 25% of the container's volume, was used. The impact of washing temperature was examined at 40°C and 20°C, with a washing time of 60 minutes. To remove any microfibers introduced during the manufacturing process, ultrasonic washing for 10 cycles was conducted before the washing and wearing simulation processes. Microfiber detection and analysis proceeded as follows: After each experiment, collected water passed through stacked stainless steel sieves with pore diameters of 500 μm and 40 μm to filter microfibers repeatedly. The filtered water was rinsed through each sieve, and microfibers were individually filtered using a vacuum filtration system with glass fiber filters (pore size: 1μm). After air-drying for 24 hours in the shade, observations were made using a microscope (Kyowa BIOLUZ-12 Japan) equipped with an image capture program. Fiber count, average fiber length, and total fiber length were derived from microfiber images using software developed based on artificial neural networks.

Results & Discussion

Before consumers purchase and use clothing, the amount of microfibers introduced during the

manufacturing process was measured using an ultrasonic washing machine. Ten cycles of ultrasonic washing were performed, and the total length of microfibers emitted during the manufacturing process was 77.3 cm. The highest amount (18.0 cm) was emitted in the first cycle, decreasing to 5.8 cm in the tenth cycle. Analysis of microfibers generated during the wearing process revealed that the total length of microfibers after 10,000 wear cycles was 35.8 cm, with 18.5 cm being waterborne microfibers and 17.3 cm being airborne microfibers. Approximately 66% of microfibers were emitted during the initial 1000 wear cycles, while 24% were emitted from cycles 1001 to 5000, and 10% from cycles 5001 to 10,000, indicating that a significant amount of microfibers was emitted during the early stages of wear. Analysis of microfibers generated during the washing process using Launder-O-Meter showed that the total length of microfibers detected after five wash cycles was 44.3 cm. Despite minimal differences in microfiber emissions based on washing temperature, increasing the number of wash cycles led to increased friction. When analyzing the average values for each process mentioned above, the largest amount of microfibers were emitted most during the manufacturing process (49%), followed by the washing process (28%), and the wearing process (23%).

Conclusion

It was revealed that approximately 28% of microfibers originated during the washing process, while 49% of microfibers were generated during the manufacturing process. The wearing process accounted for the smallest proportion, standing at 23%. Therefore, it was thought that if the microfibers generated during the manufacturing process are well controlled, the amount of microfibers released during the washing process could be significantly reduced. Consumers can minimize the release of microfibers by using laundry bags that filter out microfibers before wearing new clothes. Additionally, consumers can reduce the emissions of microfiber by using the "microplastic care" course or installing the filter system to the front-loading washer. Furthermore, by conducting more in-depth research, methods can be developed to remove microfibers generated during the manufacturing process before they are distributed to consumers. It is expected that such measures could effectively reduce overall microplastic emissions.

References

First Sentier MUFG. (2022). *Microfibres: The invisible pollution from textiles.* https://www.firstsentier-mufg-sustainability.com/content/dam/sustainabilityinstitute/assets/research/FSI-Sustainability-Investment-Institute-Report-January2022-final.pdf

Hann, S., Sherrington, C., Jamieson, O., Hickman, M., Kershaw, P., Bapasola, A., & Cole, G. (2018). Investigating options for reducing releases in the aquatic environment of microplastics emitted by (but not intentionally added in) products. *Report for DG Environment of the European Commission, 335.* https://ec.europa.eu/environment/marine/good-environmental-status/descriptor 10/pdf/microplastics_final_report_v5_full.pdf

Nguyen, B., Claveau-Mallet, D., Hernandez, L. M., Xu, E. G., Farner, J. M., & Tufenkji, N. (2019). Separation and analysis of microplastics and nanoplastics in complex environmental samples. *Accounts of Chemical Research, 52*(4), 858–866. https://doi.org/10.1021/acs.accounts.8b00602

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DUST REMOVAL VIA FABRIC MOVEMENTS WITHIN THE CLOTHING CARE SYSTEM

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Introduction

Care processes such as washing, drying, and ironing are essential for clothes during the use phase. Since water, heat, and detergent are used for conventional washing and/or drying, fabric damage was often occurred by mechanical force and chemical reaction (Nayak & Ratnapandian, 2018). Recently, as the reason for washing clothes has moved from removing soils to removing odors, dust, and wrinkles, it does not require strong washing, drying, and ironing as before (Jakobi, 1987; Seong & Lee, 2010; Ko et al., 2007). Accordingly, a clothing care system has emerged as a home appliance that can easily care clothing products while causing less damage to the fabric. The clothing care system consists of a drive system that involves mechanically moving the clothes like shaking, a heating system that can control internal temperature, a steam generator, and a ventilation and deodorization system. Using them, the clothing care system removes dust, odors, and wrinkles by controlling the fabric movement, steam, and air-flow intensity (Nayak, 2019; Kim et al., 2019; Choi et al., 2018). Therefore, we aimed to devise a method of analyzing the fabric movements in the clothing care system and improve the dust removal performance of the clothing care system based on the fabric movements.

Research Method

After recording the fabric movement using a digital camera, the outline of the fabric was tracked for 5 s of 150 frames using the TEMA Motion-Outline tracker (Image Systems Co., Ltd., Sweden). The center of the hanger was set to the origin and an XY coordinate system was created using two points (#1, #2) by the actual distance. Using the coordinate system, the fabric movements could be expressed with numbers. The patterns of the fabric movements were analyzed by accumulating the outline of 150 frames. The reciprocating speed of the moving hanger was 120 to 360 rpm, including 180 rpm used in the actual product. The fabric movement was identified and analyzed by comparing the actual movement with the simulation. Cotton, hemp, and silk fabrics, which are representative clothing textiles, were used for evaluating the fabric movements. The dust removal was evaluated by attaching the polyester yarns to the cotton fabric. A single thread that was dropped by fabric movements was counted as '1', and a single thread that displaced from its original location was counted as '0.5'.

Results & Discussion

When the fabric movements was simulated by changing the fabric type and the reciprocating speed, the vibration displacement of a specific position of the fabric was less than that of other positions because of the formation of nodes and anti-nodes. Thus, it was assumed that the dust removal performance for a given fabric could be different depending on the location of nodes. When examining the fabric movements using the outlines of the fabric, it was different depending on the characteristics of the fabric and the reciprocating speed. The larger drapability due to a small initial modulus and faster reciprocating speed resulted in more diverse movement. It was also confirmed through the outline of the fabric that nodes occurred at specific locations depending on conditions such as fabric characteristics and the speed of the movement system. These results were consistent with that from the simulations. After checking that the force of removing the dust by the reciprocating motion is within the range of the magnitude of the Van der Waals force between the dust and fiber, it was possible to predict that the dust removal performance could be dramatically improved with an increase in the reciprocating speed. The areas where the dust was not removed were large at the lowest reciprocating speed of 120 rpm, which was thought to be the result of the

role of nodes in the fabric movements and the smallest acceleration. Upon an increase in the speed, the reciprocating cycle became faster, increasing the acceleration. Thus, dust could be easily removed. However, even at high speeds, dusts were not removed at a specific location due to nodes. To compensate for the part where the dust could not be removed due to nodes, a complex movement algorithm was proposed by combining various speed configurations. In contrast to the conventional algorithm with the constant speed, the proposed algorithm facilitated the more effective removal of the dust from all positions of the fabric.

Conclusion

The fabric movements through the moving hanger in the clothing care system was experimentally verified along with the simulation, and it was confirmed that the dust removal performance could be improved through the control of fabric movements. It is expected that this approach could be used not only for dust removal but also for odor and wrinkle removal in the further research related to a clothing care system.

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References

Nayak, R., & Ratnapandian, S. (2018). *Care and maintenance of textile products including apparel and protective clothing*. CRC Press.

Jakobi, G. (1987). *Detergents and textile washing*. VCH GmbH.

Seong, H. Y., & Lee, J. S. (2010). The effect of washing machine type on the behavior of clothing management and consumer satisfaction. *Fashion & Textile Research Journal*, *12*(3), 389-397.

Ko, S. Y., Kim, C. H., Park, J. H., Lee, H. J., Lee, J. H., & Lee, K. H. (2007). Laundering and care of knitwear products. *Journal of the Korean Society of Clothing and Textiles*, *31*(9_10), 1364-1372.

Nayak, R. (Ed.). (2019). *Sustainable technologies for fashion and textiles*. Woodhead Publishing.

Kim, J., Lee, J., Kim, D., Gwon, S., & Baek, J. (2019). A study on the dry flow technology of clothing manager. In *Proceedings of the Korean Society of Mechanical Engineers, 2019 Conference, Korea* (pp. 190-193).

Choi, S., Hwang, Y. J., Lee, H. J., Kim, M. K., Kim, S. G., & Kim, H. S. (2018). Investigation of particulate matter removal efficiency via image processing. *Textile Science and Engineering*, *55*(2), 89-94.

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EFFECT OF STEAM IRONING ON WRINKLE RECOVERY OF VARIOUS FABRICS

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Introduction

In recent years, the global trend in the consumer electronics market has been a marked growth in the small appliance market. The growth of imported small appliance market is a result of a combination of social phenomena such as the increase in single-person households with income, pursuit of small but sure happiness, and Veblen effect. The imported small home appliance market is pre-empting the domestic market by targeting product lines not produced by large domestic home appliance companies through high-priced marketing. This is contributed to by a consumer culture of single-point luxury that is spreading mainly among people in their 30s and 40s. It refers to the tendency to spend lavishly on certain areas instead of cutting back elsewhere, and this has led to fandom for certain products.

With the increase in the number of dual-income households, there is a high demand for products that can complete tedious household chores more quickly. The main reason for the expansion of the steam iron market is that steam iron is more convenient and time-saving than ordinary iron. This expansion of the steamer market has prompted global appliance manufacturers to introduce the new products with features and design upgrades. However, in the case of imported appliances, expensive prices and poor AS are pointed out as problems compared to performance and technology, so it is necessary to develop the domestic high-performance steamer. The aim of the present work is to determine the optimal conditions for wrinkle removal of fabrics based on steam temperatures and pressures in order to derive the universal optimal wrinkle removal conditions for all garments.

Literature Review

Temperature, relative humidity and the pressure act to achieve a desirable cloth ironing effect.[1-3] When temperature applied during ironing is beyond glass transition temperature T_g of the fiber, the molecules in the fibers of the wrinkled cloth acquire the energy to relax and return to their original, that is, unwrinkled, positions and then are fixed once cooled down. At a given time, other variables that also affect molecule relaxation will contribute to the result, notably pressure via the iron and high moisture from the steam. After water absorption, swelling and weakening of intermolecular bonds reduce the glass transition temperature. Steam is provided by heating a boiler to provide saturated steam at a certain pressure (3 bar) to allow the steam to escape.

Wagner[4] reported the condensed steam contains tiny droplets of water called wet steam. When the moisture vapor comes into contact with the fabric, it condenses into a liquid and is absorbed by the fabric. The heat of adsorption causes the temperature to rise. The condensed water and the heat of adsorption make the fabrics easier to iron. The specific steam temperature, in the ironing process, the steam generator could achieve different saturation level of steam in temperature ranges from 100°C to 170°C. In the ironing progress, the steam not only condense into liquid water, but also lead to a transform of the attribution of the material and influence the ironing which is resulted by change the humidity of the material. The steam duration and pressure may be critical factors to the steam ironing effect. The steam flow rate, soleplate and ironing speed play a key role of smooth appearance.[5]

Research Method

Samples were prepared from cotton, wool, cotton and nylon fabrics (Testfabrics) and modal fabrics (commercially available), each was cut to 100cm × 20cm. They were wrinkled in a creasing machine for 1 minute and then hung on a hanger for 24 hours before steam ironing. The steam ironing was processed in the steam pressure to 3,4,5 bars and the steam temperature to 140~210℃ by 10℃ increments. To evaluate the appearance, the samples were steam ironed and then hung on a pants hanger for 4 hours. The test was conducted with KS K ISO 7768 (Textiles test methods for the evaluation of the appearance smoothness of textiles after washing).The evaluation was performed on the front of the sample at a distance of 1.2m from the judging table and compared to a standard judging board (replica of AATCC TM124).

Results & Discussion

To determine the optimal conditions for wrinkle removal of fabrics, steam ironing was performed with steam temperatures and pressures. The wrinkle removal effect of the fabrics using a high-pressure steamer. was examined When the cotton fabrics were treated by steam ironing at 210℃ and 5 bar under contact condition between the fabric and the steamer, wrinkle removal was most effective. The wrinkles in silk fabrics (thick twill) were not effectively removed under all the steam ironing conditions. The wrinkle removal effect was increased when they were steam ironed at 180℃ and 5 bar under close contact conditions. Wool fabrics exhibited the most effective wrinkle removal under all the steam ironing conditions, requiring less pressure for wrinkle removal compared to other fabrics

Modal fabrics showed good steam ironing effect under all the steam ironing conditions, so high pressure was not required for wrinkle removal of Modal fabrics. Nylon fabrics did not effectively remove wrinkles under all the steam ironing conditions, and heat shrinkage occurred when in close contact with the steamer. Observing the steam ironing effect based on the number of sprays at low temperature, in the case of cotton fabrics, no wrinkle removal effect was observed even after steam ironing was repeated 8 times at steam spray distance of 1.4cm. However, in the close contact condition, wrinkle removal effect was observed from 4 times. The wrinkle removal effect of the high-pressure steamer was shown to be better than that of the regular steamer for cotton fabrics and silk fabrics.

Conclusions

In this study, in order to determine the optimal conditions for wrinkle removal of various fabrics, steam ironing was performed depending on steam temperatures and pressures, and winkle recovery of the fabrics was rated. Consequently, the wrinkle removal effect increased at 4 bar. In close contact conditions, the number of repeating improved the wrinkle removal. High-pressure steamer was more effective at removing wrinkles from cotton and silk fabrics than the ordinary steamers. At maximum temperature of 210℃, there were no color changes of cotton fabrics over the entire pressure range. When reducing the pressure, the temperature of the steam should be increased. In the case of fabrics that can wrinkle a lot, the optimal pressure is considered to be more than 4 bar, but the optimal temperature for wrinkle removal of fabrics varies. Therefore, it is thought to be necessary to provide the function to control steam temperature and pressure to the high-pressure steamer product.

References

Bryant, G., & Water A. (1959). Stiffness and resiliency of wet and dry fibers as a function of temperature. *Textile Research Journal, 29*, 211-219.

Guh, P., & Elder, H. (1966). The effect of temperature and humidity on the flexural rigidity of some man - made fiber fabrics. *Journal of the Textile Institute Transactions, 57*, 541-544.

Liang, S., Pan, N., Wu, X., Ding, X. (2018). Effects of pressure-free steam ironing on cotton fabric surfaces and wrinkle recovery. *Textile Research Journal*, *88*(22), 2535-2543.

Masteikaite, V., Saceviciene, V., Kopbajeva, E., & Nurjasarova, M. (2015). Influence of heat transfer material on the deformability of knitted fabrics. *International Journal of Clothing Science and Technology, 27*(2), 191-206.

Shuaitong, L., Xue, D., Xiong, W., Fan, W., & Tesfaye Mulu A. (2016). Design and practicability evaluation: a novel platform for fabric steam ironing. *International Journal of Clothing Science and Technology*, *28*(4), 191-206.

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STYLER-BUILT-IN HIGH-PRESSURE HANDY STEAMER DEVELOPMENT THROUGH STEAM QUALITY BASIC RESEARCH

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Introduction

Recently, the market demand will continue to increase as social factors are changing the home appliance market, where it is more important to consume value for oneself. This expansion of the high performance steamer market has prompted global appliance manufacturers to introduce new products with better features and designs. Therefore, it is necessary to develop the domestic functional smart high-pressure steamer. The high-pressure steamer is a complex physical process with steam generation and condensation, water absorption by fabrics and the caused changes in the physical and surface properties of fabric during the process. In this study, we evaluated and analyzed the changes in texture, deodorization performance and appearance of the various fabrics under high-pressure steamer treatment conditions. Through experimental research results, we sought a synergistic effect of high-pressure steamer and Styler and developed a Styler built-in high-pressure handy steamer.

Literature Review

The effects of ironing factors including temperature and steam on wrinkles have been widely studied.[1,2] True steam means of steamer that is completely vaporized by heating water to 100°C. It can supply moisture and energy uniformly to a specific space. The steam of the high-pressure steamer has a high temperature and pressure, which quickly penetrates deep into the fiber by spraying, and has a quick wrinkle removal and sterilization/deodorization effect. When the fabrics strengthened by washing are treated by a high-pressure steamer, moisture of steam penetrates between the fibers, making the fiber tissue flexible and removing wrinkles, thereby improving tactile property. The cause of the odor is that odor-causing particles are attached between the warp and weft of the fabric. The odor particles remain adhered to the fiber. If moisture is added in this state, the odor particles dissolve in the moisture, or moisture penetrates between the odor particles and the fiber, loosening the bond. This phenomenon is effective at high temperatures, so using high temperature of steam is efficient. When a physical impact is applied, odor particles are separated from the fiber and the odor is removed. In the case of a high-pressure steamer, high-temperature and high-pressure are added to the fiber, increasing deodorizing performance.

Research Method

Tactile Sensation Analyzer (TSA) is used to evaluate the softness and smoothness of the fabrics by analyzing the sound waves generated by applying friction to the fiber (unit dB) The high-pressure steamer treatment was at 140°C and 5 bar for 20 sec for tactile assessment of fabrics.

The deodorizing performance of the fabric was evaluated by applying ISO 17299-1:2014. The high-pressure steamer and a regular steamer (Cuckoo) were treated at a steam spray distance of 1.5 cm at 140 °C, 5 bar for 10 sec For treatment time effect, the odor-adsorbed wool fabrics were treated by high-pressure steamer in spray distance of 1.5 cm for 10 to 60 sec at interval of 10 sec. Six odor-adsorbed wool fabrics were treated in the styler (standard) and steamer, respectively. The odor-absorbed wool fabrics were treated with high-pressure steamer (10 sec) and then styling (standard). Appearance evaluation was performed using KS K ISO 15487.

Results & Discussion

Tactile evaluation of fabrics; TSA was used to evaluate the softness (TS7), smoothness (TS750), and stiffness (D) of fabrics. For cotton, wool, cotton, and modal fabrics, the high-pressure steamer treatment

increased the bulkiness of the fine fibers, resulting in an increase in softness. The high-pressure steamer treatment made the fabric softer and smoother than softener treatment.

Deodorization performance evaluation of fabrics; The deodorization rates by high-pressure steamer treatment varied by fibers. They were 62.50% for woolen fabrics, 47.96% for cotton fabrics, and 65.27% for nylon fabrics, which were 3, 2, and 1.25 times higher than those by low-pressure steamer. The deodorizing performance of high-pressure steamer according to treatment time has the maximum effect (64.6%) at 140℃ and 5 bar, in the spray distance of 1.5cm, for 10 sec.

Synergistic effect of high-pressure steamer and Styler treatment; The deodorization rate was 91.75% for both Styler (standard) course and steam (low pressure) treatment, 100% for Styler (standard) course after high-pressure steamer treatment (10 sec), 83.50% for Styler (rapid) course, and 87.50% for Styler (rapid) course after high-pressure steamer treatment. The deodorization rate increased by 4% when the high-pressure steamer was applied before Styler (rapid) course, compared to Styler (rapid) course alone.
When comparing deodorization rates between Styler (standard), steamer (low pressure), high pressure steamer + Styler (standard), Styler (rapid), and high-pressure steamer + Styler (rapid), high pressure steamer + Styler (standard) was the best. The appearance of the Styler (standard) treatment after high-pressure steamer treatment was rated better than Styler (standard) treatment alone. Smoothness of the seam at the shoulder line was rated better for Styler (standard) treatment after high-pressure steamer treatment.

Developing a Styler built-in high-pressure handy steamer; Based on the above basic experimental results, we developed a Styler built-in high-pressure steamer.

1) Features of RX high-pressure steamer ; RX high-pressure steamer is a concept module that complements the Styler for quick and convenient steam ironing. The steam pressure is adjustable. The high-pressure steamer allows wrinkle removal. It is easy to work and organize. It can be removed directly from the Styler storage compartment for quick ironing preparation. After using the high-pressure steamer, it is placed in the storage compartment and the cable is tucked away, reducing need to move around. After Styler treatment, the high-pressure steamer can be used for finishing. Besides, deodorization of household products is possible. Automatic cleaning of the high-pressure steam generator. It is easy to remove impurities and lime by cleaning the generator periodically.

2) Structure: It is composed of a steamer, a high-pressure steam generator and a steamer storage box. The steamer includes a spray button. The blowing modes include strong (3 stage), medium (2 stage) and weak (1 stage). Strong (3 stage) has the maximum steam amount of 75cc/min. Medium (2 stage) has 55 cc/min, and it is a weaker but relatively fuller steam than the strong mode. Weak (1 stage) has 45 cc/min, which is suitable for cleaning clothes that are vulnerable to moisture.

3) Steam generation mechanism: Pump supply of water → Water sensor water level detection → Heater operation → Thermistor (temperature sensor) or pressure switch control → Temperature/pressure detection → Press steam injection button → Solenoid valve opening to release steam → Steamer heater reheat some condensed steam → Steam injection

Cleaning mode mechanism: Check the steam generator is temperature below 80℃ → Pump supply of water → Heater heat up → Reach at temperature of 80℃ → Drain the valve open → Drain for 60 seconds → Close valve

Conclusions
In this study, we investigated the changes in texture, deodorization performance, and appearance of the the fabrics by high-pressure steamer treatment. Through these results, we induced the synergistic effect of high-pressure steamer and Styler, and developed a new Styler built-in high-pressure handy steamer.

References

Liang, S., Pan, N., Wu, X., & Ding, X. (2018). Effects of pressure-free steam ironing on cotton fabric surfaces and wrinkle recovery. *Textile Research Journal, 88*(22), 2535-2543.

Kim, P., Abkarian, M., & Stone, H. A. (2011). Hierarchical folding of elastic membranes under biaxial compressive stress. *Nature Materials, 10*(12), 952-957.

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ANALYZING CONSUMER SEGMENTATION IN THE PERCEPTION OF SMART WASHING MACHINE TECHNOLOGY: A PRODUCT IMAGE-BASED APPROACH

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Introduction

This study explored the consumer market of smart washing machines (SWMs) based on the perceived product images, which are rapidly evolving to meet the swiftly changing market demands. In recent years, consumer trends in the home appliance market have shifted from a focus on price competitiveness to an emphasis on brand value, consumer experience, and satisfaction. In response, global home appliance companies are increasingly concentrating on developing IoT-enabled premium smart home appliances equipped with cutting-edge technologies (Kim & Gun, 2020).

Moreover, environmental degradation due to climate change has heightened consumer demand for hygiene and health. Consequently, home appliance companies are addressing these needs through innovative "new life" appliances that offer distinct advantages over conventional appliances. Particularly, changes in consumer lifestyles have prompted these companies to introduce a range of novel home appliances characterized by enhanced functionality as well as sensibility (Jung & Kim, 2020; Lee & Hyun, 2022). Against this backdrop, this study aims to deepen the understanding of the SWM market, offering insights for the advancement of SWM technology and contributing to the expansion of research within the clothing and textiles discipline.

Literature Review

SWMs represent a significant advancement in laundry appliances, integrating utilitarian and hedonic benefits through four key characteristics: digital, connectivity, responsiveness, and intelligence (S. Kim & Moon, 2022). The advent of new technologies has catalyzed the introduction of various smart home devices (Elmenreich & Egarter, 2012). Nonetheless, delineating the specific technologies that could attract consumers to SWMs remains challenging due to the limited availability of their market data. In addition, the concept of "image" is understood as a mental construct formed from selected impressions of a broader array (Reynolds, 1965), with "product image" representing its symbolic value in the consumer marketplace (Grubb & Grathwohl, 1967). Quester et al. (2000) asserted that product purchases are influenced by the alignment of product images with consumers' needs and the enhancement of their self-concept (Quester et al., 2000). Therefore, identifying the product images associated with SWMs is crucial for guiding technological development and shaping effective marketing strategies. Given the above discussion, we draw the research questions as follows:

RQ1. To understand the product images of SWMs desired by consumers and the core technologies equipped in SWMs.
RQ2. To segment the consumer market based on the product images associated with SWMs.
RQ3. To clarify the attributes of the identified consumer market segments.
RQ4. To explore the differences in the perceived usefulness of smart technologies applied to SWMs according to the segments.

Research Method

This study adopted a mixed-methods research approach, integrating both qualitative and quantitative methodologies to pioneer a novel research domain while ensuring the robustness of the findings (Tashakkori & Teddlie, 2010). Initially, a qualitative investigation identified the desired product images of SWMs and the key smart technologies integrated within SWMs. Data were garnered through two focus

group interviews, engaging 16 Korean women in their 30s to 40s. These sessions employed the projective technique, facilitating participants' expression of subconscious thoughts and opinions via indirect stimuli rather than direct inquiries (Zaltman & Coulter, 1995). Subsequently, a quantitative analysis was undertaken. An online survey was completed by 416 married South Korean women, ranging in age from 20 to 50, to explore from RQ2 to RQ4. The collected data were analyzed via exploratory factor analysis, one-way ANOVA, cluster analysis, and chi-square tests to examine the underlying patterns and segmentations within the consumer market.

Results & Discussion

The qualitative analysis revealed eight distinct product images associated with SWMs: (1) health-oriented appliances that promote well-being; (2) devices embodying a Lifestyle of Health and Sustainability (LOHAS); (3) eco-friendly appliances enhancing environmental safety; (4) dependable home assistants that integrate seamlessly into family dynamics; (5) appliances equipped with information technology; (6) innovations designed to elevate overall life quality; (7) premium appliances mirroring individual lifestyle choices; and (8) appliances that extend beyond mere functionality to augment interior design aesthetics. Furthermore, the analysis identified six core technological dimensions within SWMs: (1) wash cycles (universal, adaptive, and customizable); (2) control panels (user-friendly and one-touch operation); (3) laundry technologies (intelligent sorting, precise detergent dispensing, and advanced rinse management); (4) maintenance technologies (proactive system diagnostics and hygiene monitoring); (5) informational technologies (real-time status updates and personalized usage insights); and (6) connectivity technologies (seamless integration between washer and dryer and all-in-one care systems). These qualitative insights were corroborated by subsequent quantitative analysis. Exploratory factor analysis of the eight identified product images yielded three overarching themes: LOHAS Life, Balanced Life, and Refined Life. Cluster analysis further delineated four consumer segments: the Refined Space Creators (n = 136), the Indifferent Group (n = 85), the Sustainability Seekers (n = 57), and the New Life Enthusiasts (n = 138). The New Life Enthusiasts exhibited the highest factor scores across all themes, indicating a broad appreciation for SWM technologies. The Sustainability Seekers and the Refined Space Creators, while distinct in their motivations, showed similar levels of technology appreciation. Conversely, the Indifferent Group demonstrated lower factor scores and technology appreciation. Nevertheless, the importance of rinse cycle management, proactive maintenance, and sanitation diagnostics remained consistent across all groups, suggesting these features are fundamental to SWM design.

Conclusion

This study sheds light on consumer perceptions and technological preferences in the SWM market, revealing a shift towards appliances that align with lifestyle values and environmental considerations. Through mixed-methods research, we identified eight product images and six core technological dimensions integral to SWMs, highlighting the importance of health, sustainability, and advanced functionality in consumer preferences. The segmentation into four distinct consumer groups—Refined Space Creators, the Indifferent Group, Sustainability Seekers, and New Life Enthusiasts—offers critical insights for tailoring SWM innovations to diverse consumer needs. The cross-segment appeal of technologies like rinse cycle management and proactive maintenance diagnostics emphasizes their essential role in SWM design. Contributing to the field of clothing and textiles, this research provides a foundation for further exploration into the interrelationship between consumer expectations and SWM technological advancements. It underscores the necessity for manufacturers to develop SWMs that resonate with contemporary consumer values and environmental sustainability.

References

Elmenreich, W., & Egarter, D. (2012). Design guidelines for smart appliances. *Proceedings of the 10th International Workshop on Intelligent Solutions in Embedded Systems,* Klagenfurt, Austria (pp. 76-82).

Grubb, E. L., & Grathwohl, H. L. (1967). Consumer self-concept, symbolism, and market behavior: A

theoretical approach. *Journal of Marketing, 31*(4), 22–27.
https://doi.org/10.1177/002224296703100405

Jung, M.-K., & Kim, S. (2020). A study on the effects of home appliances to home furnishing: Focused on millennials. *Journal of Digital Convergence, 18*(4), 389–395.
https://doi.org/10.14400/JDC.2020.18.4.389

Kim, S., & Moon, H. (2023). Understanding consumer acceptance of smart washing machines: How do female consumers' occupations affect the acceptance process? *International Journal of Human–Computer Interaction, 39*(4), 801–822. https://doi.org/10.1080/10447318.2022.2049135

Kim, T.-J., & Gun, E. J. (2020). A study on the management strategy mechanism of the premium consumer electronics market based on Ser-M framework: Focused on LG Electronics' case. *Korean Business Education Review, 35*(6), 509–531. https://doi.org/10.23839/kabe.2020.35.6.509

Lee, H., & Hyun, E. (2022). An analysis of design marketing case in South Korea's major consumer electronics manufacturers: Focusing on 'BESPOKE' in S Electronics and 'Objet' in L Electronics. *Journal of the Korean Society of Design Culture, 28*(4), 329–339.
https://doi.org/10.18208/ksdc.2022.28.4.329

Quester, P. G., Karunaratna, A., & Goh, L. K. (2000). Self-congruity and product evaluation: A cross-cultural study. *Journal of Consumer Marketing, 17*(6), 525–535.
https://doi.org/10.1108/07363760010349939

Reynolds, W. H. (1965). The role of the consumer in image building. *California Management Review, 7*(3), 69–76. https://doi.org/10.2307/41165634

Tashakkori, A., & Teddlie, C. (2010). *Sage handbook of mixed methods in social & behavioral research.* Sage Publications.

Zaltman, G., & Coulter, R. H. (1995). Seeing the voice of the customer: Metaphor-based advertising research. *Journal of Advertising Research, 35*(4), 35–51.

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DEVELOPMENT OF QUICK STEAM COURSE CONTROLLING *MORAXELLA OSLOENSIS*, A MAJOR BACTERIUM CAUSING LAUNDRY OFF-ODOR, TO ELIMINATE ODOR ORIGINATED FROM CLOTHES

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Introduction

Laundry is usually progressing at under 40℃ temperatures with irregular cycle depending on laundry accumulates. The standard laundry process is not suitable to sterilize microorganisms contaminated in the fabrics. To the contrary, the common laundry process is only to wash out the contaminated microorganism. Furthermore, the microorganisms growing in clothes generate volatile organic compounds, leading to laundry odorous. Therefore, a high-temperature washing is used to solve this problem while it may result in fabric damage. On the searching to overcome this issue, steam process has been recommended as a method, which is minimizing the fabric damage and effectively eliminating microorganisms resulting in deodorization. Therefore, this study aimed to develop an effective quick steam course in sanitizing *Moraxella osloensis* that is known to cause laundry off-odors while minimizing fabric damage.

Literature Review

There are many reports on the relationship between steam and microbial death. As well known, Gram-negative bacteria are vulnerable to physical stress and are easily sterilized by the treatment of high temperatures. However, few research is available on applying steam treatment to home appliances. Thus, this study will contribute to present scientific evidence on the effect of steam treatment to control the contaminated microorganism in clothes generating off-odors.

Research Method

The samples, towels, were inoculated for 12 h with 60 mL of *M. osloensis* culture. Then the samples were incubated for 12 h at 30℃ and dried for 12 h at 25℃. The entire process was repeated three times to generate a typical laundry off-odor <Figure 1>. The samples were put into 25 kg washing machine model equipped with TrueSteam (LG Electronics) and washed with the quick steam course (steam washing; 100℃, 50 min). The samples were divided into two group with washing (BW) or without washing (AW). The viable cell count was conducted to confirm the sterilization efficacy of steam washing process with high temperature. To measure odor reduction, sensory evaluation was conducted by 5-point measurement method according to the 'Environmental Ministry's odor process test standards. GC/MS analysis was used for qualitative analysis of isovaleric acid, a standard laundry off-odor compound as a secondary metabolite generated from *M. osloensis*.

Figure 1. Preparation of standard samples to generate laundry off-odor in towel.

Results & Discussion

It was observed 99.99% of microbial sterilization by the steam washing in BW samples. Also, a significant reduction in off-odor intensity was determined in sensory evaluations, with a decrease from 3.53 to 0.27 in BW samples. Furthermore, GC/MS analysis revealed a substantial decrease of isovaleric acid in BW samples, compared to AW samples. These remarkable results suggest that the steam washing plays a crucial role in decreasing the microbial viability, the off-odor score and the strength of isovaleric acid.

Figure 2. Effect of steam washing on microbial viability.

Figure 3. Effect of steam washing on off-odor sensory score (Bar) and strength of isovaleric acid (Line).

Conclusion

Clothes off-odors come from bacteria growth resulting the production of secondary volatile metabolites. It has been used high temperature washing to solve the off-odor, while resulting the fabric damage. The quick steam course revealed the efficacy in decreasing the microbial viability, the off-odor score and the strength of isovaleric acid.

References

Choi, H. W., Jurg, C. J., & Park, M. J. (2022). Analysis of the survey on the consumer's knowledge and laundry habits to microorganisms living in clothing. *Journal of Costume Culture Association*, 10(6), 781-792.

Lemfack, M. C., Nickel, J., Dunkel, M., Preissner, R., & Piechulla, B. (2014). mVOC: a database of microbial volatiles. *Nucleic Acids Research*, 42(Database issue), D744–D748.

Hu, Y et al. (2016). Microbial decontamination of wheat grain with superheated steam. *Food Control*, 62, 264-269.

Kubota, H., Mitani, A., Niwano, Y., Takeuchi, K., Tanaka, A., Yamaguchi, N., ... & Hitomi, J. (2012). Moraxella species are primarily responsible for generating malodor in laundry. *Applied and Environmental Microbiology*, 78(9), 3317-3324.

National Institute of Environmental Research Notice. (2019). Environmental Ministry Odor Process Test Standards.

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Proceedings

EFFECT OF STEAM TREATMENT TO DEODORIZE THE INSIDE OFF-ODORS IN CLOTHES DRYER

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Introduction

With rising national incomes, hygiene is emerging as an important purchase point. Clothes dryers provide efficiency in hygienic clothing care, saving time and effort. However, despite this efficiency, consumer complaints are increasing due to off-odors from the dryer inside. As volatile organic compounds (VOCs) are metabolic products originated from microbial growth, it has been reported that they cause off-odors. In addition, it has been known that a steam treatment is a method to reduce VOCs. Therefore, in this study, it was evaluated the steam effect on deodorization using a clothes dryer contaminated artificially by odorous microorganisms.

Literature Review

Steam is known to sterilize microorganisms by denaturing protein. temperatures. It is used to sterilize microorganisms in home appliances such as washing machines and clothes dryers for hygiene management. However, there is not much research on controlling off-odor produced by microorganisms in the clothes dryer. Therefore, in this study, we attempted to control the off-odor generating clothe dryer inside using steam treatment. The results obtained in this study will apply to develop a new hygienic manual for clothes dryer.

Research Method

To prepare a contaminated dryer with microorganisms, *Escherichia coli* KCTC 2571 was artificially inoculated inside a 20 kg dryer with a new steam generating device (LG Electronics). After operating the standard course, the dryer inside was steamed for 20 min and left for 1 h and 24 h. According to the leaving conditions, the experimental group was classified into two groups: Open the door of dryer and keeping (OD) and close the door of dryer and keeping (CD) (Table 1). The deodorization effect by the steam treatment was confirmed through sensory evaluation and GC-MS analysis. The sensory evaluation was conducted using a 5-point scale according to the Ministry of Environment's odor process test standards. After conducting GC-MS qualitative analysis, it was also analyzed changes in dimethyl disulfide, a standard substance produced by E. coli, with a strong odor.

Table 1. Schematic of experimental diagram to evaluate the deodorization by steam treatment.

OD	CD
First standard course	
Steam treatment	
Keep 1 h (door open)	Keep 1 h (door close)
Keep 24 h (door open)	Keep 24 h (door close)
Second standard course	

OD, open the door of dryer and keep after steam treatment. CD, close the door of dryer and keep after steam treatment.

Results & Discussion

The sensory evaluation scores of OD and CD were 2.80 and 2.60 prior to the steam treatment, respectively, and increased to 3.60 and 3.40, respectively, after steam treatment. It was conducted that the sensory evaluation score of OD decreased when kept for 1 h after the steam treatment, while CD decreased after 24 h. This difference is prospected that the volatile substances adsorbed on the steam diffuse faster in the OD.

Figure 1. Sensory evaluation results according to dryer conditions. OD, open the door of dryer and keep after steam treatment. CD, close the door of dryer and keep after steam treatment.

As a result of GC-MS analysis, many odorous substances were detected prior to steam treatment. The odorous substances were reduced after the steam treatment (data non-shown). In particular, when kept for 1 h, the area of dimethyl disulfide in OD samples decreased significantly (Figure 2).

(A)

(B)

Figure 2. Chromatogram of dimethyl disulfide in dryer inside under different conditions. (A), chromatogram of OD. (B), chromatogram of CD.

Conclusion

In this study, the deodorizing effect of steam treatment was confirmed, and the deodorizing effect was better in OD with waited the door open. We can present scientifically reliable manuals to consumers. The results of this study can be used as basic data in the future development of home appliances such as new dryers.

References

National Institute of Environmental Research, 2019, Odor process test method 6.1.1 odor intensity recognition test

Lemfack MC, Nickel J, Dunkel M, Preissner R, & Piechulla, B, 2014, mVOC: a database of microbial volatiles, *Nucleic acids research*, 42(D1), D744-D748

Ratiu, I. A., Ligor, T., Bocos-Bintintan, V., Al-Suod, H., Kowalkowski, T., Rafińska, K., & Buszewski, B, 2017, The effect of growth medium on an Escherichia coli pathway mirrored into GC/MS profiles, *Journal of breath research*, 11(3), 036012.

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THE ATTRIBUTES OF QUALITY CLASSIFICATION FOR MOBILE LAUNDRY SERVICES

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Introduction

The rapid growth of mobile laundry services has been spurred by advancements in online platforms and the introduction of early morning delivery services. Specifically, 'Laundry-Go' has experienced explosive user growth, with its revenue soaring from 1.6 billion won in 2019 to 37 billion won in 2022 (Park, 2023). This trend is attributable to the increasing number of single-person households and the limited availability of leisure time, suggesting that mobile laundry services have lightened the load of home management. These services have eliminated the hassles associated with traditional laundry shop hours, allowing users to conveniently arrange for their laundry to be collected and returned within 1-2 days through an app, thus easing the chores associated with household upkeep. Kang and Lee (2024) found that millennials, in particular, favor the ease of obtaining professional laundry results without needing expert knowledge, reflecting their preference for convenience in managing household tasks. Moreover, mobile laundry services have emerged as a preferable alternative to traditional housekeeping services, which were often marred by intrusive home visits and poor time management. The rise of the mobile laundry sector, however, has also brought to light issues such as damages, delays, and cases of lost or incorrectly delivered items, as highlighted by Kim (2021). These problems have raised concerns over potential avoidance tactics by service providers, such as blaming manufacturers or ignoring issues inherent to the laundry process. Addressing these concerns necessitates targeted research to understand consumer needs and expectations for mobile laundry services, to enhance customer satisfaction and loyalty.

In this study, we aim to investigate the needs of consumers who have recently utilized mobile laundry services, understand the factors they consider important when evaluating service quality, and examine whether these factors influence service satisfaction. Through this, we intend to propose marketing strategies to develop mobile laundry services into consumer-oriented services.

Research Question 1: What are the factors that consumers consider important when evaluating the quality of mobile laundry services?
Research Question 2: What are the important factors on service satisfaction in mobile laundry services?

Literature Review

Despite the success and longstanding presence of mobile laundry services, there has been limited research conducted in this area. Given that mobile laundry services fall within the broader category of service offerings, the SERVQUAL framework was deemed an appropriate theoretical basis for our study. SERVQUAL is a widely recognized tool for measuring service satisfaction, often used by researchers to evaluate service quality from the consumer's perspective and to enhance the service provider's quality. The model is built around five key dimensions: tangibles (encompassing the physical aspects of service delivery such as environment, facilities, equipment, and materials), reliability (the ability of the provider to deliver services accurately and on time), responsiveness (the speed and efficiency with which a provider meets consumer needs), assurance (the degree to which consumers trust the provider's

competence, knowledge, and integrity), and empathy (the provider's attentiveness to and understanding of consumer needs and viewpoints).

However, there has been debate regarding the reliability and validity of this scale for evaluating quality based on the gap between performance and expectations. In response, Cronin and Taylor (1992) introduced the SERVPERF model, a streamlined approach that evaluates service quality purely based on performance, using the same measurement items as SERVQUAL. This study aims to assess the quality of mobile laundry services, adapting the SERVPERF model to assess consumer satisfaction with the quality of these services.

Research Method

This study utilized judgment sampling to target users of mobile laundry services. An online survey was conducted via the Entrust survey platform from May 29th to June 8th, 2020, yielding a total of 300 responses. Among the participants, 45.3% (n=136) were male and 54.7% (n=164) were female. The majority were in their 30s, accounting for 40.7% (n=122), with 55.7% (n=167) being married. Data analysis was conducted using R version 4.3.2.

A pre-interview survey identified 31 possible service items related to laundry services. Some participants lacked experience with certain services, leading to missing data. Given the significant data loss that would result from deleting these cases (resulting in data from only 174 participants), it was deemed necessary to address the missing values. Therefore, the normality of each service item was assessed, and as no issues with normal distribution were found, mean imputation was utilized for handling the missing data. Exploratory factor analysis and multiple regression analysis were employed to analyze the research questions.

Results & Discussion

To identify the factors that consumers consider important when evaluating the quality of mobile laundry services, exploratory factor analysis was conducted with Varimax rotation to derive constituent concepts (see Table 1).

Table 1. Factor Analysis

	Factor loading	Communality	Cronbach's alpha
Service tangibles & sympathy			0.76
Competitive pricing	0.62	0.50	
User-friendly mobile application	0.60	0.57	
Service variety	0.59	0.43	
Customizable service options	0.51	0.37	
Service responsiveness			0.72
Anytime pick-up and delivery	0.64	0.54	
Everywhere accessibility	0.61	0.46	
Quick delivery	0.49	0.42	
Service reliability			0.65
Partnership with expert	0.64	0.49	
Diverse range of pick-up equipment	0.48	0.30	
Deodorization and fragrance services	0.45	0.34	
Use of natural detergents	0.42	0.30	
Service assurance			0.66
Restoration service	0.78	0.73	
Stain removal service	0.47	0.36	

Items unsuitable for analysis were removed based on factor loadings and Cronbach's alpha values, resulting in a total of 13 items used in the factor analysis (R^2=.45, RMSR=.02). The final factors identified were 'Service Tangibles & Sympathy' (Cronbach's alpha=.76), 'Service Responsiveness' (Cronbach's alpha=.72), 'Service Reliability' (Cronbach's alpha=.65), and 'Service Assurance' (Cronbach's alpha=.66). Factor loadings for service items ranged from .42 to .78, while communality ranged from .30 to .73. Therefore, these factors are considered important by consumers when evaluating the quality of mobile laundry services.

A regression analysis was conducted to examine the factors influencing satisfaction with mobile laundry services. The model's F-value was 18.47 (p<.001), indicating that the factors derived from factor analysis significantly influenced satisfaction with mobile laundry services. Specifically, 'Service Tangibles & Sympathy' (β=.18, t=4.23, p<.001), 'Service Responsiveness' (β=.18, t=4.14, p<.001), and 'Service Reliability' (β=.14, t=3.07, p<.01) significantly influenced Service Satisfaction. Although 'Service Assurance' (β=.08, t=1.92, p=.056) slightly exceeded the significance threshold, it still influenced Consumer Satisfaction.

In previous studies on SERVQUAL and SERVPERF, 'Service tangibles' and 'Service sympathy' were analyzed as separate factors. This means that the interaction between service providers and consumers is important in traditional service industries. However, in this study, within the platform application environment, the distinction between service tangibles and service sympathy has become blurred, as services provide consumer-centric features through the application, customized to the needs and preferences of consumers. Moreover, 'Service tangibles & sympathy' factor has the greatest impact on satisfaction with mobile laundry services, it is inferred that providing services that consumers desire through the application is closely associated with satisfaction.

Conclusion

Through this study, we identified key factors in evaluating service quality and examined their impact on service satisfaction among consumers using mobile laundry services. The analysis revealed four factors in service quality evaluation, and their influence on satisfaction was examined. While previous research on O2O laundry services for single households (Jeong & Chang, 2021) focused on the usability of applications, this study contributes by deriving conceptual frameworks for mobile laundry services. Future research should validate the quality factors of mobile laundry services and examine differences in service demand according to demographic variables.

References

Cronin Jr., J. J., & Taylor, S. A. (1992). Measuring service quality: A reexamination and extension, *Journal of Marketing, 56*(3), 55-68.

Jeong, J. Y., & Chang, K. K. (2021). A study on the usability evaluation of laundry O2O service reflecting the living pattern of one-person households: focused on Laundrygo and Getwashswat application. *Bulletin of Korean Society of Basic Design & Art, 22*(5), 469-480.

Kang, J. H., & Lee, Y.-J. (2024). An exploratory study on millennials' purchasing experience of home appliances. *Journal Korea Society of Visual Design Forum, 29*(1), 263-280.

Kim, S. (2021, April 30). Getwashswat, Laundrygo, and other untact laundry services suffer disproportionately... Fair Trade Commission-related terms are like 'Confucius says'. *CNmedia.* https://www.consumernews.co.kr/news/articleView.html?idxno=625068

Park, Y. (2023, December 5). "From laundry pickup with just one click to early morning delivery"… Online laundry service 'Laundrygo'. *Sisajournal-e.* https://www.sisajournal-e.com/news/articleView.html?idxno=305810

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THE IMPACT OF DRYER TUMBLING MOTION ON REDUCING SHRINKAGE OF CLOTHING

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Introduction

The drying process is the stage where the absorbed water during the washing process is removed and involves mechanical methods such as spinning and drying by heat. In Korea, the traditional method of drying clothes in natural conditions, such as sunlight or wind, has been widely used. However, in recent times, the usage of machine drying has significantly increased. While the use of dryers offers quick and convenient benefits, it poses challenges to the dimensional stability of clothing compared to natural drying conditions, potentially causing shrinkage (Ju et al., 2017). Consequently, consumers tend to avoid using dryers for clothing that is prone to shrinkage and instead choose methods that involve natural drying to minimize shrinkage. Factors influencing clothing shrinkage include force, moisture content, and temperature. Particularly, shrinkage in knitted fabrics is accelerated by physical forces such as tumbling in the dryer and the relaxation of residual stress within the knit structure (Higgins et al., 2003a, 2003b). Therefore, this study aims to analyze the impact of the tumbling motion in dryers on clothing shrinkage and provide fundamental data to develop algorithms for minimizing shrinkage

Literature Review

The primary factors that cause the shrinkage of fabrics are broadly categorized as thermal shrinkage, hygroscopic shrinkage, relaxation shrinkage, and in the case of wool, felting shrinkage (Kim & Oh, 1992). Shrinkage occurring during drying, particularly in the case of fibers, is known to result from fiber swelling and the relaxation of internal stress. Shrinkage in dryers is influenced by external forces, moisture content, and heat (Collins, 1939). In particular, shrinkage in knitted fabrics is facilitated by physical forces such as tumbling in the dryer and the relaxation of residual stress within the knit structure (Higgins et al., 2003a, 2003b). According to the study by Ju et al. (2018), in a natural drying state where external forces like tumbling are not applied, changes in shrinkage rates appear differently depending on variations in drying temperature and moisture content. Furthermore, when the moisture content is below 30% during drying, the diameter of cotton fibers that have swollen decreases. At this point, external energy acting on the reduced diameter can destroy spaces between fibers, thereby further promoting shrinkage (Leah, 1986).
In this way, clothing shrinkage during the drying process appears to be influenced by external forces and motions such as tumbling, which vary with changes in moisture levels. In this study, we aim to analyze changes in the shrinkage rate based on the application of tumbling motion during the drying process. The study seeks to evaluate the influence of external forces and motion on clothing shrinkage, as well as the impact of moisture levels. Furthermore, it aims to verify the effectiveness of a dryer control algorithm that minimizes shrinkage.

Research Method

This study used three types of garments to evaluate the impact of both traditional dryer motion and a newly developed 6-motion dryer motion on clothing shrinkage. The selected samples were garments with frequent dryer use and high dissatisfaction with shrinkage, identified through preliminary assessments. The garments included 100% cotton single jersey T-shirts, French terry fabric T-shirts composed of 84% cotton and 16% polyester, and 100% nylon woven jackets. The operating principle of the newly developed 6-motion dryer involves minimizing the destruction of voids between yarns due to the drop force of tumbling observed in the later stages of drying when the Final Moisture Content (FMC) value is 20% or below. To achieve this, the height of tumbling was reduced, and the rotation rpm was increased. This allows the drying material to adhere to the wall, reducing the overall applied energy. Each dryer was loaded with the three types of garments and a dummy load to achieve a total load of 3 kg. The experiment was repeated three

times. The shrinkage rate was measured according to KS K 1000 by taking measurements of back length and back width, sleeve length, and sleeve width before drying, and then measuring the length changes at the same positions after the drying process was completed.

Results & Discussion

The 6-motion applied cycle of the dryer involves transforming drum motion with spreading(Nul-gi) rolling(Gulli-gi), pulling(Danggi-gi), and other movements when the Final Moisture Content (FMC) of the drying materials is 20% or lower. This modification aims to reduce the energy applied to the drying material. The results of calculating the physical forces applied during the drying process as positional energy showed that, for the 6-motion cycle, the energy was approximately 595.4 kWh, indicating a reduction of around 64% compared to the conventional method. After measuring the FMC values following the drying process, the average FMC for the three samples was 4.5% for the conventional motion and 4.4% for the 6-motion, with drying times being 111.7 minutes for the 6-motion and 71.4 minutes for the conventional motion.

Shrinkage rate analysis results indicate that, for a single jersey cotton shirt, the conventional motion showed an average shrinkage rate of 4.5% for sleeve length and width, while the 6-motion exhibited 3.4%. In the case of the double jersey blend CP, the conventional motion had a shrinkage rate of 3.7%, and the 6-motion showed 3.0%. For nylon woven garments, the conventional motion had a shrinkage rate of 0.5%, and the 6-motion showed 0.3%. Examining the average shrinkage rate for body length and width, in the case of single jersey cotton, the conventional motion had a rate of 3.9%, and the 6-motion had 3.8%. For the double jersey blend CP, the conventional motion exhibited a shrinkage rate of 3.2%, while the 6-motion showed 2.6%. For nylon woven garments, the conventional motion had a shrinkage rate of 0.8%, and the 6-motion showed 0.4%.

Conclusion

In the use of a dryer, the causes of clothing shrinkage are temperature, moisture content, and physical forces such as tumbling. In natural drying conditions, where external forces like tumbling are minimized, the shrinkage is less compared to dryer usage. Therefore, in this study, 6-motion was applied when the Final Moisture Content (FMC) value, at which the most significant shrinkage occurs during the drying process, was 20% or below. The aim was to reduce external forces caused by the drop during tumbling, confirming the alleviation of shrinkage by minimizing the destruction of inter-yarn voids due to tumbling-induced drop forces.

References

Collins, G. E. (1939). Fundamental Principles that Govern the Shrinkage of Cotton Goods by Washing. *Journal of the Textile Institute Proceedings, 30*(3), 46-61.

Higgins, L., Anand, S. C., Hall, M. E., & Holmes, D. A. (2003a). Effect of tumble drying on selected properties of knitted and woven cotton fabrics: Part 2- Effect of moisture content, temperature setting, and time in a dryer on cotton fabrics. *The Journal of the Textile Institute, 94*(1/2). 129-139.

Higgins, L., Anand, S. C., Hall, M. E., & Holmes, D. A. (2003b). Factors during tumble drying that influence dimensional stability and distortion of cotton knitted fabrics. *International Journal of Clothing Science and Technology, 15*(2), 126-139.

Ju, J. A., Kyung, M. S., Kim, J. H., Park, Y. W., Kim, S. Y., & Oh, Y. K. (2017). Shrinkage of knitted fabric depending on the condition of Air drying. *Journal of the Korean Society of Clothing and Textiles, 41*(6), 1050-1059.

Kim, S. J., & Oh, A. K. (1992). Shrinkage Characteristics of Fiber Assemblies" or "Shrinkage Properties of Fiber Assemblies (1). *Journal of the Korean Fiber Society*, *29*(4), 14-20.

Leah, R. D. (1986). The Starfish Project: An Integrated Approach to Shrinkage Control in Cotton knits. Part 5; Finishing to Achieve Specification. *Knitting International, 93*(8), 96-99.

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COMPARISON OF CONSUMER LAUNDRY CARE BEHAVIOR IN SOUTH KOREA AND THE UNITED STATES BASED ON TYPES AND PRICE RANGE OF CLOTHING

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Introduction

Clothing care behaviors vary depending on the types of clothing and consumer characteristics, leading to the development and use of slightly different clothing care methods and appliances. Therefore, analyzing clothing care methods based on national and consumer characteristics is an important step in developing appliances that suit the market's needs. This research analyzes differences in clothing care behavior observed among consumers in South Korea and the United States, based on consumer characteristics, materials, and types of clothing currently prevalent in the recent apparel market. Additionally, our aim was to examine variations in clothing care methods across different price ranges for the same clothing item made of the same material. Furthermore, we sought to collect data to predict market demand for premium clothing care appliances by comparing the differences in choices that emerge by country.

Literature Review

Laundry behavior refers to the actual washing methods and habits that consumers apply when doing laundry (Ryu & Lee, 1999). There are differences in the actual washing and care methods of clothing applied by consumers' characteristics (Oh & Ryu, 1997). In particular, general consumers often lack knowledge about appropriate care methods for each clothing product, and the level of understanding and application of quality labeling information on clothing products varies among consumers (Bae & Lee, 1994). According to Koo's study (2020), modern consumers perceive clothing care in connection with aesthetic aspects such as clothing style and brands, and this perception is linked to clothing purchasing behavior. As a result, there has been an increase in the sale of clothing care devices such as the Styler developed by LG Electronics targeting premium clothing in the market in Korea. However, there is a lack of research on clothing management methods based on consumers and types of clothing in countries other than Korea, limiting the development of new markets. Therefore, through consumer research in Korea and the United States, we aim to provide foundational data for the development of new clothing care devices and performance tailored to consumer demand in each country.

Research Method

This study conducted a survey targeting women aged 20 to under 60 residing nationwide, utilizing online survey companies such as Embrain in South Korea and Qualtrics in the United States. The survey took place from September 9 to September 25, 2020. To ensure comparability with the United States, the content of the questions was kept as similar as possible after review by a bilingual researcher. The final analysis involved the statistical analysis of responses from 372 Korean consumers and 374 American consumers.

Survey questions were designed to explore the clothing care methods chosen by consumers based on demographic characteristics such as age, occupation, family composition, clothing material, items, and price range. The variable for the price range of clothing was guided to be determined subjectively rather than providing objective price ranges, as the criteria may vary for each consumer. Using SPSS 25.0, frequency analysis and chi-square tests were conducted to analyze the differences in washing methods by country.

Results & Discussion

The cross-tabulation analysis of the age group and the types of clothing care devices revealed a significant difference ($\chi2$: 35.322 ***). For those aged 50 and above, the ownership rate of irons was higher, while for those in their 30s and 40s, the ownership rate of clothing appliances such as LG Styler was higher. According to the income level, the group with a monthly income of over 8 million won showed a significantly higher proportion of ownership of clothing appliances such as LG Sthyler ($\chi2$: 54.298 ***).

The percentage of using a washing machine at home to wash expensive cotton outerwear was 9.7% in Korea and 39.3% in the United States. Meanwhile, the percentage of relying on laundry services was 88.4% in Korea and 39.0% in the United States. This indicates that Korean consumers have a higher tendency to entrust the cleaning of higher-priced garments to laundry services.

When examining the differences in washing methods based on materials and price of clothing, it was observed that the usage of washing machines for expensive cotton clothing, overall, ranged from 25% to 43%. This was significantly lower compared to the percentage for inexpensive clothing, which ranged from 72% to 88%. This suggests that different washing methods are applied based on the price range. Particularly, Korean consumers showed a significant decrease in the usage of washing machines for expensive cotton clothing compared to American consumers. Korean consumers were shown to use washing machines for expensive clothing at a rate of approximately 10% to 30%, whereas American consumers showed a higher rate of around 25% to 43%. In other words, while there was almost no difference between countries for less expensive cotton clothing, a significant difference between countries emerged for expensive clothing. Analyzing consumers who own wool clothing, the results showed that 78% of Korean consumers rely on laundry services, while only approximately 54% of American consumers use laundry services. The percentages for handwashing and washing machine usage were higher for American consumers compared to Korean consumers.

Conclusion

Consumers in the United States and Korea showed differences in their choice of clothing care methods depending on the type and price range of garments, particularly with a higher proportion of Koreans opting for laundry services for the care of perceived expensive clothing items. For affordable clothing, the rate of machine-washing selection was similar in both Korea and the United States; however, there was a significant difference between the two countries in the selection of laundry services and machine washing for expensive clothing. Additionally, Korean consumers showed a tendency to prefer various washing methods depending on the type of clothing compared to American consumers. They tended to manage outerwear with the most delicate method (dry cleaning) and bottom clothing with the most convenient method (washing machine). This study is exploratory research that examines the laundry care behaviors of consumers in both countries to propose appropriate directions for technological development in laundry appliances. However, there are limitations in reflecting the various consumer characteristics observed in both countries. Therefore, it is necessary to clarify the influence of various variables on consumer clothing care behaviors through future research.

References

Bae, S. W., & Lee, M. S. (1994). A Study on consumer's perception and attitude to care labels of textile products. *Journal of the Korean Society of Clothing and Textiles*, *18*(4), 480-489.

Koo, Y. S. (2020), Trend analysis on clothing care system of consumer from big data. *Fashion & Textile Research Journal*, *22*(5), 639-649.

Oh, K. W., & Yu, H. K. (1997). Evaluation of washing efficiency based on consumer's washing Behavior. *Journal of the Korean Society of Clothing and Textiles*, *21*(2), 251-261.

Ryu, D. H., & Lee, B. Y. (1999). The study of relationship among housewive's backgrounds, laundry practice, laundry concept and interests about environmental pollution. *Korean Journal of Human Ecology*, *8*(1), 109–124.

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CONSUMER RESPONSES TO PERSONALIZED LAUNDRY SOLUTIONS BASED ON CONSUMER LAUDRY VALUES: AN INVESTIGATIVE STUDY

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Introduction

This study is the final stage of a research series to develop personalized solutions according to clothing care lifestyles conducted through industry-academic collaboration with LG Electronics. The purpose of this study is to investigate consumers' responses and develop a final personalized solution by examining consumers' overall evaluation of the customized solution according to the consumer's laundry value and evaluating the detailed contents of the solution. Personalized solutions are commonly utilized in the content service industry and retail business, but have recently expanded into various fields such as home energy management and automobiles (Aheleroff, et al., 2020; Luo, et al., 2020). Accordingly, LG Electronics seeks to provide personalized solutions that reflect consumers' clothing care lifestyles in order to solidify its position as a leading position in the clothing care device field.

Research Method

The survey in this study contains two parts: 1) participation in the Laundry Lifestyle Typology Test and 2) evaluation of the test. The Laundry Lifestyle Typology Test consists of 13 questions (2 questions on clothing management perceptions, 1 question on laundry values, 3 questions on laundry behavior patterns, 2 questions on family composition and sorting behavior, and 5 questions on lifestyle and personality). It takes about 1 minute to do this. After completing the test, respondents were immediately provided with a personalized solution tailored to their test results. According to the results of the laundry value, consumer types were divided into 31 types, and different profiling and recommended laundry courses were presented for each type. Depending on the results of questions other than the value sought for washing, different clothing care tips were provided and a total of 126,976 different results were prepared. After the test results were presented, respondents were asked to make an overall evaluation of the test, evaluate the overall suitability of the personalized solution, and evaluate the detailed content of the customized solution. Additionally, consumers' intention to accept the recommended solution and WOM were asked. All items were measured with a 5-point Likert scale. Data were collected from male and female aged 25 to 55 who use drum washing machines by themselves, and a total of 846 responses were used for analysis.

Results & Discussion

As a result of the analysis, the distribution by types of primarily pursued laundry value is: a group focused on soil removal and prevention of deformation (12%), a group focused on soil removal, prevention of deformation, and sterilization (10%), and a group focused on soil removal, prevention of deformation, and convenience (10%), followed by the group focused on soil removal, prevention of deformation, sterilization, convenience, and eco-friendliness (9%), and the group focused on soil removal (8%). The results of the test evaluation showed positive results such as overall attitude (M=4.07), trust in solution information (M=3.84), and attitude toward the company (M=3.82). Those who own a smart washing machine were more positive toward customized solutions. Consumers' overall evaluations on the suitability of suggested customized solutions and consumer laundry lifestyle type classification (M=3.92) were positive. Additionally, Examining the consumer evaluation results by customized solution content, type profiling (M=3.84), customized course suggestions (M=3.84), laundry tips (M=3.94), and eco-friendly tips (M =3.94), all responses were found positively. In the case of intention to accept recommended solutions, both intention to implement recommended laundry courses of washing machine (M=4.00) and intention to implement recommended laundry tips (M=3.95) were high, while intention to

install apps to receive solutions appeared low (M=3.66). WOM was lower than the intention to accept the solution (M=3.66).

Conclusion

The Laundry Lifestyle Typology Test, the results of which were verified in this study, is a consumer communication tool aimed at proposing personalized solutions. One may question the role of this tool, given that customized solutions are generally based on individual usage data, and in the case of AI based laundry devices, optimized and customized laundry courses can be recommended by collecting course usage pattern data. However, laundry cannot be simply a matter of taste, and there is the most efficient and desirable laundry method depending on the purpose. Thus, recommendation logics for the laundry should be differentiated from the existing personalized recommendation system. The personalized solution verified in this study is based on consumers' laundry behaviors, pursued laundry values, and lifestyles, but reflects expert diagnosis, so it can be expected to have a sustainable and efficient educational effect on the use of clothing care devices. Consumers who accept the solution will be able to experience increased clothing management performance, which will lead to increased satisfaction with the device and brand loyalty.

References

Aheleroff, S., Xu, X., Lu, Y., Aristizabal, M., Velásquez, J. P., Joa, B., & Valencia, Y. (2020). IoT-enabled smart appliances under industry 4.0: A case study. *Advanced engineering informatics, 43*, 101043.

Luo, F., Ranzi, G., Kong, W., Liang, G., & Dong, Z. Y. (2020). Personalized residential energy usage recommendation system based on load monitoring and collaborative filtering. *IEEE transactions on industrial informatics, 17*(2), 1253-1262.

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STRATEGIC CONSUMER SEGMENTATION
FOR PERSONALIZED SOLUTIONS IN CLOTHING CARE DEVICES:
A MARKETING TOOL DEVELOPMENT STUDY

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Introduction

This study was conducted as an industry-academia collaboration with the aim of employing strategic consumer segmentation to develop personalized solutions in clothing care devices. Following the COVID-19 pandemic, there has been a noticeable shift in consumer lifestyles and clothing care behaviors (Elmaslar Özbaş, et al., 2022). With increased interest in the efficiency of household labor and the heightened importance of safety and hygiene practices, the range of clothing care devices used by consumers has expanded from washing machines to dryers and steam closets. In this study, our ultimate goal was to propose personalized solutions for expanded clothing care devices. We sought answers on how consumer perceptions and behaviors in clothing care have changed, aiming to classify types accordingly. By developing a consumer segmentation tool that diagnoses consumer characteristics in clothing care and the usage of clothing care devices, we seek to accumulate consumer data and formulate strategies for personalized service development. Additionally, we aim to leverage the effectiveness of gamification in viral marketing.

Research Method

This study was conducted in three main phases: 1) Preliminary stage focusing on case studies of consumer segmentation; 2) Understanding consumer behavior through text mining research; 3) Development of a consumer segmentation tool through a three-stage process involving surveys and discussions with LG Electronics practitioners. Considering the expected gamification impact in the consumer segmentation tool, the preliminary stage focused on analyzing consumer segmentation cases that adopted the format of widely popular personality assessments, such as the Myers-Briggs Type Indicator (MBTI). For the second stage, Textom was used, which is a big data collection and analysis solution that collects data from portal websites such as Naver, Daum, Google, etc.. Textom uses text mining which makes it possible to grasp the importance of keywords by analyzing frequency of words appearing simultaneously from numerous unstructured data (Jeon & Seo, 2013). We collected 117,908 posts from Naver and Daum blogs (2019.3~2021.2) containing eight keywords related to clothing care through data crawling. After refining the data, a total of 95,666 data were used for the final analysis, employing text mining techniques such as frequency analysis, TF-IDF, and matrix analysis for keyword extraction through Textom. Next, UCINET and NetDraw software were used for conducting social network analysis. In the third stage, the first study aimed to validate the strategies derived in the preliminary stage. A total of 480 male and female consumers utilizing clothing care devices participated in a consumer segmentation test, where we examined consumer responses (perceived value, adoption; measured on a 5-point Likert scale) based on the presentation methods of the test results. We differentiated the presentation of consumer segmentation test results, categorizing groups into those provided with individual laundry care scores and those without, as well as those presented with social compatibility matching contents (SCMC: match well with me/not match well with me) and those not presented. Additionally, we examined differences based on the three recommendation algorithm methods (collaborative, knowledge-based, hybrid). The contents provided to the control group were composed of type descriptions, fashion lifestyle tips, and device utilization tips. The second phase of the study was conducted to verify the validity of clothing management-related factors derived in the second stage as

criteria for consumer typology. A survey was administered to 907 men and women who reported being responsible for clothing care at home, targeting specific inquiries about clothing care behaviors, clothing care involvement, and laundry values (measured on a 5-point Likert scale. In the third phase of the study, data was collected from 1,057 men and women who use both washing machines and dryers to validate the item validity of the Laundry Lifestyle Typology Test (LLTT) as marketing tools for personalized solution and evaluated consumer responses to personalized solution developed. The refined questions from the LLTT, derived from the second phase, were posed, and a detailed investigation was conducted on the usage courses and manual adjustment items for washing machines and dryers. Additionally, questions were asked regarding the comprehensibility, appropriateness of the number of test items, and interest aspects of the developed test. Based on the results of the second phase of the study, the results of the developed test (presenting results for each type) were provided, followed by inquiries into the willingness to accept personalized solution.

Results & Discussion

Based on the results of the first-stage study, personality assessment-type consumer segmentation tools were classified into four categories: 1) Consumer typology based on lifestyle (Market Kurly, FOREST), 2) Typology based on the combination of lifestyle and personality type tests (CATCH, JAJU), 3) Typology based on the combination of product/service usage behavior and personality type tests (Snackpot, Danggeun Market), and 4) Typology based on behavior diagnosis of product usage characteristics (Dr.G). In accordance with the results of case typology, specific development strategies for marketing tools for consumer typology were formulated as follows. Providing individual laundry care scores enhances consumer trust in the results and presenting social compatibility matching contents aims to increase viral effects, Through the second-stage text mining, factors related to clothing care were derived as clothing care behavior factors (washing behavior, detergent usage, laundry sorting, laundry device utilization, laundry values, clothing care involvement, clothing storage) and lifestyle factors (family composition, presence of pets, household chore allocation, leisure activities, eco-friendly perception). These factors were incorporated into the development of test items.

In the results of the first phase of the third stage, both the value perception and acceptance of the recommendation service were highest in the group (M_utility=3.20; M_pleasure=3.62; M_acceptance=3.79) presented segmentation results and recommendation based on hybrid filtering reflecting individual usage patterns (F_utility=3.10***; F_pleasure=3.71*** F_acceptance=5.30***). In the second phase of the study, it was confirmed that laundry values were a significant variable influencing differences in clothing management behavior. Notably, the five values—soil removal, deformation prevention, sterilization pursuit, convenience pursuit, and eco-friendliness—were found to be core factors causing essential distinctions in consumer behavior. Based on consumer preferences for the five laundry values, a total of 33 groups were derived, and for each group, group naming and profiling were conducted. The largest group among them was identified as "Heavenly Fashionistas" (n=125), and they considered soil removal and deformation prevention as crucial factors. This group was confirmed to be highly involved consumers with clothing care and higher stress levels. Additionally, refining the LLTT questions, including additional items for suggesting personalized solutions, resulted in a total of 15 questions. In the third phase of the study, preferences for laundry courses and manual adjustments of washing machines were analyzed for each of the 33 groups. Based on the results, an effective course configuration was established for each group as a recommended course setting, including the most effective standard course setting, four basic courses (excluding the standard course), and two or three specialized courses. Additionally, considering laundry care involvement, hand washing preferences, weather considerations, family composition, and laundry habits, tailored solutions were developed for consumers. Based on the results of the third phase, the typology logic and recommended contents were confirmed for the LLTT according to consumer responses.

Conclusion

The LLTT developed in this study provides interactive communication based on consumer behavior and lifestyle, ultimately offering clothing care solutions grounded in consumer usage. This test thus has the capability to fulfill both pleasurable and practical values. As the number of consumers participating in the typology test increases, it is possible to accumulate data on consumer typology results. By leveraging this accumulated data, personalized services reflecting consumer laundry values, clothing care behaviors, consumer needs, and more can be provided. Additionally, by examining trends over time, it is expected that changes in consumers' clothing care lifestyles can be diagnosed, future directions can be predicted, and this information can be utilized as valuable data in laundry care device development.

References

Elmaslar Özbaş, E., Akın, Ö., Güneysu, S., Özcan, H. K., & Öngen, A. (2022). Changes occurring in consumption habits of people during COVID-19 pandemic and the water footprint. *Environment, Development and Sustainability, 24*(6), 8504-8520.

Jeon, C. N., & Seo, I. W. (2013). Analyzing the big data for practical using into technology marketing - Focusing on the potential buyer extraction. *Marketing, 21*(2), 181-203.

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Concurrent Sessions

Special Topic Oral Presentation Session 2
: Human-Tech Synergy for Circular Economy in Fashion

Chair: Dr. Kyu-Hye Lee, Hanyang University

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VIRTUAL POSSESSIONS AND REAL CONNECTION: THE INFLUENCE OF PERCEIVED OWNERSHIP IN THE METAVERSE ON CONSUMER BEHAVIOR

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Introduction

The Metaverse is attracting considerable attention from both industry and academia. Defined as a virtual world that extends the physical universe where various activities occur (Papagiannidis et al., 2008), the Metaverse has captivated many retailers. Luxury brands such as Gucci, Chanel, Dior, and Balenciaga are utilizing the Metaverse as a marketing space, further virtualizing their products for sale within it (Holmes, 2023). Consumers can purchase a brand's products in reality as well as in their virtualized forms, diversifying the consumer journey. Furthermore, since virtualized products are intangible, a deeper understanding of why consumers buy such items necessitates a grasp of perceived ownership. However, there is a notable gap in exploring the connection between this digital world and the real world in terms of perceived ownership. Consequently, this study aims to explore consumer behavior within both virtual and real-world contexts through the lens of perceived ownership. Specifically, it investigates how perceptions of ownership, in terms of being an owner versus a non-owner and the environment (virtual vs. real), influence purchase intentions and attitudes towards products. Additionally, it examines how these effects are moderated by identification with an avatar.

Literature Review

Perceived ownership refers to a feeling of possession toward a certain object or a sense of 'mine' (Pierce et al., 2003). This definition has evolved with technological development, expanding the object realm from tangible to intangible items (Morewedge et al., 2021). Typically, owners of a certain object feel a higher sense of ownership than non-owners, as owning an object fulfills more prerequisites (i.e., motives and antecedents) for perceived ownership. This is because the three main pathways to forming perceived ownership (i.e., controllability, intimate knowledge, and investment of self) are more easily established when one owns the object (Peck & Shu 2009). Therefore, the following hypothesis was developed: *H1: Being an owner (versus a non-owner) will lead to higher perceived ownership*. Moreover, people feel a sense of ownership for both tangible objects (i.e., real products) and intangible ones (i.e., virtual products) (Morewedge, 2021), though the level of perceived ownership might differ. A higher sense of ownership is felt for physical objects than for digital objects (Atasoy & Morewedge, 2018). Thus, the following hypothesis was developed: *H2: Real (versus virtual) environments will lead to higher perceived ownership*. However, the sense of ownership can vary between the real world and the metaverse, depending on whether the product is owned. In virtual spaces, ownership stems from users' investment in and attachment to their avatars, the freedom from physical product limitations like size and wear, and the immersive experience of customization and stimulation within a virtual environment. Thus, the following hypothesis was developed: *H3: There is an interaction effect between ownership status and world type (real versus virtual) on perceived ownership, with the effect being more pronounced in the virtual world.*

The impact of perceived ownership has been an important driver of consumer behavior in contexts. A common theme across these studies is the attachment of the self to an owned object, enabling people to hold an unrealistically positive view of themselves. Thus, positive self-association based on perceived ownership leads people to evaluate their possessions positively (Morewedge et al., 2021). Hence, the following hypotheses were developed: *H4: Perceived ownership will positively influence attitudes toward the product, regardless of its form. H5: Perceived ownership will positively affect purchase intentions in the alternate world (i.e., from real to virtual or vice versa).*

A strong association with a product integrates it into the self, becoming an extended part of one's identity, which individuals strive to preserve over time (Belk 2013). This study suggests that perceived ownership, influenced by self-concept association that reveals identity and evokes event-related memories, prompts people to purchase and favorably evaluate products across different worlds to maintain their identity and recall associated events. Therefore, the following hypotheses were developed: *H6a: Perceived ownership will mediate the relationship between world settings (virtual versus real) and attitudes toward a product. H6b: Perceived ownership will mediate the relationship between ownership status (owner versus non-owner) and purchase intention.*

Perceived ownership is influenced by the level of interaction between an owner and an object and the object's relevance to the owner's identity, with higher avatar identification enhancing ownership feelings due to preferences for avatars that mirror one's gender, type, and characteristics (Morewedge et al., 2021; Atasoy & Morewedge, 2018). This identification with avatars, reflecting the owner's self-concept across different worlds, heightens perceived ownership. Thus, the following hypothesis was developed: *H7: In the context of the virtual world, avatar identification will moderate the effect of ownership type (owner versus non-owner) on perceived ownership, with this effect being stronger for owners of virtual products compared to non-owners.*

Figure 1. Research Framework

Research Method

A 2 (ownership: owner vs. non-owner) by 2 (world type: metaverse vs. real world) mixed-design study was conducted. In this between-subjects design, participants were randomly assigned to each cell via an online survey platform, where they read different scenarios and then responded to questions borrowed from previous studies. 240 samples (169 males, 71 females) were used for analysis. Validity and reliability were assessed using EFA, Cronbach's alpha, composite reliability, and AVE.

Results & Discussion

The two-way ANOVA was conducted to test Hypotheses 1 and 2. The results showed a main effect in both ownership and world settings. Participants primed with owning a product exhibited significantly higher perceived ownership compared to the groups primed as non-owners (M_{owner}=5.05, $M_{non-owner}$=4.48, $F(1, 236)$=20.33, $p<.001$). A main effect of world settings was also observed, indicating that people perceive a higher sense of ownership of real products compared to virtual products (M_{real}=5.30, $M_{virtual}$=4.31, $F(1, 236)$=62.09, $p<.001$). Thus, **Hypotheses 1 and 2 are supported**. A post-hoc analysis tested the interaction effect of ownership × world setting ($F(1, 236)$=12.90, $p<.001$), confirming that the perceived ownership difference between the virtual and real-world conditions was significantly greater for owners (M=4.78) than for non-owners (M=3.68). Therefore, **Hypothesis 3 was supported**. Regression analysis was conducted to test Hypotheses 4 and 5. The results showed that perceived ownership of the virtual (real) product in a virtual world positively influences purchase intention of the real (virtual) version of the product (β=.373, t=6.207, $p<.001$) and the attitude toward the real (virtual) version of the product (β=.329, t=5.376, $p<.001$). The more people perceive a sense of ownership of the real (virtual) version of the product, regardless of whether they own it or not, the more likely they are to purchase and positively evaluate the virtual (real) version of the product. Therefore, **Hypotheses 4 and 5 were supported**. To test Hypotheses 6a and 6b, mediation effects were assessed using PROCESS Macro Model 4. When the dependent variable was purchase intention of the product in a different world, perceived ownership fully

mediated the relationship between world setting and purchase intention (Indirect effect: Effect size=-.38, LLCI=-.57, ULCI=-.22) and attitude toward the product (Indirect effect: Effect size=-.33, LLCI=-.05, ULCI=-.17), particularly showing stronger effects in terms of the real world. Conversely, perceived ownership partially mediated the relationship between ownership status and purchase intention (Direct effect: Effect size=-.42, LLCI=-.68, ULCI=-.15; Indirect effect: Effect size = .18, LLCI = .05, ULCI = .34) and attitude toward the (Direct effect: Effect size=-.34, LLCI=-.60, ULCI=-.08; Indirect effect: Effect size=.15, LLCI=.04, ULCI=.30), with the direct mediation effect being more pronounced in the owner condition. Thus, **Hypotheses 6a and 6b were supported**. To test Hypothesis 7, PROCESS Macro Model 1 was used, revealing an interaction effect where avatar identification was observed (Coefficient=.517, LLCI=.191, ULCI=.844). The results indicated that individuals with higher avatar identification felt a higher perceived ownership when they owned a virtual product compared to non-owners. Therefore, **Hypothesis 7 was supported**.

Conclusion

This study examines the impact of perceived ownership on consumer behavior in both virtual and real-world contexts, focusing on ownership status (owner vs. non-owner) and world type (metaverse vs. real). This study found that perceived ownership mediates behavior across worlds (i.e., metaverse vs. real world), with stronger avatar identification boosting ownership feelings towards virtual items and highlighting the interconnectedness of real and virtual environments. Theoretically, the study broadens our understanding of the metaverse by illustrating how perceived ownership operates in both virtual and real settings and linking consumer behaviors across digital and physical realms. Practically, it underscores the metaverse's potential as a novel retail channel, suggesting that interactions with virtual products can shape real-world purchasing intentions, and emphasizes the critical role of avatar identification in virtual consumer behavior.

References

Atasoy, O., & Morewedge, C. K. (2018). Digital goods are valued less than physical goods. *Journal of Consumer Research*, *44*(6), 1343-1357.

Belk, R. W. (2013). Extended self in a digital world. *Journal of consumer research*, *40*(3), 477-500.

Holmes, F. (June 20, 2023). *Ranking The 10 Most Popular Luxury Brands Online In 2023*. Forbes. https://www.forbes.com/sites/greatspeculations/2023/06/20/ranking-the-10-most-popular-luxury-brands-online-in-2023/?sh=622e1bf91632

Lee, Y., & Chen, A. N. (2011). Usability design and psychological ownership of a virtual world. *Journal of Management Information Systems, 28*(3), 269-308.

Morewedge, C. K. (2021). Psychological ownership: Implicit and explicit. *Current Opinion in Psychology*, *39*, 125-132.

Morewedge, C.K., Monga, A., Palmatier, R.W., Shu, S.B. and Small, D.A. (2021), "Evolution of consumption: a psychological ownership framework", *Journal of Marketing*, *85*(1), 196–218.

Papagiannidis, S., See-To, E., & Bourlakis, M. (2014). Virtual test-driving: The impact of simulated products on purchase intention. *Journal of Retailing and Consumer Services*, *21*(5), 877-887.

Peck, J., & Shu, S. B. (2009). The effect of mere touch on perceived ownership. *Journal of Consumer Research*, *36*(3), 434-447.

Pierce, J. L., & Peck, J. (2018). The history of psychological ownership and its emergence in consumer psychology. *Psychological Ownership And Consumer Behavior*. Springer, Cham, 1-18.

Pierce, J.L., Kostova, T. and Dirks, K.T. (2003), The state of psychological ownership: integrating and extending a century of research. *Review of General Psychology, 7*(1), 84-107.

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CONSUMERS' PERCEPTION OF THIRD-PARTY CERTIFICATE HANGTAGS IN MOBILE SHOPPING BASED ON THE INFORMATION PROCESSING THEORY

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Introduction

Offering sufficient information to consumers in mobile shopping helps ameliorate uncertainty from information asymmetry in mobile shopping (Chiu et al., 2009). One of the effective methods to provide information, hangtag with a third-party certificate (i.e., hangtags made of third-party investigators' certificate logos for high-quality appeal), is widely used in the fashion industry in order to communicate between brands and consumers instead of having a face-to-face conversation (Thompson et al., 2019). However, despite these hangtags' informant role in the clothing consumption stage, according to Iwanow et al. (2005), only 11% of consumers take advantage of the information in hangtags. Moreover, even though much research has been done on the informant role of the hangtag, its role throughout the whole mobile shopping environment has not been explored. Therefore, this study aims to investigate the role of third-party certificate hangtags in the mobile shopping environment through the lens of the consumers' information processing theory.

Literature Review

Information processing theory explains how consumers perceive and analyze the given information. According to the consumers' information processing preferences, there are two processing types: (a) cognitive self (CS) and (b) experiential self (ES) (Epstein et al., 1996). In the mobile shopping context, the cognitive type seeks as many information sources as possible, while the experiential type seeks to find the specific information they need (Yi & Lee, 2012). This suggests that when according to consumers' information processing types, they may perceive the amount of information in these hangtags differently. In addition, the significant role of the third-party certificate is to guarantee the products' quality and increase consumer trust (Thompson et al., 2019). Thus, through third-party certificate hangtags, consumers assume that they are purchasing quality products, and the sellers are reliable, which leads to high repurchase intention (Chiu et al., 2009). Accordingly, filling the gap in the hangtag's role in the mobile shopping environment, this study posits that the perceived amount of information (PAI) and consumer responses - perceived quality (H1) and consumer trust (H2) - will mediate the relationship between the information processing type - (a) CS and (b) ES - and repurchase intention.

Research Method

Data were collected through an online survey of 209 adult participants who have previously had mobile shopping experience from Amason MTurk. The participants were evenly distributed by gender (male - 52% and female - 48%), and most were in their 30s (43%). This study provided stimuli images of a sweatshirt with three third-party certificate hangtags and explanations about each hangtag to help the participants be immersed in the survey following the mobile shopping routine (i.e., information search on a mobile shopping platform). All measures were selected from the existing studies (Chiu et al., 2009; Epstein et al., 1996; Kim & Lennon, 2000; Seo, 2019). CR values were over .75, except for the cognitive self (CR = .73). AVE values were over .60 and larger than the corresponding correlation coefficient of the factors. Therefore, the discriminant validity was confirmed (Kline, 2015).

Results & Discussion

To test our hypotheses, we conducted PROCESS macro (Hayes, 2018; Model 6). As a result, this study found that H1 and H2 were both partially supported. In the case of CS, the sequential mediating effect of PAI and perceived quality between CS and repurchase intention was not significant (B= -0.3, CI[-0.08,

0.02]), rejecting H1a. In addition, the sequential mediating effect of PAI and consumer trust between CS and repurchase intention was also insignificant (B= -0.4, CI[-0.10, 0.02]), rejecting H2a. On the other hand, in the case of ES, PAI and perceived quality serially mediated the relationship between ES and repurchase intention (B= 0.6, CI[0.01, 0.01]), accepting H1b. PAI and consumer trust also serially mediated the relationship between ES and repurchase intention (B= 0.6, CI[0.02, 0.17]), accepting H2b.

Conclusion

The findings have several theoretical and managerial implications. The study findings suggest that according to the information processing types, consumers may perceive different product quality through third-party certificate hangtags in mobile shopping. In particular, experiential-self consumers consider third-party certificate hangtags to be sufficient informants to perceive good quality as they are inclined to find landmark information to make decisions effectively (Yi & Lee, 2012). These findings can also help brand marketers develop their marketing strategies for hangtags customized to their consumer profiles. If a brand targets experiential-self consumers, the third-party certificate hangtags can be effective measures to enhance the trustworthiness of the brand and the product quality. On the other hand, if a brand targets cognitive-self consumers, the brand might need more information to persuade the product quality beyond the third-party certificate hangtags. Since this study investigated the effect of third-party certificate hangtags as an informant in mobile shopping, the effects of other hangtags, such as brand concept tags with brand logos, are not confirmed. Therefore, future study is recommended to compare the effectiveness of the different types of hangtags.

References

Chiu, C. M., Chang, C. C., Cheng, H. L., & Fang, Y. H. (2009). Determinants of customer repurchase intention in online shopping. *Online information review*, *33*(4). 761-784. doi.org/10.1108/14684520910985710

Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality & Social Psychology, 71*(2), 390-405.

Hayes, A.F. (2018), *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*, 2nd ed., Ebook. The Guilford Press.

Iwanow, H., McEachern, M. G., & Jeffrey, A. (2005). The influence of ethical trading policies on consumer apparel purchase decisions: A focus on The Gap Inc. *International Journal of Retail Distribution Management, 33*(5), 371-387. doi.org/10.1108/09590550510596740

Kim, M., & Lennon, S. J. (2000). Television shopping for apparel in the United States: Effects of perceived amount of information on perceived risks and purchase intentions. *Family and Consumer Sciences Research Journal*, *28*(3), 301-331. doi.org/10.1177/1077727X00283002

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford Publications.

Seo, M. J. (2019). Research on consumer responses to similar social value seeking activities conducted by fashion social enterprises and cause-related marketing. *Journal of the Korean Society of Clothing Textiles, 43*(4), 506-520. doi.org/10.5850/JKSCT.2019.43.4.506

Thompson, F. M., Tuzovic, S., & Braun, C. (2019). Trustmarks: Strategies for exploiting their full potential in e-commerce. *Business Horizons*, *62*(2), 237-247. doi.org/10.1016/j.bushor.2018.09.004

Yi, Y. J., & Lee, M. A. (2012). The effects of consumer knowledge on thinking systems and online information search patterns: The moderating role of product price. *Journal of Consumer Studies, 23*(1), 115-142.

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EXPLORING THE IMPACT OF VULNERABILITY DISCLOSURES BY VIRTUAL INFLUENCERS ON CONSUMER PERCEPTIONS

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Introduction

Influencer marketing has become a key element of brands' digital marketing strategies due to effective endorsements. Recently, a new form of influencers, known as virtual influencers (VIs), has gained prominence. VIs are AI-generated personas that simulate human influencers in real-life scenarios, primarily for marketing. These VIs not only look human but also display emotions in their content, even revealing vulnerability. For instance, Lil Miquela, a popular Instagram VI, posted about her breakup with tears. While recent research has examined VI's emotional expressions (Ham *et al.,* 2024), yet there has been no investigation into their vulnerability disclosures. Building on the Uncanny Valley (UV; Mori, 1970), this study examines the negative impacts of VI's vulnerability disclosures on consumer perceptions. We analyzed field data (i.e., Miquela's posts and the corresponding comments), followed by a survey to further understand the effect. The findings contribute to both scholars and practitioners.

Literature Review

Vulnerability is associated with negative emotions and reduced life satisfaction (Yamaguchi *et al.,* 2022). It is intricately linked to trust, fostering connections, and deepening intimacy within relationships (Khalifian and Barry, 2020). When celebrities openly share their vulnerabilities, it signals authenticity, which positively influences public perceptions and behaviors (Gronholm and Thornicroft, 2022). As vulnerability is predominantly associated with human beings due to their complex emotional and cognitive capacities (Brown *et al.,* 2017), we assume that the disclosures of vulnerability from VIs will increase their human-likeness. According to the UV theory, however, non-human entities such as VIs are perceived as uncanny when they exhibit a high level of human-likeness (Mori, 1970), leading to less trustworthiness (Qu and Baek, 2023). We thus propose: Vulnerability disclosure of VI leads to consumers' uncanniness perceptions (H1), which decreases consumers' trustworthiness of VI (H2).

Study 1 Method

Study 1 analyzes Miquela's Instagram posts, which include 1,263 posts and 469,493 comments spanning from April 23, 2016, to June 21, 2023. For independent variables, the Microsoft Azure Vision API was used to identify negative (vs. neutral vs. positive) emotional facial expressions in images. We specify the negative facial expressions as an indication of VI's vulnerability. For dependent variables, the Linguistic Inquiry and Word Count (LIWC) tool evaluates perceptions of uncanniness and sentiments from the comments. Control variables include the number of images, post type (image/video), number of faces per image, the influencer's gender, and the year of posting.

Study 1 Results

In line with our hypothesis, it was observed that consumers perceived significantly more uncanniness when the VI disclosed vulnerability through the demonstration of negative facial expressions ($\beta = .08$, SE $= .15$, $t = 1.99$; $p < .05$), supporting H1. However, positive emotional expressions by the VI did not elicit consumers' perceptions of uncanniness ($\beta = .07$, SE $= .11$, $t = .69$; $p > .05$), and no effect was observed from the neutral emotional expressions ($\beta = .01$, SE $= .11$, $t = .13$; $p > .05$). Furthermore, consumers tended to use more negative tones ($\beta = .12$, SE $= .09$, t $= 3.44$; $p = .001$) and presented more negative emotions ($\beta = .09$, SE $= .103$, $t = 2.68$; $p < .05$) in their comments when viewing the VI showing their vulnerability, compared to viewing VI's positive or neutral emotional expressions (ps $> .05$). Consumers' positive tones/emotions were not affected by VI's different emotional expressions (ps $> .05$)

Study 2 Method

Study 2 adopted a single-factor, three-level (emotional expression: negative vs. control vs. positive) between-subjects design. We created fictitious screenshots of the VI's Instagram posts using selfies from Miquela as the stimuli. The VI shows her vulnerability within negative emotions with the caption, "A really bad day and I'm heartbroken." A total of 209 valid responses from US-based Instagram users were recruited via Prolific (Male = 103, Female = 98; M_{age} = 31.56; SD = 8.45). Perceived trustworthiness, uncanniness, manipulation check questions, and demographics were measured.

Study 2 Results

A one-way ANCOVA was conducted with gender as the covariate. The results indicated that participants had the least trustworthiness of the VI after viewing its' vulnerability disclosure through negative emotional expression in the post compared to the control condition or positive emotional expression condition (Mnegative = 2.78, SD = 1.39 vs. Mcontrol = 3.34, SD = 1.48 vs. Mpositive = 3.58, SD = 1.69; F(2, 205) = 4.96, p < .01), while the latter two were no difference (p = .35). Moreover, we conducted a mediation analysis (Process Model 4, 5,000 bootstraps) with uncanniness as the mediator. Participants felt greater uncanniness toward the VI when it was expressing negative emotion rather than in control conditions (β = -.77, SE = .31; p < .01). Participants' uncanniness perceptions did not differ in negative and positive emotional expression conditions (β = -.51, SE = .31; p = .11). Subsequently, the uncanniness lowered participants' trustworthiness toward VI (β = -.36, SE = .05; p < .001). H2 was supported.

Discussion

The first two studies reveal that VIs' disclosures of vulnerability, particularly through negative emotional expressions, significantly increase perceptions of uncanniness among consumers, thereby reducing trustworthiness. In the subsequent studies, we aim to underlie the effect of VIs' vulnerability disclosures on uncanniness by exploring its mechanism. The comparison between human and virtual influencers will be conducted to test whether uncanniness is triggered only by VIs' vulnerability disclosures. To enhance the generalizability, we plan to replicate the findings by using other VIs as stimuli. Generally, the findings align with the Uncanny Valley (UV) theory (Mori, 1970), thereby deepening our understanding of virtual human avatars.

References

Brown, K., Ecclestone, K., & Emmel, N. (2017). The many faces of vulnerability. *Social Policy and Society,* 16(3), 497-510.

Gronholm, P. C., & Thornicroft, G. (2022). Impact of celebrity disclosure on mental health-related stigma. *Epidemiology and psychiatric sciences,* 31, e62.

Ham, J., Li, S., Looi, J., & Eastin, M. S. (2024). Virtual humans as social actors: Investigating user perceptions of virtual humans' emotional expression on social media. *Computers in Human Behavior,* 108161.

Khalifian, C. E., & Barry, R. A. (2020). Expanding intimacy theory: Vulnerable disclosures and partner responding. *Journal of Social and Personal Relationships*, 37(1), 58-76.

Mori, M., MacDorman, K. F., & Kageki, N. (2012). The uncanny valley [from the field]. *IEEE Robotics & automation magazine*, 19(2), 98-100.

Qu, Y., & Baek, E. (2023). Let virtual creatures stay virtual: tactics to increase trust in virtual influencers. *Journal of Research in Interactive Marketing*, (ahead-of-print).

Yamaguchi, S., Kawata, Y., Murofushi, Y., & Ota, T. (2022). The development and validation of an emotional vulnerability scale for university students. *Frontiers in Psychology*, 13, 941250.

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CUSTOM IMAGE SEGMENTATION USING YOLO-v8
TO EXTRACT REFERENCE POINTS OF PANTS' FRONT PANEL

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Introduction

Pattern making involves repetitive drafting and cutting tasks to transform flat pieces of paper into a garment. This iterative two- and three-dimensional process has been improved with the availability of 3D body scanning technology, which allows fashion designers to develop made-to-measure and custom sewing patterns based on anthropometric measurements (Daanen & Ter Haar, 2013). However, it shows lower reliability in extracting data from certain body parts, such as armpits and crotch, and above all is expensive. Researchers also have investigated pattern generation in computer graphics, but most of their work has been concentrated on clothed avatars. A few studies recently examined methods of computing sewing patterns from 3D garment models. Korosteleva & Lee (2021) generated a dataset of 3D garments and sewing patterns, which was considered one of the early steps of representing garment designs with patterns. Bang et al. (2021) also presented a new approach to creating simulation-ready garment models from clothed 3D avatars by finding the optimal human skin-garment boundaries. Goto & Umetani (2021) developed a technique to estimate data-driven garment patterns from scan data. Pietroni et al. (2022) suggested a new method to segment a 3D garment shape into pattern pieces that can be cut out and sewn together to create a garment. There have been attempts to create garment patterns within this context, but they have a limitation in that they are not life-sized. This study investigates a new method of creating sewing patterns by combining computer graphics and apparel design knowledge. The study employs an instance segmentation algorithm to extract the reference points, which could be used to create a pattern, directly from a 2D image along with the measurements of the pattern. Considering the lack of literature review on this topic, the study is focused on pants and sets out to gradually expand the scope of the garment category as it develops.

Methods

To scrutinize the feasibility of creating a sewing pattern based on the reference points extracted from an image, the study employed the YOLO-v8 instance segmentation model that identifies and segments individual objects within an image. Using custom datasets to train a pre-trained model on a new task has validated capturing knowledge without extra effort to build a model from scratch while saving time and resources (Tan et al., 2018). The COCO dataset that the segmentation model used for this study was trained on did not include apparel items. Thus, custom datasets of pants were collected to train the model to segment the pants along with the dress form, which was used as a region of interest (ROI) to calculate the measurements of the pattern through pixels-to-inches conversion. In total, 132 images, 13 images, and 6 images were used for datasets after labeling them as training, valid, and test sets. The model was optimized for the instance segmentation task by changing different settings for hyperparameters, such as batch sizes (16, 32) and number of epochs (10, 20, 50, 100). For evaluation, training, and validation losses were evaluated, and F-1 score and precision were also measured. Based on the model performances, the best model was selected and the coordinates of the contour line of the segmented pants were used to extract the reference points consisting of a front panel of pants in the test image. In pattern making, half-scale pattern blocks are primarily used for educational purposes to create full-size patterns (Vuruskan & Ashdown, 2017). Thus, the reference points in this study were designed to form a half-scale front pant and ultimately create a full-size pattern. Four extreme points toward the corners of the image were first extracted in a way that the shortest distance was calculated. Here, the top two points were set as the front waist ends. After approximating the line of best fit between the waist ends, the middle point was calculated. The reference point of the crotch was extracted by finding the highest point that intersects the x-axis of the middle point.

Based on this x-axis, the point of the inner leg opening was also calculated. The point of the high hip was set as the rightmost point out of the coordinates above the y-axis of the crotch.

Results & Discussion

In this study, fine-tuning different parameters of the model on a new dataset was conducted to find an optimal configuration of hyperparameters. On the validation set, the best segmentation model was the one trained with a batch size of 32 and 100 epochs. Having larger batch sizes and epochs showed better performances, with the model not converging within the experiment environment. Given the F-1 scores, it appeared that the task was not hard for the pre-trained model as it did not require the model to recognize multiple, or small objects in images. In terms of precision, the model performances were low on a few test sets with the pants taken from the left or right side. The measurements of the front panel were calculated by measuring the distance of a pair of respective reference points in pixels and then converted to inches. The dimensions of the front panel's waist, front rise, inseam, and leg openings were 7.91, 18.28, 32.03, and 3.3 inches (*Fig. 1*). Since the length was broken down into two parts and calculated separately, this measurement was not included. The corresponding measurements of the actual pants were 7.5, 10.5, 28.5, and 5 inches. The front rise was estimated longer than the actual one because broader boundaries were segmented as the rise in the image. On the contrary, the horizontal lines, the front panel's waist and leg openings, were estimated shorter than the actual measurements. It was also because the model failed to segment the leg opening region from the dress form, and the contour line of the segmented pants were accordingly mis-segmented.

Fig. 1. Reference points and measurements of the front panel marked in pixels (A) and inches (B)

Conclusion

Accurate measurements are essential in pattern making since they serve as a foundation to create patterns for clothing that fit the human body. A challenge existed in obtaining accurate measurements of the front panel of pants, but this study showed the synergy of machine learning and apparel design and great potential to create patterns based on the measurements. Opportunities exist here to apply various pattern making techniques to create natural crotch and hip curves based on the reference points extracted from the image. As the measurements were miscalculated due to the segmentation results, further studies on data augmentation, including background images with no objects and labels, could be conducted to optimize the model performance. Additional data collection and labeling are also expected to make pants segmentation more reliable and applicable to various applications in fashion.

References

Bang, S., Korosteleva, M., & Lee, S. H. (2021, September). Estimating garment patterns from static scan data. In *Computer Graphics Forum* (Vol. 40, No. 6, pp. 273-287).

Daanen, H. A., & Ter Haar, F. B. (2013). 3D whole body scanners revisited. *Displays*, 34(4), 270-275.

Goto, C., & Umetani, N. (2021). Data-driven Garment Pattern Estimation from 3D Geometries. In *Eurographics* (Short Papers) (pp. 17-20).

Korosteleva, M., & Lee, S. H. (2021). Generating datasets of 3d garments with sewing patterns. *arXiv preprint* arXiv:2109.05633.

Pietroni, N., Dumery, C., Falque, R., Liu, M., Vidal-Calleja, T. A., & Sorkine-Hornung, O. (2022). Computational pattern making from 3D garment models. *ACM Trans. Graph.,* 41(4), 157-1.

Tan, C., Sun, F., Kong, T., Zhang, W., Yang, C., & Liu, C. (2018). A survey on deep transfer learning. In *Artificial Neural Networks and Machine Learning–ICANN 2018: 27th International Conference on Artificial Neural Networks, Rhodes, Greece, October 4-7, 2018, Proceedings*, Part III 27 (pp. 270-279). Springer International Publishing.

Vuruskan, A., & Ashdown, S. P. (2017). Modeling of half-scale human bodies in active body positions for apparel design and testing. *International Journal of Clothing Science and Technology*, 29(6), 807-821.

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ENHANCING FASHION DESIGN EDUCATION: A COMPREHENSIVE EXPLORATION INTO THE IMPACT OF OBJECT-BASED LEARNING ON STUDENT DEVELOPMENT

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Introduction

The investigation into fashion design through object-based research serves as a valuable research approach, delving into the analysis of physical fashion items such as garments, accessories, and textiles. This study advocates for the integration of an object-based research approach into fashion design education. By immersing learners in a tangible exploration of fashion artifacts, this teaching method aims to enhance students' comprehension of garment construction. Through hands-on experiences, students delve into historical techniques, fostering creativity and mastery in contemporary design. Beyond bridging the gap between theory and practice, this teaching method cultivates critical thinking and deeper insights.

Literature Review

Object-based research, as advocated by Mida and Kim (2015), has become a significant research approach in the fashion design field. This method goes beyond theoretical knowledge, offering hands-on experiences by examining physical fashion artifacts.

Student feedback is vital for improving education, offering insights into teaching and course content. Understanding diverse perspectives enables educators to create dynamic learning environments. In addition, educators' self-evaluations, complemented by peer drive continuous professional development. Reflecting on instructional methods helps tutors identify strengths and areas for improvement, refining teaching strategies for more effective and engaging educational experiences, ultimately benefiting student learning outcomes.

Research Method

The Fashion Design construction module focuses on manufacturing garments. The aim is to acquire insights into the construction techniques, design elements, and craftsmanship inherent in garments. The first session focuses on 'Understanding the Construction and Design of a Garment' through an object-based study technique. Students engaged in observing garments under tutors' guidance, documenting findings according to a checklist emphasizing general information (e.g., target gender, fabric, color, labels, unique aspects) and construction details (e.g., components, structure, manufacturing methods, fastening, interfacing, lining, pocket, and notable features).

At the middle of semester, students are asked to complete feedback survey regarding the experience of the session and the questionnaire is developed using Quality Matters (QM) Higher Education Rubric (Quality Matters, n.d.), evaluating object-based research technique; workshop content; long-term impact; and general feedback with suggestions for further improvement. The module leader and tutor assessed the object-based learning's effectiveness using criteria outlined by Robinson (n.d.), including learning outcomes; engagement and participation; understanding and critical Thinking; skill development; comparison with traditional Methods; and integration into curriculum.

Results & Discussion

Students excelled in achieving educational objectives through hands-on engagement, demonstrating heightened critical thinking and analytical skills. Their active participation in the object-based research session cultivated a dynamic learning environment, encouraging exploration of historical garments and elevating their overall learning experience.

Object-based learning significantly contributed to advancing students' practical skills, enabling them to proficiently comprehend construction techniques and design elements in garment manufacturing. In comparison to traditional methods, object-based learning introduced a distinctive experiential dimension, resulting in deeper understanding and skill development. Its seamless incorporation into the curriculum complemented existing teaching approaches, offering a comprehensive learning experience. This integration bridged the gap between theoretical concepts and practical application, effectively enhancing students' comprehension of garment construction beyond conventional teachings.

Conclusion

The incorporation of object-based research approach in fashion design education, as advocated in this research, offers a valuable and innovative method to enhance students' comprehension of garment construction. The hands-on engagement in the object-based learning session resulted in students excelling in achieving educational objectives, demonstrating heightened critical thinking and analytical skills. The significant contribution of object-based learning to practical skill advancement, deeper understanding of construction techniques, and integration into the curriculum underscores its potency in fostering a dynamic learning environment. This research underscores the importance of integrating experiential learning approaches like object-based study to bridge the gap between theory and practice in fashion design education.

References

Mida, I. and Kim, A. (2015) *The Dress Detective: A Practical Guide to Object-based Research in Fashion*. London: Bloomsbury Visual Arts.

Quality Matters. (2024, January 28) Specific Review Standards from the QM. Retrieved from https://www.qualitymatters.org/sites/default/files/PDFs/StandardsfromtheQMHigherEducationRubric.pdf. (Accessed: 28 January 2024).

Robinson, D. (2023, December 11) *University of Exeter, 3 - Evaluating teaching: guidelines and good practice - Teaching Quality Assurance Manual - University of Exeter*. Retrieved from https://as.exeter.ac.uk/academic-policy-standards.

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STYLE THAT IS SUSTAINABLE: EXPLORING HOW FASHION DESIGN EDUCATION CAN ENHANCE PARTICIPANTS' AWARENESS OF SUSTAINABLE PRACTICES

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Introduction

Upcycling deadstock fabric waste into a catwalk collection as part of a live industry project is a valuable skill for today's next generation of creative designers. The aim of this study is to observe if creative fashion design students can gain personal and professional skills through first hand industry experience beyond the academic curriculum. To investigate the participants sustainable development through industry participation and to understand what sustainable practices are needed to improve the industry through collaboration. Thus, this study observes and analyses the process and outcome of a live design collaborative project with an international fashion brand where the participants worked as part of the design team to support and develop the line up for a gender neutral upcycled collection at New York Fashion Week September 2023.

Literature Review

Current literature describes a clear divide between sustainable knowledge and practice within the fashion industry, there is little understanding of participants' application of sustainable knowledge (Cochrane, 2023) acquired at university when entering industry. Equally, fashion brands and industry's expectations rarely achieve effective sustainable approaches on an industrial scale (Wood, 2023), instead this practice is regarded as only achievable for small independent forward-thinking businesses with and interest in activism (Carlotto and McCreesh, 2019., Wang et al. 2020.,Von Busch, 2022., Wrap, 2023). Further research is essential to close the gap between the sustainable and ethical needs of participants within industry led curriculum development and the fashion industry, evidencing how collaboration can improve both the education and fashion industry (Van Den Bergh and Behrer, 2016., Hastings-Narayanin, D., Rhodes, E., Kramer, J. 2023).

Research Method

Participants were tasked with designing and upcycling dead stock fabric to create new garments within an international brands collection (Kim, Y. S. & Koh, A.-R., 2018). They utilised a natural dye process, using rust demonstrated by the brand, to add colour to existing dead stock and fit within the brand guidelines for a cohesive collection. The brand and tutor continually met with the participants to provide feedback and guidance online during the summer holidays. This mimicked the style of a freelance fashion design job role within industry. Once the designs were selected by the brand, participants experimented with a range of sustainable patterning cutting techniques to toile and manufacture the garments. The final garments were then transported to New York for the fit event with the brand owner and models the day before the catwalk to make sure the garments fit and were cohesive with the brands garments to create the desired final look.

Results & Discussion

Throughout the process, observations were documented to note the transfer of knowledge shared between the brand and the participants to review the specialist skills in line with the tutor and industry's expectations for entering the Fashion industry. The observation method has been chosen due to the project being a collaboration with an industry professional which would provide enhanced insight into how the industry works and the expectations they have of the new designers. This is unlike how modules are taught so

observation is a key method to learn from. This will be done through Ethnography where we will study through direct observation of participants in their creative environment with an objective to gain insights into how the industry and students collaborate to produce an outcome in line with the brand's needs. Observations will be recorded in note form as well as photographs documenting the process and the outcome of the garments created in line with the brand. Observing the students to review if creative fashion design students can gain personal and professional skills through first hand industry experience beyond the academic framework. The second quantitative method utilised will be in the form of in-depth interviews with professionals and participants as well as objective garment analysis.

Based on these results the participants took part in this extracurricular project with a longer deadline than traditional University modules and the outcome demonstrates huge levels of personal and professional growth. With positive feedback from industry experts, it is clear this live project provided the participants with further specialist industry knowledge to enhance their understanding of industry's expectations. Moreover, further research is needed to support and develop preparing the next generation of fashion design graduates in line with industries needs to develop a sustainable solution and decrease the negative impact upon the environment.

Conclusion

There is a strong relationship between practical fashion design participants learning first hand from an industry mentorship. The live project added a higher level of pressure to perform to the project however these participants were highly motivated with the potential for the work to be exhibited internationally which supported to them excelling within this project. Demonstrating a need for academic familiar support to encourage and advise the participants throughout the journey due to the unfamiliarity of working within a live brief and external international brand. It is essential to link educators and industrial education to overlap through a hands on learn by doing approach (Kett, 2017).

Not only did the project build professional practice for the participants, but it also developed confidence in existing knowledge whilst developing new skills. Furthermore, this collaborative project enhanced relationships with industry brands and expanded their understanding of sustainable opportunities achievable when working with participants.

This project provides scope to develop the relationship with Turtlehorn, allowing collaboration to further expand participants knowledge of sustainable practices, by showcasing the collaborative collection at Copenhagen – the world's most sustainable fashion week. Participants would be challenged to comply with the sustainable action plan, meaning the collaborative development of sustainable skills to meet the minimum requirement of Copenhagen's 18 goals, over 6 key areas: strategic direction, design, smart material choices, working conditions, consumer engagement and show production. Opportunity for future development would entail collaboration between, alumni's (previous graduates) small independent brands, and brands all of which meet the UN sustainable goals. These goals are embedded throughout the BA (Hons) Fashion Design and BA (Hons) Fashion Business and Promotion curriculum and are reflected within the institutes 2025 strategy.

References

Birmingham City University. (2024) *Sustainability in the curriculum.* Available at:
> https://www.bcu.ac.uk/about-us/corporate-information/environment-sustainability/sustainability-in-the-curriculum (Accessed 11/03/2024).

Carlotto, F. And McCreesh, N.C. (2019) *Engaging with fashion, Perspectives on communication, education and business.* 1st edn. Netherlands: Brill Rodopi. At the interface/probing the boundaries, Volume 112.

Chan, E. (2023) *How Copenhagen Became The World's Most Sustainable Fashion Week.* Available at: https://www.vogue.co.uk/fashion/article/copenhagen-fashion-week-sustainability#:~:text=First%20unveiled%20back%20in%202020,consumer%20engagement%20and%20show%20production. (Accessed:11/03/2024).

Cochrane, L. (2023) 'You can't keep teaching people to dream': why Britain's young designers are struggling.' *The Guardian (*Lifestyle Edition), 24 October. Available at:

https://www.theguardian.com/fashion/2023/oct/24/fashion-britain-youngdesigners-struggle-for-money? (Accessed:16/02/2024).

Hastings-Narayanin, D., Rhodes, E., Krammer, J. (2023) *LSN Viewpoints: The Overconsumption mindset.* UK:LSN Global, Available at: https://www.lsnglobal-com.bcu.idm.oclc.org/viewpoints/article/29439/the-overconsumption-mindset (Accessed:16/02/2024).

Kett, J. F. (2017) "THEORY RUN MAD": JOHN DEWEY AND "REAL" VOCATIONAL EDUCATION. *The journal of the gilded age and progressive era*. [Online] 16 (4), 500–514.

Kim, Y. S. & Koh, A.-R. (2018) *Re;Code : upcycling deadstock fabrics into a fashion brand*. London, UK: Bloomsbury Publishing.

United Nations. (2023) The 17 Goals. Available at: https://sdgs.un.org/goals (Accessed: 11/03/2024)

Van Den Bergh, J. And Behrer, M. (2016) *How Cool Brands Stay Hot: Branding To Generations Y & Z.* 3rd edn. London: Kogan Page Limited.

Von Busch, O. (2022) '"What is to be sustained?": Perpetuating systemic injustices through sustainable fashion', *Sustainability: Science, Practice and Policy*, 18:1, Article: 400-409, Available at: DOI: 10.1080/15487733.2022.2069996, (Accessed:16/02/2024).

Wang, B., W. Luo, A. Zhang, Z. Tian, and Li, Z. (2020) 'Blockchain-Enabled Circular Supply Chain Management: A System Architecture for Fast Fashion.' *Computers in Industry,* 123: Article: 103324, Available at: DOI: 10.1016/j.com-pind.2020.103324 (Accessed:16/02/2024).

Wood, Z. (2023) 'Fashion's efforts to go green cancelled out by shopaholics.' *The Guardian* (Climate Crisis Edition), 08 November. Available at: https://www.theguardian.com/fashion/2023/nov/06/fashions-efforts-green-cancelled-shopaholics-wrap (Accessed:16/02/2024).

Wrap (2023) *Textiles 2030 Annual Progress Report 2022/2023*. Available at: https://mcusercontent.com/65343110dd35be920e719fccd/files/504e8dea-65fc-c641-985f-87e61afe5591/Textiles_2030_Annual_Progress_Report_22_23.pdf (Accessed:16/02/2024).

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SUSTAINABLE PEDAGOGY IN FASHION DESIGN: EXPLORING THE INTEGRATION OF UPCYCLING PRINCIPLES IN HIGHER EDUCATION

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Introduction

Sustainability is defined as the creation of value for society through the acknowledgment of economic, cultural, social, and environmental impacts, drawing from the University of Leeds's Sustainability Strategy (Sustainability, 2024, January 20). The university aligns its initiatives with the United Nations Sustainable Development Goals (SDGs) to structure and direct its endeavors. Academic professionals are instrumental in facilitating Education for Sustainable Development (ESD), utilizing their teaching methodologies, assessment practices, and curriculum design to offer students opportunities for cultivating essential competencies in ESD (Sustainability, 2024, January 25 and QAA, 2021). This study delves into the integration of upcycling principles within the undergraduate Fashion Design course, evaluating the teaching methods based on guidelines and feedback from students.

Literature Review

The UN SDGs constitute a comprehensive global framework aimed at fostering a more equitable and sustainable future. Addressing 17 key objectives, these goals tackle pervasive challenges such as poverty, climate change, and social justice (United Nations, 2024, January 20). Integration of the SDGs into the academic landscape is anticipated through modules, a Sustainable Curriculum, and research within UK Higher Education. The Leeds Sustainable Curriculum framework aims to ensure that education for sustainable development becomes embedded within teaching and integrates with the University's ambitious Education Strategy and Curriculum Redefined program (Sustainability, 2024, February 2)

In the UK, the concept of upcycling has roots in the broader history of recycling and sustainability. However, it gained significant traction in the fashion industry in the early 21st century as a response to the environmental and social issues associated with fast fashion. Fast fashion refers to the rapid production and consumption of inexpensive, trendy clothing, which often leads to excessive waste (Sung, K. et al., 2020). The upcycling movement has gained momentum, driven by an escalating awareness of environmental concerns and a collective aspiration for more sustainable fashion practices. This shift reflects a broader societal move towards conscious consumerism and away from disposable fashion. The educational advantages associated with upcycling extend to students, fostering environmental awareness, critical thinking, decision-making, and ethical considerations aligning with specific SDGs.

Research Method

The primary aim of the upcycling project for fashion students is to empower and inspire the future generation of fashion designers with sustainable practices. The sessions seek to develop a deep understanding of upcycling principles, fostering creative thinking, and encouraging students to adopt sustainable approaches in their design processes. Students' submissions are assessed based on the level of applications from the pre-existing knowledge and techniques provided prior to the hands-on workshop sessions. The evaluation involves the analysis of works utilizing resources like discarded garments and leftover fabrics or fabric scraps. In addition, the assessment includes an examination of the techniques applied, such as fabric embellishment and embroidery.

The effectiveness of teaching is assessed using UNESCO's key competencies for sustainability, which are designed for global learners. These competencies can be applied in higher education by aligning them with appropriate learning outcomes. The evaluation criteria involve grasping Education for ES and the UN SDGs within the context of their respective disciplines. This involves acknowledging how the fields of study might

uphold inequitable and environmentally harmful perspectives or methodologies. Furthermore, the objective is to comprehend UNESCO's sustainability competencies and seamlessly integrate them into course and module outcomes.

Results & Discussion

The results of an upcycling project extend beyond the physical products created, encompassing educational, environmental, and social impacts. The outcomes contribute to students experiencing a more sustainable and conscientious approach to design and consumption. Upcycling projects result in the production of unique, one-of-a-kind items, demonstrating creativity and innovation in fashion design. Students transformed discarded materials into new, valuable products contributing to sustainable and eco-friendly consumption. It is obvious that upcycling projects result in valuable learning experiences for students to learn practical skills, environmental awareness, and a deeper understanding of sustainable design principles. This project leads to innovative approaches in fashion design, challenging traditional norms and inspiring new perspectives contributing to the broader conversation about sustainable practices within the fashion industries. In addition, the project contributes to raising awareness among consumers about the possibilities of conscious and responsible consumption.

Conclusion

The upcycling project provides transformative educational experience, making fashion students able to acquire the knowledge, skills, and mindset needed to contribute to a more sustainable and ethical future in the fashion industry. The outcomes of an upcycling initiative go beyond the tangible products produced, involving educational, environmental, and social influences. In conclusion, this upcycling project serves as a noteworthy endeavor in the pursuit of sustainable and innovative practices and the results highlight the transformative potential of repurposing materials, not only in creating unique and environmentally responsible garments but also in advancing sustainable design principles. The outcomes of this project contribute to a growing body of knowledge on the intersection of creativity, sustainability, and conscious consumerism in the fashion industry. Through an examination of the tangible and intangible impacts, the upcycling project will play a role in fostering a more sustainable and mindful attitude towards fashion design and consumption.

References

QAA (2021). *Education for Sustainable Development.* Retrieved from https://www.qaa.ac.uk/the-quality-code/education-for-sustainable-development#

Sustainability (2024, January 20). *Sustainability Strategy.* Retrieved from https://sustainability.leeds.ac.uk/about/sustainability-strategy/

Sustainability (2024, January 25). *Embedding Sustainability in Teaching.* Retrieved from https://sustainability.leeds.ac.uk/our-work/leeds-sustainable-curriculum/embedding-sustainability-in-teaching/

Sustainability (2024, February 2). *Embedding Sustainability in Teaching.* Retrieved from https://sustainability.leeds.ac.uk/our-work/leeds-sustainable-curriculum/embedding-sustainability-in-teaching/

Sung, K. et al. (2020). Multi-stakeholder perspectives on scaling up UK fashion upcycling businesses. *Fashion Practice,* 12(3), pp. 331–350. doi:10.1080/17569370.2019.1701398.

United Nations (2024, January 20). *The 17 Goals.* Retrieved from https://sdgs.un.org/goals.

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Concurrent Sessions

Special Topic Oral Presentation Session 3 : Design Practice for Circular Economy

Chair: Dr. Yoo Jin Kwon, Korea National Open University

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AMERICAN CONSUMERS' PURCHASE INTENT OF FAUX LEATHER FASHION PRODUCTS: THE MEDIATING ROLE OF PERCEIVED MORAL INTENSITY

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Introduction

Vegan fashion refers to fashion that does not exploit or abuse animals. Faux leather fashion, a type of vegan fashion, has gained recognition recently. According to a marketing consulting company, the global market size for faux leather was estimated to be approximately $29.13 billion in 2019 and is expected to grow at a rate of over 7.8% by 2027. Existing research on the purchase of artificial leather fashion primarily focuses on Korean consumers, with limited studies on global consumers. Furthermore, previous research has relied on a small number of interviews and surveys to explore purchase motivations and the relationship with eco-friendly attitudes. This study aims to investigate the purchase behavior of artificial leather fashion products among American consumers. Specifically, we seek to understand how values influence the intent to purchase faux leather fashion items. Additionally, we aim to explore the role of perceived moral intensity, which evaluates the perception of the degree of animal abuse associated with the purchase of natural leather fashion products from several aspects, in their decision to purchase faux leather fashion items, using empirical data.

Literature Review

Individuals' values shape their preferences, attitudes, and behaviors, with idealism and relativism representing aspects of moral philosophy. In assessing right and wrong, idealism adheres to absolute standards, while relativism uses different standards depending on the context (Forsyth et al., 2008). Particularly, relativist decision-making seems to have a tendency to depend on whether the choice is good or bad for them in each situation (Nebenzahl et al., 2001, Singhapakdi et al, 1999). Moral intensity refers to the overall impact, either harmful or beneficial, resulting from individuals' decisions or actions. It is determined by factors such as the probability, magnitude, immediacy, proximity, concentration, and social consensus of the harm or benefits (Jones, 1991). According to the Value-Attitude-Behavior (VAB) hierarchical theory proposed by Homer & Kahle (1988), an individual's values sequentially influence their attitudes toward specific products, behaviors, or situations, and their ultimate behavior. Previous qualitative research has shown that Korean consumers' purchase behavior of faux leather and faux fur fashion products is based on altruistic reasons such as their empathetic consumption and practice of social responsibility (Kim & Kwon, 2016). A study conducted by Li (2018) found that Korean women and men in their 20s and 30s who have purchased faux leather or faux fur preferred these two items because they were aware of animal protection and eco-friendly fashion, and their purchase behavior was influenced by their eco-friendly motivation (Li, 2018). Female Koreans in their 20s and 30s who have purchased faux leather products, faux fur products, and animal-sponsored products have purchased such vegan fashion influenced by mass media and SNS channels and their own pets (Choi, 2019). In addition, they also purchased vegan fashion products due to aversions (or rejections) toward natural leather and natural fur fashion products, according to Choi (2019). In particular, Korean women in their 20s and 30s who participated in the interviews purchased faux fur because it can replace natural fur, and purchased faux fur apparel products as a compromise between their desire for natural fur clothing and social criticism of purchasing natural fur clothing (Kim & Kwon, 2016). Building on the VAB theory and corroborated by prior findings, we hypothesize that idealism (H1) and relativism (H2) will positively influence the perceived moral intensity of animal abuse resulting from the purchase of natural leather fashion products. Furthermore, we expect that the perceived moral intensity of purchasing natural leather fashion products will positively affect the intention to purchase faux leather fashion products (H3).

Research Method

Data were collected from American consumers using an American online survey service site. Among the 635 respondents, 31.1% were female and 56.1% were male. The majority of respondents were relatively young (20-39 years old, 79.2%), including 20s (31.5%) and 30s (36.4%). The sample predominantly consisted of individuals identifying as White (42.7%) and Asian (22.7%), residing in the USA. Additionally, 76.2% of respondents reported being office workers, and 55.6% were married. We used a 5-point Likert scale to assess research variables: idealism, relativism, moral intensity of purchasing natural leather fashion products, and purchase intent of faux leather fashion items. The moral intensity of natural leather fashion products purchase was measured in six sub-dimensions. Demographic variables were measured by forced-choice questions and free-response. We conducted confirmatory factor analysis and structural equation modeling analysis using AMOS 25.0, and reliability analysis and frequency analysis using SPSS 20.0. Indirect effects were analyzed by the PROCESS macro version 3.3 for SPSS.

Results & Discussion

Results of confirmatory factor analysis, the fit indices of the measurement model were with in acceptable levels (CFI =.950, TLI = .945, RMR=.057, GFI=.899, AGFI=.882, χ^2/df = 2.468), RMSEA value was also acceptable (RMSEA = .048, LO 90=.045, HI90=.052, p close=.804). Thus, the measurement model fit appears quite good. In addition, the values of composite reliability (CR) and the average variance extracted (AVE) for most constructs exceeded the acceptable level, the reliabilities of all variables included in the measurement model were also between .784 and .940(Cronbach's alpha). Thus, the CFA results confirmed the convergent validities of all variables included in the measurement model. All squared multiple correlation (SMC) values were lower than all AVE values, confirming discriminant validity for all scales. The result of testing structural equation model, fit indices of the pooled second-order path model were overall acceptable (CFI =.950, TLI =.945, RMR=.057, GFI=.899, AGFI=.882 and χ^2/d.f.= 2.465), including RMSEA value (RMSEA=.048, LO 90=.045, HI90=.052, p close=.812). Idealism (standardized γ=.724) and relativism (standardized γ=.323) significantly and positively affected the perceived moral intensity of natural leather fashion product purchase. The impact of idealism value on the perception of moral intensity was found to be higher than the impact of relativism value on it. The perceived moral intensity for the purchase of natural leather fashion items positively influenced the purchase intent of faux leather fashion items (standardized β=.634). Therefore, all research hypotheses proposed were supported. We further explored our research model by incorporating two direct effects—idealism and relativism—on the intent to purchase faux leather fashion products. Upon analysis, we found no statistically significant differences in the goodness of fit between our original research model and this alternative model. Additionally, the direct effects of idealism and relativism on purchase intent, as proposed in the alternative model, were not significant. To better understand the underlying dynamics, we analyzed the mediating effects of perceived moral intensity on purchase intent using the PROCESS macro for SPSS. Our findings revealed that idealism and relativism indirectly influenced the intent to purchase faux leather fashion products through perceived moral intensity, with indirect effects of .403 and .310, respectively. This confirms that moral intensity plays a crucial mediating role in the relationship between both idealism and relativism and the intent to purchase faux leather fashion products.

Conclusion

The findings of this research lend support to the hierarchical theory of Value-Attitude-Behavior (VAB) and offer insights into American consumers' purchasing behavior regarding faux leather fashion items. In addition, they shed light on strategies for promoting these products. For instance, by using quantitative data, global and domestic brands can highlight the likelihood, severity, immediacy, proximity, and social consensus surrounding animal abuse associated with natural leather fashion item purchase, aiming to encourage consumers to purchase faux leather items. Brands developing artificial leather fashion lines could target consumers who refrain from purchasing natural leather products because perceived moral intensity of such products. They can achieve this by illustrating how opting for faux leather reduces animal abuse linked to the production of natural leather, and aligns with ethical values, especially the values of idealists which

are oriented to altruistic and pro-environment, are and respect for life. Nonetheless, faux leather generally has both positive and negative aspects, reducing animal abuse but causing environmental pollution. Using faux leather materials that cause fewer environmental problems will be crucial to appealing to idealistic consumers as a target market and lowering their moral intensity against faux leather. Moreover, our results imply that when marketing natural leather fashion items, brands must transparently communicate with consumers, presenting objective and qualitative data that reveal minimal instances of animal abuse in the leather acquisition and manufacturing processes. Additionally, natural leather-related brands can enhance the persuasiveness of their products by openly showcasing efforts made to minimize animal cruelty in their production methods.

References

Choi, Y. J. (2019). *A qualitative research on shopping orientation and purchase decision making process of vegan fashion consumer*, [Unpublished doctoral dissertation]. Yonsei University.

Forsyth, D. R., O'boyle, E. H., & McDaniel, M. A. (2008). East meets west: A meta-analytic investigation of cultural variations in idealism and relativism. *Journal of Business Ethics*, *83*(4), 813-833. https://doi.org/10.1007/s10551-008-9667-6

Homer, P. M., & Kahle, L. R. (1988). A structural equation test of the value-attitude-behavior hierarchy. *Journal of Personality and social Psychology*, *54*(4), 638-646.

Jones, T. M. (1991). Ethical decision making by individuals in organizations: An issue-contingent model. *Academy of management review*, *16*(2), 366-395.

Kim, Y. J., & Kwon, Y. J. (2016). Is ethical consumption altruistic or egoistic? : Consumer culture of wearing faux fur. *Journal of the Korean Society of Costume*, *66*(7), 17-33. http://dx.doi.org/10.7233/jksc.2016.66.7.017

Li, K. K. C. (2018). *Determinant factors of younger generations' perception and preferences on eco-friendly synthetic leater/fur fashion clothes*, [Unpublished doctoral dissertation]. Yonsei University.

Nebenzahl, I. D., Jaffe, E. D., & Kavak, B. (2001). Consumers' punishment and rewarding process via purchasing behavior. *Teaching Business Ethics*, *5*, 283-305.

Singhapakdi, A., Vitell, S. J., & Franke, G. R. (1999). Antecedents, consequences, and mediating effects of perceived moral intensity and personal moral philosophies. *Journal of the Academy of Marketing Science*, *27*(1), 19-36. https://doi.org/10.1177/0092070399271002

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DEMONSTRATION AND PROCESS FORMULATION THROUGH CAD SIMULATION FOR UPCYLING OF OLD SHIRT : A HOLISTIC APPROACH TOWARDS CIRCULAR FASHION

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Introduction

Circular fashion refers to an approach within the fashion industry that aims to create a closed loop system, reducing waste and maximizing the lifespan of clothing and textiles. It aligns with the principles of the circular economy, which includes not only the production and lifecycle of a garment, but also its utilization and recycling or upcycling after the expiry of its present end-use. ('The Sustainable Fashion Forum' 2024). In this context, the zero-waste fashion is categorized into two general approaches – i.e. dealing with pre-consumer waste and dealing with post-consumer waste. In case of the former, the objective is to eliminate the textile waste during manufacturing. Whereas, in case of post-consumer waste approach, the maxim is to upcycle the abandoned apparel product to transform it into another product with a fresh start of lifecycle. So that the rapid depletion of energy and water can be restricted, along with reduction in carbon-footprint. (Stephanie R. 2010) (R. Rathinamoorthy 2019).

Literature Review

A huge amount of water and natural resources are consumed in producing fabrics. It is evident that 2700 liters of water are consumed for making one t-shirt, which is enough for a person to drink for 900 days (Julie Malon**,** 2013**) (**Higgins Leah, 2018). Manufacturing of shirt involves different processes which require 10 kilowatt-hour of energy. Also, a large amount of carbon emission is noted in the process of garment manufacturing (Caorbonfact 2024). In this context, so far as the sustainability of planet earth is concerned, the main principle of circular fashion is to design and adopt the mechanism of creating new and market-acceptable products by upcycling the old garments (Madeleine Hill 2022) (Sayoni Nath and Anirban Dutta 2023 ; Ismay Mummery 2017).

Research Method

The 100% cotton plain-woven old shirt is collected form volunteer-household following proper social and medical protocols. Collected old shirt is properly disinfected followed by washing as per standard method (Rubio-Romero JC. et.al. 2020). After ironing, the back portion of the washed and disinfected shirt is cut to extract a rectangular piece of fabric of the dimension 60 cm x 30 cm (approx.) (Figure-1). The areal density (GSM) and longitudinal stiffness (flexural rigidity) are determined as per ASTM test methods. Three embroidery designs with known parameters have been identified **(**Dutta, A. and Chatterjee, B. 2020A)**.** CAD simulation is done using CorelDraw Graphic Suite 2022 software for virtual visualization of the embroidered fabric in case of each of the three embroidery motifs, using the scanned image of the cut-fabric from the old shirt. Also, the predicted GSM and flexural rigidity of the simulated embroidered fabrics are determined using the established prediction equations in this context **(**Dutta, A. and Chatterjee, B. 2020A ; Dutta, A. and Chatterjee, B. 2020B). In addition to that, another embroidery motif is developed and simulated embroidered fabric is created. Next, five different garments are designed for infant (3 to 6 months age- group), as it is found that the dimension of the cut-fabric matches with the measurements chart of the half-sleeve woven kurta for infants. All the five different garments are virtually developed using all the four simulated embroidered fabrics, using CorelDraw Graphic Suite 2022 software. Hence total 20 options of garments are simulated. The operation breakdown and Standard Allowed Minute (SAM) for the designed garments are estimated using PMTS and GSD. Also, the estimated carbon footprint and the water and energy consumption for embroidery and stitching of those garments using fabric pieces of old shirt are estimated.

This is compared with the standard energy and water consumption and carbon-footprint in case of those garments produced from new and virgin fabrics.

Fig.1: Extraction of fabric cut-piece from old-shirt

Results & Discussion

The Simulated embroidered-fabric along with corresponding product-visualization of garments are represented by Figure 2 to Figure-5 using different embroidery motifs.

Fig. 2

Fig. 3

Fig.4

Fig. 5

Fig 2 to 5: The simulated fabrics along with simulated garments using different embroidery motifs on the scanned image of the fabric cut from old shirt

It is found that the estimated energy consumption and carbon-footprint are much lower in case of such planned garments by upcycling of old- shirt, compared to regular infant wears produced from fresh and virgin fabrics.

Conclusion

It is noted, based upon the comparison with respect to energy-consumption and carbon-emission data, the production of such infant-wears by upcycling of old shirt is significantly environment-friendly and sustainable , without compromising the aesthetics and consumer-acceptance. Also, it is demonstrated that

all the initial stages of product development, sampling, motif selection, color selection, pre-estimation of physical and functional parameters of final product etc. can be done using design software. Moreover, finalization of product or even consumer survey can be done using such simulated garments made of the scanned images of old cut-fabric. Hence such simulation process also saves lots of material and reduces carbon-footprint. It helps the designers to explore unlimited options for upcycling of old and abandoned garments, i.e. post-consumer waste, which is essential for the global sustainability.

References

Caorbonfact. (2024). How much carbon is a t-shirt. https://www.carbonfact.com/blog/tshirt#:~:text=Manufacturing%20a%20tshirt%20involves,of%20carbon%20emissions%20come%20from

Dutta, A. and Chatterjee, B. (2020A), "Development of prediction model through linear multiple regression for the prediction and analysis of the GSM of embroidered fabric", *Research Journal of Textile and Apparel*, Vol. 24 No. 1, pp. 53-71. https://doi.org/10.1108/RJTA-07-2019-0033

Dutta, A., Chatterjee, B. (2020B). Development of prediction model through linear multiple regression for the prediction of longitudinal stiffness of embroidered fabric. *Fash Text* 7, 36 (2020). https://doi.org/10.1186/s40691-020-00225-6

Higgins Leah. (2018). How much water?', *Cloth in Common*. https://clothincommon.com/how-much-water-d45/

Ismay Mummery. (2017). Zero Waste and Circular Fashion Sustainable Fashion. Sept 2 2017., https://boywonderland.com/zero-waste-circular-fashion/

Julie Malon. **(2013)**. It Takes 2,700 Liters of Water to Make a T-Shirt . *Triple Pundit.* https://www.triplepundit.com/story/2013/it-takes-2700-liters-water-make-t-shirt/54321

Madeleine Hill. (2022). What is Circular Fashion. *Good on You*. https://goodonyou.eco/what-is-circular-fashion

Rathinamoorthy, R. (2019). Circular Economy in Textiles and Apparel. *The Textile Institute Book Series.* 2019. page 13-48 . https://doi.org/10.1016/B978-0-08-102630-4.00002-9

Rubio-Romero JC, Pardo-Ferreira MDC, Torrecilla-García JA, Calero-Castro S., (2020), 'Disposable masks: Disinfection and sterilization for reuse, and non-certified manufacturing, in the face of shortages during the COVID-19 pandemic', *Saf Sci.* 2020 Sep; 129:104830. doi: 10.1016/j.ssci.2020.104830. Epub 2020 May 13. PMID: 32406406; PMCID: PMC7218384

Sayoni Nath , Anirban Dutta. (2023). Design and Production of Fashionable Home Furnishings by Reusing Old Saree: A Holistic Approach Towards Circular Fashion for Sustainability'.
https://www.researchgate.net/publication/369553413_Design_and_Production_of_Fashionable_Home_Furnishings_by_Reusing_Old_Saree_A_Holistic_Approach_Towards_Circular_Fashion_for_Sustainability

Stephanie, R. (2010). Fashion Tries on Zero-waste Design. *The New York Times,* Aug.13, 2010. https://www.nytimes.com/2010/08/15/fashion/15waste.html/

The Sustainable Fashion Forum. (2024). What is Circular Fashion ? https://www.thesustainablefashionforum.com/pages/what-is-circular-fashion.

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SUSTAINABLE AND CIRCULAR PRACTICES IN THE UK FASHION AND TEXTILE INDUSTRY

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Introduction

This research investigates how UK Fashion and Textiles (FT) businesses are implementing sustainability and circularity practices in response to the global climate emergency and government targets. It builds on a prior study, which revealed that sustainability is a key priority for this sector (Hemingray et al, 2023). In this area, there is a lack of research on exemplary UK FT businesses from across the supply chain, documenting how businesses are responding to issues relating to sustainability. This research aims to address the gap by identifying best practice as well as highlighting opportunities and challenges that businesses encounter concerning sustainability and circularity. This study provides recommendations to facilitate increased uptake of sustainability practices within the UK FT industry.

Literature Review

The significant environmental impacts of the fashion and textile industry are well documented (e.g. Niinimäki et al 2020; Moazzem et al., 2022; Peters et al., 2021). In response to the climate crisis, the UK government has set the goal of achieving Net Zero by 2050 and published guidelines to reduce the carbon footprint (Burnett et al, 2023). Over 100 UK FT businesses have signed up to Textiles 2030, an initiative aiming to reduce the industry's carbon footprint, work towards climate goals, and embrace the principles of the circular economy (WRAP, 2021). This paper explores the practices companies currently implement to reduce their environmental impacts in their quest to embrace circularity.

It is important to note that impacts overall are still increasing: despite a 2% reduction in carbon emissions per ton of clothing are cancelled out by a 13% increase of new products placed on the market (WRAP, 2023). The excessive use of natural resources and resulting waste is exacerbated by the dominant business model of 'fast fashion' which relies on high volumes and rapid turnover of clothing (Niinimäki et al 2020). This research includes insights from industry experts on issues relating to overconsumption and overproduction.

Research Method

This research adopts a qualitative methodology. The dataset consists of 15 semi-structured interviews with participants from businesses across the UK FT industry. This includes small and medium-sized enterprises as well as larger scale businesses, such as fabric and apparel manufacturers, footwear brands, sustainability consultants, NGOs, and recycling providers. The interview protocol builds on findings from an industry report published in 2023 (Hemingray et al, 2023) and offers detailed insights into issues regarding sustainable and circular business practices. Thematic analysis was carried out using QSR NVivo software to enable the sharing of analysis data within the interdisciplinary research team. Themes emerging from the data relate to business models, digital technologies, certification, greenwashing, communication, legislation, social responsibility, the value chain, consumer demand and funding.

Results & Discussion

The results show a wide range of different approaches towards sustainability and circularly implemented by UK FT businesses. The types of practices vary depending on the business size and company ethos. Larger companies, such as Burberry and John Lewis, typically employ external consultants for devising a carbon reduction strategy. Many smaller companies describe sustainability as central to their business

model, with some demonstrating nature-led ways of thinking and working. Despite sustainability increasingly becoming a ubiquitous, or even fashionable concept within the sector, some criticized the lack of meaningful change. The intention for good practice was unanimously expressed, but subsequent action was at times hindered by the lack of a business case for the often more expensive sustainable options over conventional ones. The interviewees welcomed policy that would help create a level playing field if was developed in consultation with industry, to ensure relevance to businesses in the sector.

Conclusion

The findings demonstrate the breadth of approaches UK FT businesses are taking to embrace sustainability and circularity. Examples of best practice aim to inspire the sector, and barriers to the adoption of more radical sustainable practices are identified. Recommendations include industry-led policy that incentivize sustainable and circular business models. A limitation of this research is the geographical location which was centered on the UK. International comparative research would overcome limitations of the small sample size in this study and facilitate further comparison of prevalent practices in the industry, providing avenues for future research.

References

Burnett, N., Edwards, T., Watson, N. (2023) The UK's plans and progress to reach net zero by 2050 (online). Available from: https://commonslibrary.parliament.uk/research-briefings/cbp-9888/

Hemingray C, Vecchi A, Bonetti F, Toms S, Bulman S, Connor-Crabb A, Guo Y, Sirimal Silva E, Solomon L. (2023) *Impact of Brexit and Covid-19 on the UK Fashion and Technology Ecosystem* [online]. University of Leeds and University of Arts London. Available from: https://www.leeds.ac.uk/leeds-institute-textiles-colour/doc/impact-brexit-covid-19-uk-fashion-textiles-technology-ecosystem

Moazzem, S., Crossin, E., Daver, F. and Wang, L. 2022. Environmental impact of apparel supply chain and textile products. *Environment, Development and Sustainability.* **24**(8), pp.9757-9775.

Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., Gwilt, A. (2020) The Environmental Price of Fast Fashion. *Nature Reviews Earth and Environment* 1, 189-200.

Peters, G., Li, M. and Lenzen, M. 2021. The need to decelerate fast fashion in a hot climate - A global sustainability perspective on the garment industry. Journal of Cleaner Production. 295, p126390.

WRAP (2021) Textiles 2030 Circularity Pathway [online]. Available: https://wrap.org.uk/resources/guide/textiles-2030-roadmap

WRAP (2023) *Textiles 2030: Annual Progress Update 2022-23* [online]. Available: https://wrap.org.uk/resources/report/textiles-2030-annual-progress-update-2022-23

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MINDFUL CONSUMPTION: CASE STUDIES OF CLOTHING SWAP AND REPAIR COMMUNITIES IN THE UK

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Introduction

Community-based collaborative consumption (CBCC) in the form of local clothing swaps and repair café events has emerged because these grassroots initiatives provide alternative ways of consuming fashion and foster community circular fashion practices. Although CBCC practices can play crucial roles in transformative sustainable actions, local communities often face several cultural, logistical and infrastructural challenges to operating circular fashion practices. This study examined CBCC practices through case studies of repair and clothing swap community activities in the UK and, by considering both organisers' and community members' perspectives, identified key drivers of the activities and several barriers to community engagement. The study also investigated the role of mindful consumption in strengthening personal well-being, community actions and caring environments and discussed the requirements necessary to foster sustainable community practices and transformative circular fashion.

Literature Review

Clothing consumption has doubled from 100 billion to 200 billion items per year over the past 15 years, during which the total number of times a garment was worn declined by 36% (Mulhern, 2022). According to the Waste & Resources Action Programme (WRAP), the average UK consumer possesses approximately £4000 worth of garments but over 30% of these garments have been unused for at least a year (WRAP, 2012). Annually, over 500 billion USD in clothing ends up in landfills due to a lack of clothing utilisation or recycling of preloved clothing (EllenMacArthurFoundation, 2017). Expanding garments' life by nine months could ultimately save £5 billion in resource usage. Optimising garment lifespan has been recognised as a vital practice for lowering garments' carbon, water and material footprints (WRAP, 2024). Although several researchers classify how consumers use and dispose of their garments, people commonly participate in circular fashion practices in three major steps: (1) purchasing or exchanging preloved garments; (2) using and caring for garments via repairing or upcycling; and (3) disposing of unwanted garments by donating them to charity shops or reselling them (Zhang and Hale, 2022).

The concept of mindful consumption (MC) is closely associated with Buddhist philosophy, whereby consciousness is considered to be cultivated by directing one's attention towards the present moment without making judgements (Hunecke and Richter, 2019). According to Sheth et al. (2011), MC prioritises self-care, community and nature. Such a mindset leads to a reduction in self-destructive, wasteful consumption, which is often connected with acquisitiveness and repeated aspirational consumption. Community-based circular fashion practices, which are connected to the principles of MC, can play a significant role in transformative sustainable actions and in shaping and transforming sustainable lifestyles at the local level. However, how MC can be used effectively in circular fashion community practices is not well understood. This study uncovered opportunities and challenges involved in facilitating CBCC activities from local community perspectives, identified strategies for removing barriers to CBCC practices and discussed the roles of MC in harnessing self (individual), community and environmental well-being.

Research Method

Qualitative in-depth interviews were conducted with community event organisers and visitors to local repair café (n=10) and clothing swap events (n = 20) between 2019 and 2020 in Yorkshire locations in the UK. Using participatory action research, the researcher also contributed to the organisation of these clothing swap and repair café events and observed the practices at the events. Purposeful sampling to gather both

community organisers' and members' perspectives was used to understand the community mechanism and CBCC practices. Before the interviews were conducted, an interview protocol was provided to the participants, and each provided informed consent. All audio-recorded interview data were transcribed and analysed using Nvivo 11. Braun and Clarke's (2006) thematic analysis technique was applied. The data were coded and grouped according to initial coding themes. Similar codes were divided into themes that were developed gradually from the data until theoretical saturation was reached.

Results & Discussion

Community members who regularly join repair and clothing exchange community activities shared major motivations for participating at personal, community, social and environmental levels. First, self-benefits include the financial value in saving money through joining in clothing swap/repair events and extending garment life. Participants expressed experiential value derived by finding unexpected items, described as treasure-hunting experiences. Repair café members highlighted self-expressive value by exploring their style and creativity through participating in the activities. Second, social benefits are emphasised by community members valuing social engagement in sharing knowledge and gaining tips for mindful consumption practices. Third, environmental benefits and sustainability concerns were frequently mentioned by the participants. Depending on their levels of engagement in community activities and the lengths of their experiences wearing second-hand clothes, community members emphasised benefits ranging from self-oriented to community and environmental values.

Visitors' initial motivations were predominantly related to self-oriented personal values, such as economic value (n = 4), experiences and experiments with style benefits (n = 6) and increasing self-esteem through participating in community activities (n = 13). Participants often made statements such as: 'It makes me feel really good, I'm not wasting things, and I'm not wasting my money' (P12) and 'You just rejuvenate your wardrobe. So, stuff that I have loved and worn and no longer wear, I can come and swap it for stuff that somebody else has loved and worn and doesn't wear' (P17). However, participants who had been involved in the community for a longer period were likelier to emphasise other-oriented values, such as caring about environmental, social and community well-being, by becoming co-producers of such events themselves.

Clothing swap visitors mentioned general environmental concerns (n = 4), waste issues (n = 3), ethical and worker's rights (n = 3), and animal welfare (n = 1). One visitor said, 'So obviously, climate change is a very prominent issue today, and we're reading about how it was cars and eating meat that was contributing to it, but now we realise that the fashion industry and fast fashion is one of the worst and one of the most significant contributors, and I don't think people really realised that a few years ago. So I think now more than ever, it's more important for people to realise the choices they are making' (P13). Community care reasons, such as doing something with other people (n = 5), meeting like-minded people (n = 4) and revaluing worth (n = 2), were also highlighted as motivations for taking part in clothing swap events. Six people noted one benefit of swap events: 'You can bring things back if you don't like them'. Visitors greatly valued the opportunity to meet individuals who shared similar interests. 'It is good to meet people from the local area who have a similar lifestyle and concern of the issue' (P2). Participants often highly praised volunteers' activities and engagement with other people at clothing swap and repair events, saying such things as 'I love that people volunteer' and 'Really friendly and … helpful' (P9).

Despite the various benefits afforded by community activities, there are challenges to scaling up local activities. These include a lack of consistently available time on the part of participants and/or organisers, financial resources, competing community commitments and infrastructural facilities. Participants also shared some negative experiences with using second-hand fashion products in the past. These included major concerns raised by others' expectations or stigma around second-hand fashion (n = 4), such as 'I don't want people to think we haven't got any money'. Participants also shared negative experiences with wearing second-hand items, including 'Realise it's got a hole in it', 'Difficult to find size' and 'Got skin reactions'. Other major issues mentioned included that it is 'Just time-consuming' and that it is not feasible to join

monthly clothing swap and repair events if those activities are not organised in their local areas. Consequently, clothing swap event organisers must understand the symbolic meaning and perceived images of the garments and community infrastructures used in the trading process. To achieve an ideal favourable image and promote successful practice, Camacho-Otero et al. (2020) argue that community governance management of product quality standards, exchange guidelines and more structured infrastructure are needed to enhance community practices. To enhance the viability of current local practices, it is necessary to establish infrastructure to facilitate the expansion of circular fashion community initiatives at both the local and national levels. Collaborating with the local council and implementing suitable policies can boost the efficacy of circular fashion practices and better support community efforts to achieve long-term community sustainability practices.

Conclusion

The contribution of this research is in offering empirical case studies of CBCC practices in clothing exchange and repair communities. Repair and clothing swap communities play an influential role in nurturing mindful sustainable consumption by valuing experiential consumption through sharing, learning, and engaging with other community members rather than just materialistic fashion consumption. The community members highly value social engagement, and their collective actions promote their personal well-being and caring for local community and environment. However, accessibility, logistics and volunteer support are necessary for a sustainable CBCC. Community members voluntarily organise events using their own weekend time, which constrains limited resources or funds for finding relevant community members to share repair skills or contribute to regularly organising clothing exchange events. Local councils and universities could more actively support and thus sustain CBCC activities, particularly in supporting participation in rural areas or by marginalised groups. Collaborative circular fashion practices with local organisations could leverage CBCC practices and minimise barriers to wider participation.

References

Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), pp.77-101.

Camacho-Otero, J., Pettersen, I.N. and Boks, C. 2020. Consumer engagement in the circular economy: Exploring clothes swapping in emerging economies from a social practice perspective. *Sustainable Development*. **28**(1), pp.279–293.

EllenMacArthurFoundation 2017. A new textiles economy: Redesigning fashion's future. *Ellen MacArthur Foundation*.

Hunecke, M. and Richter, N. 2019. Mindfulness, Construction of Meaning, and Sustainable Food Consumption. *Mindfulness*. **10**(3), pp.446–458.

Mulhern, O. 2022. The 10 Essential Fast Fashion Statistics. *earth.org*. [Online], p.1. [Accessed 25 September 2022]. Available from: https://earth.org/fast-fashion-statistics/.

Sheth, J.N., Sethia, N.K. and Srinivas, S. 2011. Mindful consumption: A customer-centric approach to sustainability. *Journal of the Academy of Marketing Science*. **39**(1), pp.21–39.

WRAP 2024. Design for extending clothing life. *WRAP*. [Online]. [Accessed 21 February 2024]. Available from: https://wrap.org.uk/resources/report/design-extending-clothing-life.

WRAP 2012. Valuing our clothes: the true cost of how we design, use and dispose of clothing in the UK.

Zhang, L. and Hale, J. 2022. Extending the Lifetime of Clothing through Repair and Repurpose: An Investigation of Barriers and Enablers in UK Citizens. *Sustainability (Switzerland)*. **14**(17), p.10821.

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USING INDIGO SOY PASTE RESIST AND INDIGO DYE WITH SHIBORI TO UPCYCLE FABRICS AND ENHANCE STUDENT WELL-BEING THROUGH REFLECTVE PRACTICE

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Introduction

With the fashion industry taking ownership for the impact it has previously had upon the environment and society, it can be argued it is Fashion Design educators responsibility to challenge and support the next generation of creatives with a curriculum that embeds sustainability, slow fashion and a variety of techniques to equip them which have a positive impact upon their own well-being, health and social skills. The aim of the research is to evidence how more meaningful connections to items already owned can be upcycled to create an increase of positive wellbeing associations when wearing/using them.

Literature Review

Upcycling is a process where waste materials are transformed into something of higher value / quality in their second phase of life to promote slow fashion (Sung, 2015). Solidifying what Li et al (2020) suggests that creating a positive enabling tool that adds meaning to the participant can increase positive experiences, more specifically within their time in education. Barkham, et al. (2019) define student wellbeing as a population-based term focusing on creating positive feelings about oneself and reflecting on responses to respond and cope with the pressures and challenges of student life and learning. As discussed by Aldao, A. et al (2010) more adaptive emotion regulation strategies (reappraisal) have less deleterious effects on individuals than maladaptive (avoidance). Upholding a reflective practice is a tool for emotion regulation and can be found within the reappraisal strategy. It allows individuals to adapt successfully to stressful situations and therefore benefits their overall wellbeing and development, as discussed by Garland, E. et al (2009).

Research Method

This research reviews two textiles' craft-based case studies carried out through practical activity-based workshops where students voluntarily partook to learn a new craft through social interaction and the connectedness was observed and analyzed through both qualitative and quantitative methods. Using Brookfield's (2017) four lenses of critical reflective practice, the research will reflect upon (1) autobiographical, (2) the participants eyes through observation, the emotional regulations scale and an informal focus group, (3) colleague experiences through an interview (4) scholarly literature. This is important as the focus is on how participants are experiencing learning which is impacting upon their well-being and will enhance both researchers student-centered teaching. Students were encouraged to conduct their own experiments within the delivered workshop, no two outcomes would be the same reflecting individuality. The first workshop focused on using soy paste resist to upcycle fabrics and garments. A guest speaker hosted the workshop where they presented the historical origins of indigo which linked to their ethnic decent of the Bai community in China. By embedding inclusivity, the purpose was to make all students feel a sense of belonging. The focus group will be analyzed to see if the results support the findings on the emotional regulations scale and the colleague interview will also determine if there is an impact upon the participants further studies, engagement and well-being.

Results & Discussion

Figure 1. Students creating their soy paste to experiment and upcycle their garments within the first workshop (Burton, 2023).

Outcomes revealed students bought a variety of items such as garments, interior textiles and accessories to upcycle within the workshop and have shared visual evidence of them utilizing these upcycled items with the new second phase of life used in their everyday life.

Yarin (2011) explored how crafts contribute to building relationships and contribute to student wellbeing as it brings students together to strengthen our sense of connectedness through social interaction amongst those who often struggle with social and community networks. Within the workshop students were free to experiment and upcycle their own pieces they bought along, additionally they were also invited to add a soy paste resist stencil onto the square scrap fabric labelled as the community piece. There was no specific direction, or rules for this piece, it opened conversation between students as it was a larger piece of fabric which repeated the familiar process they had just practiced on their individual piece. The emotional regulations scale demonstrate a clear increase in participants enjoyment from the beginning to the end of the workshop with a sense of achievement. Figure 2 below demonstrates the after indigo dye process where the community of students worked together to remove the soy paste resist and reveal the new pattern embedded on the fabric. Multiple students who engaged with the first workshop have engaged with the second workshop demonstrating this method of learning through common shared experiences is positive for their own experimental learnings (Carey & Asbury, 2016).

Figure 2 Left: A community piece the students together added their own soy paste stencil, indigo dyed and then scrapped away the soy paste to reveal the new print design (Burton, 2023).
Figure 3 Right: The outcome of the community piece constructed into a traditional Japanese zero waste haori jacket (Holbrook-Hase, 2024).

The textiles workshops were measured qualitatively using the Emotional Regulation Scale for Artistic and Creative Activities Scale (D. Fancourt et al, 2019), to generate relevant data regarding the links of craft-therapy and the potential positive impact on wellbeing. This scale was designed to show the potential links of emotional responses while engaging in specifically creative activities, it builds on the work of other methods of data collection such as RESS-EMA (Regulation of Emotion Systems Survey-Ecological Momentary Assessment). Medland (2020) states this is a reliable psychological measure as the assessment is conducted in real-time and in participants natural environment (at Uni). ERS-ACA is a tool to understand how and why participants use different strategies in various situations when learning. Within which different emotional regulation strategies were questioned to highlight the activity's benefits. Specific strategies were questioned including approach, problem solving, distraction, acceptance, leave and emotional support.

The results demonstrate how voluntarily participation with the textiles craft-based workshops where the work is not marked, assessed or judged have an overall positive increase upon the student's wellbeing where they interact, build a learning community, and develop a new skill stated in the colleague interview. The workshops have demonstrated a positive increase in wellbeing factors after the activity took place. Feelings were documented before the activity and then after, all students with either negative or neutral feelings of wellbeing beforehand showed a shift to the positive banding of wellbeing emotions. In addition, students who attended do not normally participate or engage with classes, potential because it is not a marked assessment, as it was a hands-on fun activity with opportunity for social interaction outside of the traditional cohort.

Conclusion

The textiles workshops were measured qualitatively using the Emotional Regulation Scale for Artistic and Creative Activities Scale, to generate relevant data regarding the links of craft-therapy and the potential positive impact on wellbeing. Within which different emotional regulation strategies were questioned to highlight the activity's benefits. Specific strategies were questioned including approach, problem solving, distraction, acceptance, leave and emotional support.

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References

Aldao, A. Nolen-Hoeksema, S. Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, 30(2), 217-317. Available at: https://doi.org/10.1016/j.cpr.2009.11.004. Accessed on 18/12/23.

Barkham, M. et al. (2019) Towards an evidence-base for student wellbeing and mental health: Definitions, developmental transitions and data sets. *Counselling and psychotherapy research*. [Online] 19 (4), 351–357. Available at: https://eprints.whiterose.ac.uk/151542/1/CPR%20Student%20mental%20health%20Perspectives%20170619%20Revised%20final%20version.pdf Accessed on 11/02/24.

Brookfield, S. D. (2017) *Becoming a Critically Reflective Teacher*. Second edition. Newark: John Wiley & Sons, Incorporated. Available at: https://ebookcentral.proquest.com/lib/bcu/detail.action?docID=4790372 Accessed 26/03/24.

Carey, M. A. & Asbury, J.-Ellen. (2016) *Focus group research*. [Online]. Abingdon, Oxon: Routledge. Available at: https://www.taylorfrancis.com/books/mono/10.4324/9781315428376/focus-group-research-martha-ann-carey-jo-ellen-asbury Accessed 26/03/24.

Fancourt D, Garnett C, Spiro N, West R, Müllensiefen D (2019) How do artistic creative activities regulate our emotions? Validation of the Emotion Regulation Strategies for Artistic Creative Activities Scale (ERS-ACA). PLOS ONE 14(2): e0211362. https://doi.org/10.1371/journal.pone.0211362. Accessed on 09/02/24.

Garland, E. Gaylord, S. Park, J. (2009). The role of mindfulness in positive reappraisal. *Explore,* 5(1), 37-44. Available at https://doi.org/10.1016/j.explore.2008.10.001. Accessed on 12/11/23

Kim, G. (2020). Study on the Korean fashion industry. *The Journal of Fashion*, 15(3), 120-135.

Li, S. Hao, Y. Yoon, J. (2020). Purpal: An interactive box that up-regulates positive emotions in consumption behaviors. CHI EA '20: Abstracts of the 2020 CHI Conference on Human Factors in Computing. Available at https://doi.org/10.1145/3334480.3382955. Accessed on 12/11/23.

Loveday-Edwards, M. (2011). Craft as a socially aware nostalgic practice: Re-envisioning a positive future. Making Futures: The crafts as change-maker in sustainably aware cultures, 2, 147

Medland, H. et al. (2020) Regulating Emotion Systems in Everyday Life: Reliability and Validity of the RESS-EMA Scale. *European journal of psychological assessment : official organ of the European Association of Psychological Assessment.* [Online] 36 (3), 437–446. Available at: https://web.p.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=0&sid=494764e3-31bc-4e1c-ae52-a6f6aed5547b%40redis Accessed 26/03/24.

Sung, K. and Sung, K., 2015. A review on upcycling: Current body of literature, knowledge gaps and a way forward. Available at: https://dora.dmu.ac.uk/server/api/core/bitstreams/dbc1f56f-6037-40c5-8528-098f9c4e0c29/content Accessed: 12/02/24.

Wellesley-Smith, C. (2021) *Resilient stitch : wellbeing and connection in textile art*. London: Batsford. Available at: https://ebookcentral.proquest.com/lib/bcu/detail.action?docID=6850301&pq-origsite=primo Accessed 11/02/24.

Yair, K (2011) Craft and Wellbeing. [Online] Available at: http://www.craftscouncil.org.uk/about- us/press-room/ view/2011/craft-and-wellbeing?from=/about-us/press-room/list/ Accessed 13/02/24.

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A STUDY OF MALE CORSET IN FASHION IN EUROPE FROM 1920 TO 2020

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Introduction

In the contemporary fashion landscape, characterized by prevalent aesthetic diversity, the incorporation of corsets into menswear fashion design has been observed. However, while the fashion world exhibits enthusiasm for this trend, the acceptance and perception of male corsets within broader society remain limited and contentious. To deepen the understanding of the development of male corsetry in Europe, this research focuses on a comprehensive historical study of the European male corset archive spanning from 1920 to 2020. The research aims to scrutinize the evolving acceptance and attitudes towards men wearing corsets from various perspectives, including the individual, commercial, and media, over the aforementioned timeframe. Consequently, it offers insights into the significance of male corsetry within the context of dress codes and aesthetic diversity. Based on the research findings, it concludes with a discussion of the potential implications for future menswear design, emphasizing a design practice perspective.

Literature Review

Various studies have assessed the global history of male corsets can be traced through various historical epochs. In the European Renaissance, influenced by Western humanist philosophies, costumes emerged as a trend to both constrain and reveal the body (Kunzle, 2004). In the 18th century, depictions of French and English aristocrats wearing corsets to support their torsos and slim their waists became prevalent (Steele, 2001). However, since 1920, influenced by the Great Masculine Renunciation, male corsets gradually diminished from European menswear, though efforts were made in advertising to promote waistband forms while minimizing associations with femininity (Flügel, 1930). Throughout the following decades, male corsets persisted primarily within subcultural communities, resurfacing in mainstream fashion during the 1960s and 1970s with the advent of fetish fashion (Steele, 1996). The 1980s Gothic subculture saw corsets become a dominant style element, characterized by subversive and romantically evocative clothing (Polhemus, 1994). Subcultures, particularly within the LGBTQ community, continue to play a significant role in the consumption of corsets, supported by the rise of gender ambiguity and the evolving concept of masculinity (Baddeley, 2002). At the same time, the rise of gender ambiguity and the evolution of the pluralistic concept of masculinity have aided in the consumption of corsets. In this process, social media platforms play an essential role in driving the spread of male corsets.

Research Method

Based on the research topic, qualitative research was selected as the primary methodological approach. Depending on the specific research inquiries, data collection was conducted using three main methods: archival research, semi-structured interviews, and focus group interviews. Specifically, archival research concentrated on male corsets from three distinct epochs housed in museums: the early 20th century, the 1930s, and the 1990s. Analysing and comparing the structure, fabric, and manufacturing techniques of corsets from these periods aids in understanding the evolution of male corsets. For the semi-structured interviews, 12 individuals from Europe, the US, and Asia, including corset sellers, designers, and consumers, were recruited online and through snowball sampling, yielding detailed insights. Additionally, online focus groups engaged five participants with diverse backgrounds in fashion education and design. This approach facilitated the collection of data relevant to a variety of topics. Interview questions were tailored to the respondents' identities and backgrounds, primarily focusing on themes such as perceptions of corsets, corset consumption, changes in the consumer base for corsets, corset design, corsetry and gender awareness, and

the future of male corsets. As the primary research data for this study comprise text and voice interviews, thematic analysis was the principal method employed for data analysis, ensuring a coherent, logical, and precise understanding of the subject.

Results & Discussion

The research discusses the male corset within the context of contemporary fashion trends. It argues that social diversity and emancipation have led to a gradual loosening of traditional gender binary perceptions, resulting in gender ambiguity and cross-gender aesthetic awareness. Consequently, the male corset has developed a distinct style that combines elements of both unified and mixed-gender aesthetics. The study reveals that wearers of male corsets prioritize expressing the diversity and meaning of gender over emphasizing traditional gender characteristics, thus promoting and challenging gender identity and masculinity. This highlights the beneficial role of the male corset in expanding menswear possibilities.

In contemporary society, the broadening of aesthetic ideals has accompanied a diversification of lifestyles and approaches to masculine aesthetics. As a result, the male corset is undergoing transformation in terms of commodification, fashion, and a burgeoning trend towards neutrality. The industrialization of menswear and the advancement of the gender equality movement have resulted in the male corset taking on an increasing variety of forms and expressions. Corsetry can be combined with masculinity to create a free and unique aesthetic style. Research indicates that a market gap persists, with consumers expressing a desire for designs that better suit the male body structure or integrate tights into their everyday lives. For the future development of men's corsets, based on the consumer needs identified during the research, two directions emerge: fashionable or casual.

Conclusion

This research motivated by an aesthetic examination of the male corset in fashion, seeks to provide practical recommendations for its incorporation into menswear. It offers two original contributions to understanding the male corset in Europe, drawing from gender aesthetic theory and fashion design practice. Firstly, it delves into the historical development of the male corset, utilizing data from literature reviews and archival research. Secondly, it investigates how gender consciousness and dress codes have shaped the male corset across different historical periods, prompting critical reflection on evolving social aesthetics and values in menswear design. Through analysis of primary data from semi-structured interviews and focus group discussions, the study argues that male corsets are not inherently gendered and do not contradict masculinity. While gaining recognition in the fashion industry, male corsets have yet to achieve mainstream acceptance. However, the genderless trend in contemporary fashion presents opportunities for their further development. The research anticipates that the momentum behind male corsets will continue, allowing for exploration of diverse aesthetic possibilities in the future.

References

Baddeley, G. (2002). Goth Chic: A Connoisseur's GuIntervieweee to Dark Culture. London: Plexus Publishing, p. 204.

Flügel, J. C. (1930). The great masculine renunciation and its causes. The psychology of clothes. In D. L. Purdy (Ed.).

Kunzle, D. (2004). Fashion and fetishism: corsets, tight-lacing & other forms of body-sculpture ([New edition].). Sutton.

Polhemus, T. (1994). Streetstyle: from sidewalk to catwalk. Thames and Hudson. Print.

Steele, V. (1996). Fetish: Fashion, Sex and Power. Oxford: Oxford University Press. Print.

Steele, V. (2001). The Corset: a Cultural History. New Haven, Conn; Yale University Press.

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CRAFTING COLLABORATIVE DESIGN: CASE STUDIES IN CHINESE TRADITIONAL CRAFTS

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Introduction

Designer-artisan collaboration is vital for enhancing design and sustainable practices, yet their quality is challenged by uncertainties and inappropriate collaboration approaches during various stages of the process. Adaptation and balancing are required based on the complex social contexts in which design collaboration and innovation are undertaken, particularly in developing countries (Kang, 2016). Previous studies have identified various design collaboration methods that may be applied during successive stages and have emphasised the importance of embedded research by connecting local situations (Murray, 2010; Wang et al., 2020). However, using different approaches to innovation can mean that the directions in which a design may evolve during the innovation process may differ, and it is unclear how design partners choose methods of maximising each actor's specific capabilities, including partnership roles and communication methods, to adapt to their actual conditions. To answer this question, this research examines the stages of collaboration where artisans and designers collaborate to devise innovative solutions in the textile industry by offering case studies of design collaborations in Chinese textile craft sectors and identifies three directions for craft innovation during eight phases of the design process. It discusses relationships, collaboration modes, and communication methods, offering options for integrating design directions and partner conditions and enhancing collaboration quality. Furthermore, this study identifies concerns that researchers should have about this field.

Literature Review

Co-design is used in this study to demonstrate professional designers and artisans conducting collective creative processes involving stakeholders without prior design education, promoting collective creativity and problem-solving (Sanders and Stappers, 2008). Designer-artisan design collaborations can take three main forms: top-down, co-decision and bottom-up. Based on design for social innovation, scholars have identified design processes that promote appropriate integration between modern design and traditional craft and empower artisans in developing areas (Kang, 2016). Due to the complex contexts and based on the capabilities of various actors, the Chinese traditional textile craft (CTTC) sector features diverse design collaboration practices and provides examples for the non-Western world (Yang, 2019)Guo and Ahn (2021) and Bryan-Kinns et al. (2022) have identified five kinds of processes for different regions and crafts in China. However, from a top-down perspective, previous research projects have separated design partners from the real world while the matching of the design collaboration methods with actors' actual capabilities is unclear, so many artisans from underdeveloped areas are unable to use their power or interact as equals with their designer partners in craft design (Shafi, 2020). These research studies have neglected the legitimacy of combining other methods that also reflect the flexibility and adaptability of design partners based on their actual situations and goals from a bottom-up perspective.

Research Method

This study investigates the relationships in designer-artisan collaborations, focusing on the negotiation processes in the traditional crafts of embroidery, spinning, weaving, dyeing, and printing. Multiple case studies were conducted to understand Chinese designers' and CTTC artisan's collaboration processes and approaches. Utilising qualitative explanatory research and pragmatism, the study examines the capabilities and behaviours of the actors influencing these collaborations (Robson, 2002; Rorty et al., 2004). The data collection involved semi-structured interviews, online observations, and participant observation, using a purposeful sampling method targeting experts in the field (Suri, 2011). Thematic analysis coding was performed to identify emerging themes, aided by NVivo 12 Plus software (Braun and Clarke, 2021). To

ensure reliability, three coders participated in the coding process. The research aimed to uncover adaptable elements in diversity and provide practical insights for real-world benefit.

Results & Discussion

The results identify three design approaches to innovation:(1) icon consistency, (2) semiotics renewal, and (3) style grafting, each of which reflects a degree of combination of design innovation elements and traditional craft elements. Icon consistency helps original CTTC visual elements and cultural meaning emphasise unique regional symbols. Examples include demonstrating ancient tails and local values through original or simplified traditional totems. Semiotics renewal enables design partners to retain parts of traditional symbols likely to be understood and accepted by the audience and to replace other parts to respond to contemporary preferences. Based on contemporary local activities and social hotspots, the design partners illustrate local stories and contemporary local values. Style grafting means that design partners do not necessarily copy original elements, but instead use traditional styles to maintain specific CTTC ambience and respond to external fashion trends. Design partners may use traditional CTTC styles to demonstrate modern symbols and contemporary global values, such as pop art and feminism, in trendy structured and functional products.

Figure 1. Icon consistency (left), Semiotics renewal (middle) and Style grafting (right). Images collected from participants. The study found eight phases of the collaboration process during which mutually inspiring communication plays a pivotal role in stimulating interactions between designers and artisans in China (see Figure 2).

Figure 2. Process of designer-artisan design collaborations

The study explains the initiative and adaptability of designers and artisans to choose their favourite collaboration methods under the existing complex situations. It also underscores the challenges artisans face in understanding design innovation, suggesting that while designers can explore CTTC through various channels during co-design processes, artisans have fewer opportunities and capabilities for such learning. The study advocates for more equitable collaboration where artisans can increase their learning capability and contribute to innovation and calls for increased access to design education for artisans. The study also highlights the importance of adapting collaboration modes based on individual capabilities and the need for a more in-depth understanding of CTTC, especially in the context of remote communication and learning, which have become more relevant post-pandemic. The study furthermore emphasises the value of professional expertise in guiding the collaboration process, suggesting that clear direction can enhance partners' confidence and capabilities, leading to more effective co-design and bottom-up approaches.

Conclusion

This study focuses on innovating traditional CTTC through designer–artisan collaborations, identifying three key innovation approaches to innovation and an eight-phase process that combines expert-direction and co-decision modes. It also emphasises communication by considering the social background, authorial intention, audience, content, structure, and tone, along with the use of supporting tools during the process to support the adaptability of design partners. The study contributes to (1) understanding the collaboration process, (2) highlighting the differences between top-down and expert-directing modes, and the value of expert direction in partnerships, (3) suggesting that practitioners should match collaboration models to innovation directions and refine responsibilities based on partners' capabilities to enhance collaboration effectiveness, and (4) identifying limitations in artisans' ideation engagement and offers insights for improving their participation. Accordingly, the future of designer-artisan collaboration can be developed through the following: (1) Using flexible co-design methods or developing adaptable co-design processes that enable flexibility in collaboration so that designers and artisans can leverage their strengths at different stages of the design process. (2) Adapting to individual capabilities, or tailoring collaboration modes to the unique capabilities and needs of design partners. (3) Enhancing communication or fostering an environment of open and mutually inspiring communication that facilitates a deeper understanding between designers and artisans, which is crucial for successful collaboration and innovation. (4) Educational support for Artisans or advocating for and providing increased access to design education for artisans to empower them with the knowledge and skills necessary to more effectively engage in design innovation. (5) Leveraging technology for remote collaboration or exploring and implementing technologies that facilitate effective remote communication and learning to ensure that geographical barriers do not hinder collaboration, given the increased relevance of remote work post-pandemic.

References

Braun, V. and Clarke, V. 2021. *Thematic Analysis* [Online] (A. Maher, ed.). London: Sage Publications Limited. [Accessed 10 July 2023]. Available from: https://lib-bwuies4vivna6v7rz24tdvoz.resist.tel/book/23817764/39ed0b.

Bryan-Kinns, N., Wang, W. and Ji, T. 2022. Qi2He: A co-design framework inspired by eastern epistemology. *International Journal of Human Computer Studies*. **160**, p.102773.

Guo, J. and Ahn, B. 2021. Collaborative Design Intervention in the Traditional Chinese Handicraft Sector for Enhancing Cultural Sustainability: New Channel Social Innovation Project. *Archives of Design Research*. **34**(4), pp.39–53.

Kang, L. 2016. Social Design as a Creative Device in Developing Countries: The Case of a Handcraft Pottery Community in Cambodia. *International Journal of Design*. **10**(3), pp.65–74.

Murray, K. 2010. Outsourcing the hand: An analysis of craft-design collaborations across the global divide. *craft+ design enquiry*. **2**(2), pp.1–24.

Robson, C. 2002. *Real world research: a resource for social scientists and practitioner-researchers*. Wiley-Blackwell.

Rorty, R., Putnam, H., Conant, J. and Helfrich, G. 2004. What is pragmatism? *Think*. **3**(8), pp.71–88.

Sanders, E.B.-N. and Stappers, P.J. 2008. Co-creation and the new landscapes of design. *Co-design*. **4**(1), pp.5-18.

Shafi, M. 2020. Sustainable development of micro firms: examining the effects of cooperation on handicraft firm's performance through innovation capability. *International Journal of Emerging Markets*.

Suri, H. 2011. Purposeful sampling in qualitative research synthesis. *Qualitative research journal*. **11**(2), pp.63-75.

Wang, W., Bryan-Kinns, N. and Sheridan, J.G. 2020. On the role of in-situ making and evaluation in designing across cultures. *CoDesign*. **16**(3), pp.233–250.

Yang, Y. 2019. Design-driven strategy for the sustainable textile heritage community in China *In*: Marcelo AmbrosioCarlo Vezzoli, ed. *Proceedings of the 3. LeNS world distributed conference*. Edizioni POLI.design, pp.999–1004.

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Concurrent Sessions
Oral Session 1. Clothing Science and Technology

Chair: Dr. Hwa Kyung Song, Kyung Hee University

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DEVELOPMENT OF UNDERWEAR PANTS FOR WALKING ASSISTANCE CONSIDERING WEARABILITY

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Introduction

As soft wearable walking aids are primarily designed for medical applications, such as stroke patients and rehabilitation, looking for effective ways to improve walking ability, there is a need for further research on wearable pants to assist walking for mildly impaired patients, the general population, or the elderly. The prior research has shown that wearable movement disability aids are more preferred when they have an inconspicuous design (Carroll & Kincade, 2007). Therefore, underwear-type wearable robot pants were designed to support daily walking. Considering the characteristics of each part of the pants, a multi-layer fabric was developed, and the wearability was evaluated through performance test evaluation, and based on this, three designs were developed. The results of the study are expected to provide fundamental data for the design development of underwear-type wearable robots.

Literature Review

As wearable pants are worn on a daily basis and laundered at home, good colorfastness is required, while breathability and moisture permeability resistance must also be considered for thermophysiological comfort (Memon et al., 2021; Wen et al., 2021). In wearable garments, the layering of fabrics has a major impact on properties such as breathability, thermal resistance, and wicking, and it is preferable to use non-hydrophilic and breathable materials for the inner layers (Hepburn & Carol, 1998). underwear-type wearable robot pants were designed for comfort requires sensory properties as a minimal factor and fabric testing is essential for objective evaluation (Bishop, 2008).

Research Method

In this study, a multi-layered fabric was developed to be applied to wearable pants as underwear for walking assistance, and the three designs were designed using the multi-layered fabric. Afterwards, the developed multi-layered fabric Color fastness to laundering (ISO 105-C06:2010), Air permeability (ISO 9237:1995), Water vapour resistance (ISO 11092:2014 RET METHOD) textile/fabric tests were conducted to objectively evaluate the material properties and suitability. Based on this, sections were designed for underwear-type wearable pants, segmented by specific areas.

Results & Discussion

The actuator attached to the waist of the pants needs to operate in a precise position without wobbling left or right, so the waist fabric is composed of an outer layer of non-stretchy loops fabric and an inner layer of relatively sweat-wicking mesh fabric. In the pants, where the routing line passes through, a thin, soft fabric is used as the inner layer and a mesh with less elasticity is used as the outer layer to increase the fixation of the routing line while effectively dissipating heat. The color fastness to laundering of the two multi-layered fabrics was very good, generally in the range of 4-5, and the air permeability was 724.9 mm/s for the waist fabric and 375.3 mm/s for the pants fabric, which is suitable for underwear (Bartkowia et al., 2015). In the case of water vapor resistance, the waist fabric is evaluated as 2.08 m2Pa/W and the pants fabric is evaluated as 12.56 m2Pa/W, which is considered to be excellent for wearability (Houshyar et al., 2015). Then, we

designed three types of underwear-type wearable robot pants for walking assistance. In common, the same multi-layered fabric was added to the waist area, and a highly elastic mesh fabric was used behind the knees. Design 1, developed in this study, is a design using only the developed multi-layered fabric, Design 2 is a design using a general legging material that has good elasticity, and Design 3 is a design that considers the elasticity required by each part. In design 3, a multi-layered fabric with less elasticity was used in the area where the routing line passes, and a single fabric with high elasticity was used in other areas to improve comfort.

Conclusion

In this study, a multi-layered fabric to be used in underwear-type wearable robot pants for walking assistance was designed considering the characteristics of each part of the body, and fiber/fabric tests were conducted. In addition, designs 1, 2, and 3 of underwear-type wearable pants for walking assistance were developed using the confirmed fabrics. We plan to produce three prototypes of underwear-type wearable pants for walking assistance using the developed fabric. In the follow-up study, it is necessary to make a prototype of wearable robot pants based on the developed multi-layered fabric and have subjects wear it directly, and to obtain objective data through EEG (electroencephalography), EMG (Electromyography), and ECG (Electrocardiogram) experiments and satisfaction surveys.

References

Bartkowiak, G., Dąbrowska, A., & Włodarczyk, B. (2015). Construction of a garment for an integrated liquid cooling system. *Textile Research Journal, 85*(17), 1809-1816.

Bishop, P. (2008). Testing for fabric comfort. *Fabric Testing*, 228-254.

Carroll, K. E., & Kincade, D. H. (2007). Inclusive design in apparel product development for working women with physical disabilities. *Family and Consumer Sciences Research Journal, 35*(4), 289-315.

Hepburn, C. D. (1998). The wicking of water through multi-layer fabric assemblies (Doctoral dissertation, University of Leeds).

Houshyar, S., Padhye, R., Troynikov, O., Nayak, R., & Ranjan, S. (2015). Evaluation and improvement of thermo-physiological comfort properties of firefighters' protective clothing containing super absorbent materials. *The journal of the Textile institute, 106(*12), 1394-1402.

Memon, A. W., de Paula, I. L., Malengier, B., Vasile, S., Van Torre, P., & Van Langenhove, L. (2021). Breathable textile rectangular ring microstrip patch antenna at 2.45 GHz for wearable applications. *Sensors, 21*(5), 1635.

Wen, Z., Yun, S., Weifeng, Y., Shu, C., Zijing, Z., & Jun, L. (2021, February). Investigation on washing durability and thermal-moisture performance of Cu-Ni plated polyester fabric. In Journal of Physics: Conference Series (Vol. 1790, No. 1, p. 012064). IOP Publishing.

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APPLICATION OF NUDGE THEORY TO TEACHING TECH-HEAVY COURSES

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Introduction

The fashion industry has been a pioneer of new cultures and trends throughout human history. In particular, the rapid evolution of technologies has encouraged the fashion industry to emphasize the efficiency in production, and adoption of new technologies in product design and development. Considering such industry demands, teaching how to handle fashion production (so-called technical design), and emerging technologies adopted in product design, retailing and business in academia is considered critical to supporting students' career planning and development. The author, as design faculty with experience in the sportswear industry and research on smart clothing, has taught technical design and smart clothing design and programming in a fashion program, and identified challenges in teaching the courses. The challenges include lack of student motivation (in teaching technical design) and limited teaching resource and students' competence in computer programming in teaching smart clothing design and programming. Such teaching challenges, indeed, are considered one of the most common issues that any faculty in academia can face when teaching tech-heavy content, requiring speculation of students' interest and class dynamics, and development of new pedagogical approaches. This abstract will document the author's problem identification in the two tech-heavy courses, and new course design and pedagogical solutions that created positive changes and increased students' engagement in class activities.

Problem Identification

Teaching Technical Design: The core content of technical design is to articulate all technical details that are essential to mass production of an item of clothing. In the modern fashion industry, this is one of the most important daily tasks that designers are expected to perform professionally in a limited time. All technical details are compiled as Techpack for every single item, which is the production manual for production factories. Therefore, teaching technical design covers the entire prototype and production procedure, which include very realistic and accurate flat drawing, point of measures, size specification, tolerance of measurement errors, grading rules, seaming/stitching methods in sequence, bill of materials, color ways, labels and hangtags, and packaging. Teaching such essential yet meticulous details in class, often encounters students' lack motivation, because students have limited experience of garment construction and don't necessarily realize how such technical details can play a critical role in success of production and sales. Teaching Smart Clothing Design and Programming: "Smart clothing," is one of the fastest-growing sectors in the apparel and textile industry, and the global smart clothing market is expected to grow into a $24-billion market by 2024, with key applications such as protective clothing for first responders, wearable healthcare products, active sportswear, and fashion products for the general public. The idea of wearable technology (i.e., smart clothing), characterized by the use of sensors, human/environment data, and smart materials responding to human needs and environmental stimuli, has been researched and prototyped through a multidisciplinary approach for more than a decade. Now, practical applications of wearable technology are found not only in the fashion industry, but also in sports, entertainment, health care, safety, security, and military industries. These applications, as smart functions embedded into wearable products on the body, have merits to offer to the most portable and readily available ubiquitous interface: clothing. However, the literature indicates the big gap between the educational need and course offerings in academia. Lin's study (2023) showed that there is very little hands-on educational opportunities and course offerings geared toward for fashion students regarding design and prototyping of smart clothing. As Perry (2017) identified, development of smart clothing requires multidisciplinary knowledge including human comfort and psychology, materials, and garment design strategies, which is essential, but often being overlooked (Lin and Park, 2024). The study proposed that there should be pedagogical effort to provide simplified, hands-on learning opportunities for students

in fashion programs who are motivated to learn this emerging tech-driven fashion products. Another teaching challenge is the limited educational resources and faculty support in most fashion programs, which makes developing smart clothing design courses difficult. Such situations lead faculty in fashion programs to teach smart clothing only in a limited scope, with emphasis on research and literature review, lacking hands-on experience and practical design and programming skills.

New Course Design and Pedagogical Approaches

The author applied Nudge theory to tackle teaching challenges in a way of improving students' motivation in class activities while aligning all relevant multidisciplinary information with assignments and projects that are designed to accommodate each student's his/her own interest. Nudge theory is "a concept in behavioral sciences, behavioral economics, and political theory, that proposes positive reinforcement" (*Simon and Tagliabue, 2018*). By reframing the situation around an individual, a nudge encourages them to make a particular choice in order to achieve certain outcomes (Saghai, 2013). The nudge also elevates an individual's motivation level when performing certain tasks. The most popular example of the nudge effect is the placement of an image of a fly near the bottom of a urinal to improve men's aim, which was proven to lower cleaning costs (Hooker, BBC News, 2017). Application to Teaching Technical Design: Students were asked to develop sweatshirts that they could wear for themselves following their own aesthetic and functional preferences as a way of increasing their motivation for techpack development, after getting the instructor's feedback on their first trial of prototyping without grading. Application to Teaching Smart Clothing Design and Programming: Simplified key learning components were taught through hands-on experience, which of all became essential work progress toward two big class projects as shown in Figure 1 below.
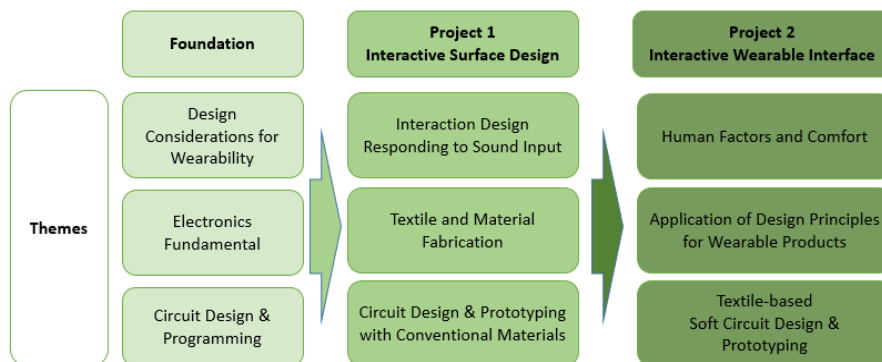

Figure 1. Integration of key themes in the course

Meaningful outcomes from this new pedagogy, students' feedback, course evaluation and plan for further improvement will be discussed in more details at the presentation.

References

"Have you been nudged" by Hooker (2017) at https://www.bbc.com/news/business-41549533

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DEVELOPMENT OF AN AUGMENTED REALITY (AR)-BASED LEARNING SYSTEM FOR INDUSTRIAL LOCKSTITCH SEWING MACHINES

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Introduction

Augmented reality (AR) is a technology that overlays digital images onto the physical space. This technology enhances the user's perception of reality by creating a composite view where virtual and real-world elements coexist and interact in real-time (Doolani et al., 2020). AR started in the gaming and entertainment fields but is currently utilized across various sectors, including manufacturing, healthcare, education, and military. Numerous studies in the literature have identified that AR significantly benefits training and education in the assembly and maintenance of complex machinery. Students majoring in clothing should operate industrial sewing machines confidently, but the machines can be intimating for beginners due to their complex mechanisms and the level of skill required to operate them. The integration of AR in teaching sewing machines is anticipated to serve as an innovative and effective tool to enrich the learning experience, making it more immersive, interactive, and engaging. However, there has been a lack of studies applying AR technology in the education sector within the clothing field. Therefore, this study aimed to develop an AR-based learning system for industrial lockstitch sewing machines. Then, this study was designed to investigate the effects of AR-based learning system on students' skill development, self-efficacy, learning motivation, and satisfaction through a pilot survey.

Research Method

To select an AR platform, a software framework that enables developers to create and deploy AR content, four AR SDK (Software development kit) or platforms including ARKit (Apple), MixedReality Toolkit (Microsoft), Vuforia Studio & Engine (PTC), and Virnect Make (Virnect) were compared. Then, this study selected Vuforia Studio platform since it enables developers to create AR content without deep programming knowledge and superimposes a 3D object's CAD image on top of its physical object with 'Model Targets' function. To project AR content on the user's physical environment, this study utilized three types of devices: (1) AR head-mounted display (HMD) 'Microsoft HoloLens 2', (2) tablets, and (3) smartphones.

The process of developing the AR-based learning system include the following steps: First, the industrial lockstitch sewing machine (SunStar model #KM-2522A) was scanned with Artec Leo scanner, and the scan file was refined using reverse engineering techniques with Rhino 6.0 software to obtain a precise 3D model. Secondly, the AR contents were developed to guide the following six sections: (1) introducing sewing machine parts and their functions, (2) winding a bobbin, (3) inserting a bobbin case into a compartment below the needle plate, (4) inserting a needle, (5) threading, and (6) checking the final status of threading. The text box for step-by-step manual was saved as an image file using Figma, a cloud-based design tool, and the animations were made using Creo Illustrate software to show the sequence of moving parts. The 3D model, animations, and text box images were imported, and the whole AR content was integrated within Vuforia Studio. Thirdly, the AR contents were saved for a HoloLens and mobile devices (tablets and smartphones) separately. Vuforia Studio could generate their QR codes that linked directly to the developed AR contents.

To explore the effects of AR-based learning system on students' skill development, self-efficacy, learning motivation, and satisfaction, a pilot survey was conducted with 10 students majoring in clothing. The questionnaire was composed of a total of 25 questions and was designed to be evaluated on a 5-point scale. Initially, they learned how to use a sewing machine through printed materials. Subsequently, they engaged with the AR-based learning system across three different devices. Following their experience, they filled out a questionnaire to compare four learning methods; (1) traditional learning method using printed

material (TM), (2) AR-based learning method with the HoloLens (ARMH), (3) AR-based learning method with tablets (ARMT), and (4) AR-based learning method with cellphones (ARMC). The analysis was conducted through one-way repeated measure ANOVA and Bonferroni correction for a post-hoc analysis using SPSS 29 software.

Results & Discussion

When the participants installed the Vuforia View app on three devices and scanned QR codes, the AR content was successfully displayed in the real-world environment. Since this study set pre-defined markers at the stitch length regulator and the stitch selection panel of the 3D sewing machine model, when the participant aligned those markers of the 3D model with those of the physical model, they superimposed precisely.

Results of the one-way repeated measures ANOVA indicated significant positive effects of the AR-based learning method on students' participation, self-efficacy, learning motivation, concentration, satisfaction, attractiveness, and sense of reality ($p<0.05$). Post-hoc analysis revealed that the students became more actively participated with the AR-based learning method using the HoloLens (ARMH) compared to the traditional learning method (TM) based on printed materials. The ARMH and the AR-based learning method with cellphones (ARMC) improved students' learning motivation compared to the traditional method (TM). The ARMT and ARTC methods improved the students' self-efficacy, concentration, and satisfaction.

The participants reported that the advantage of HoloLens is that it allows for hands-free operation through voice commands, making it more immersive. Also, it can understand and interact with the environment around it, allowing for more realistic and interactive holographic experiences. However, the participants indicated that the HoloLens might be difficult to use on one's own due to its complex usability. When using tablets and smartphones, there was the disadvantage of not having both hands free. Since a tablet requires holding with both hands, it has the drawback of not being able to try using a sewing machine in real-time. However, smartphones were found to be more preferred by the participants since they are relatively light enough to be held with one hand while practicing the sewing machine.

Conclusion

This study demonstrated the significant potential of AR-based learning systems in enhancing the educational experience for students majoring in clothing, specifically in operating industrial lockstitch sewing machines. By comparing three AR-based learning methods across different devices and traditional learning method, the research found the advantages and challenges associated with each method. The findings suggest that AR methods, particularly those utilizing the HoloLens and smartphones, significantly improve various aspects of the learning process, including participation, motivation, concentration, and overall satisfaction. Despite some usability concerns with the HoloLens, its hands-free operation and environmental interaction capabilities offer a highly immersive learning experience. Conversely, the portability and convenience of smartphones make them a preferred choice for facilitating real-time practice without the constraints of handling bulkier devices like tablets. Overall, the integration of AR technology into the education sector within the clothing field presents a promising avenue for making complex technical training more accessible, engaging, and effective. This study developed an AR-based learning system for industrial lockstitch sewing machines, but the researchers in this study are creating a system for sergers (overlock machines) with more complex structures. The sewing machines covered in this study were found to be well trained even using traditional learning methods, but in the case of sergers with complex structures, AR technology is expected to enhance learning performance significantly.

References

Doolani, S., Wessels, C., Kanal, V., Sevastopoulos, C., Jaiswal, A., Nambiappan, H., & Makedon, F. (2020). A review of extended reality (xr) technologies for manufacturing training. *Technologie*s, 8(4), 77. https://doi.org/10.3390/technologies8040077

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CO-DESIGN OF CUSTOMIZED WEARABLE SMART INNERWEAR WITH A CEREBRAL PALSY PATIENT

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Introduction

Cerebral palsy (CP) is a neurological disorder caused by prenatal brain damage, leading to varied movement and muscle impairments (Aisen et al., 2011). Managing CP requires addressing gait and balance issues that intensify over time (Osoba et al., 2019). Trendelenburg gait is a type of abnormal gait resulting from weakened hip abductor muscles, especially in gluteus medius, and it often occurs in CP patients. This gait leads to pelvic imbalance and joint strain, underscoring the need for targeted muscle strengthening to enhance walking ability (Miller, 2020). Wearable innovations, such as custom-made elastomeric orthoses, are known to contribute to better posture and mobility (Romeo et al., 2018). Innovations like the "X-tights" by Lee et al. (2020), a soft and passive device aiding knee extension, show the potential of wearable technologies to improve mobility. However, existing solutions often overlook the comprehensive physical and socio-psychological needs of disabled users. Therefore, in this study, we aimed to develop a customized Wearable Smart Innerwear (WSI) for a patient with CP, adopting the co-design process, characterized by prototyping concepts through feedback and evaluation. Sanders and Stappers (2014) assert that the co-design process facilitates a collaboration between designers and non-designers, where making is not just about creating objects but also about constructing and transforming meanings.

Research Method

For the co-design process, we recruited a female CP patient in her 40s with a Trendelenburg gait via purposeful sampling and invited her to the design process as an active member. We first identified the recruited user's needs based on the modified Functional, Expressive, and Aesthetic (FEA) consumer needs model (Orzada & Kallal, 2021), ideated WSI designs based on the identified user needs, and selected a final design through the user's feedback. We then prototyped the selected WSI design using 3D technologies (for body scanning, modeling, and printing), along with a half-scale body form created based on the user's anthropometric information. Finally, the final prototype was evaluated by the user, whether it met the user's needs and preferences.

Specifically, we conducted an in-depth interview with the user to discern her specific needs from the functional, expressive aesthetic perspectives. For prototyping development, we collected the user's body dimensions using a 3D scanner (VITUS, Vitronic, Germany), and created a half-scale body form reflecting the user's body shape and sizes. We then developed ergonomic block patterns for the WSI using the half-scale body form and applied Ziegert & Keil's (1988) pattern reduction rates, ensuring a customized fit for the user. Moreover, the lumbar support, an integral part of the WSI, was 3D modeled (Rhino 8, Robert McNeel & Associates, USA) to fit the shape of the user's waist, and 3D printed (FFF 3D printer 2X, Sindoh, Korea) using flexible TPU material to allow the user's range of motion. Once a prototype was made, we conducted gait analysis on a force-plated treadmill (FDM-TS30-3i, Zebris Medical GmbH, Germany), and evaluated body balance and walking stability when wearing with and without the WSI. Furthermore, using a modified usability evaluation questionnaire based on previous studies (Cho & Lee, 2008; Lee, 2014), we assessed the WSI on activity, acceptability, stability, convenience, functionality, and visual satisfaction. Finally, we collect comprehensive user feedback on her experience of participating in the co-design process.

Results & Discussion

This study outlined a co-design process for WSI in individuals with CP, featuring patient involvement at all stages, from needs assessment to final evaluation, deviating from disability experiences guided the creation of WSI to improve gait and address back pain from prolonged sitting, as well as mobility issues from Trendelenburg gait. The participant's input obtained through the FEA consumer needs model shaped the development of the WSI prototype emphasizing the functional need for stability, comfort, lumbar support, and mobility, with expressive needs focused on femininity and self-presentation, and an aesthetic need for a variety of colors. The design evolved through multiple stages, incorporating patient feedback into the initial concept, and using 3D scans for an ergonomic design phase, resulting in a tailored multilayer WSI. The stretchy base layer, designed to the participant's measurements, provided a snug fit and desired abdominal support, while the core mechanism and lumbar support blended seamlessly into the innerwear. This design allowed for daily wear without sacrificing the user's self-expression. Enhanced with durable, high-strength, and breathable layers, the final prototype was created in various purple hues to meet the user's aesthetic preferences.

Fig. 1. Comparison of average foot rotation & Double stance phase in walking, and distribution of average plantar pressure in standing posture.
(a) When not wearing WSI (b) when wearing WSI

The WSI, engineered for an ergonomic fit, has significantly enhanced walking stability. As shown in the graph related to Geometry in Fig. 1. This advancement is demonstrated in the graph related to Geometry in Figure 1, through improvements in foot rotation ($1.2° \pm 3.6$ to $4.4° \pm 4.9$), acceleration of load change speed (0.9 sec to 0.6 sec), and reduction in the double support stance phase ($44.5\% \pm 5.6$ to $39.3\% \pm 4.9$). These enhancements suggest a potential reduction in fall risk. Additionally, the WSI has been shown to improve the balance between the left and right sides of the body. This is evidenced by changes in the center of pressure when using the WSI, as depicted in the graph related to Average Forces (%) in Fig. 1. Before using the WSI, the majority of the force supporting the body's weight was concentrated on the forefoot due to spinal lordosis and weakened muscles around the pelvis, often resulting from conditions like CP. Moreover, the tendency to support the body's weight predominantly with the front of the foot in a standing position not only leads to foot pain but also contributes to high instability even when stationary. However, after wearing the WSI, it is observed that the pressure on the forefoot and the pressure distribution across the entire foot has become more balanced. This indicates that the WSI has enhanced the overall support across the foot area, contributing to a more even distribution of body weight and improved stability.

Usability assessments highlighted enhancements in the final version of the WSI across various aspects, as outlined in Table 1. These include stability (M=3.9), convenience (M=3.8), functionality (M=5.0), and aesthetic (M=4.1). Notably, the acceptability of lumbar support (M=4.0), stability (M=5.0), and aesthetics (M=4.1) saw substantial improvements. These enhancements led to the core components of the WSI, the base innerwear and lumbar support, reaching optimal levels of overall user satisfaction (M=5.0), compared to the previous version. Additionally, the final reflection on the co-design process indicated the user's positive outlook in that she felt respected and engaged during her participation in the co-design process and showed acceptance and enthusiasm toward the final product. This indicates that the co-design approach not only contributed to the technical improvements of the WSI but also enhanced the user experience by fostering a sense of involvement and ownership over the outcome.

Table. 1. Usability Test Results

(a) First prototype (b) Final version of WSI improved through Co-Design application

		Activity	Acceptability	Stability	Convenience	Functionality	Overall satisfaction	Aesthetic
(a)								
Innerwear	Mean	3.0	3.0	2.5	2.0	3.3	3.0	2.0
	SD	0.8	0.0	0.7	0.8	0.6	0.0	0.89
Lumbar support	Mean	3.5	2.0	3.0	2.8	4.0	5	2.8
	SD	0.6	2.0	0.0	0.5	0.0	0.0	0.4
(b)								
Innerwear	Mean	3.5	3.5	3.9	3.8	5.0	5.0	4.1
	SD	1.3	0.5	1.0	1.2	0.0	0.0	0.9
Lumbar support	Mean	4.4	4.0	5.0	3.0	5.0	5.0	4.1
	SD	0.9	0.0	0.0	1.3	0.0	0.0	0.9

Conclusion

In this study, we developed a wearable support device aimed at assisting the gluteus medius muscle and lumbar spine in a patient with CP. The WSI, equipped with a passive spring mechanism and custom lumbar support, notably improves walking balance and stability, thereby greatly elevating user satisfaction and demonstrating the effectiveness of this approach. However, the study's scope was limited, because it adopted a single case study approach, which challenges the generalizability of the results. Future research should include a wider array of participants with similar gait impairments for more substantial validation. The outcomes of this study affirmed that adopting the co-design process in designing wearable assistive devices for users with disabilities yields a fulfilling user experience by meeting their specific needs and preferences, thus enhancing their satisfaction and quality of life.

References

Aisen, M. L., Kerkovich, D., Mast, J., Mulroy, S., Wren, T. A., Kay, R. M., & Rethlefsen, S. A. (2011). Cerebral palsy: clinical care and neurological rehabilitation. *The Lancet Neurology, 10*(9), 844-852.

Cho, H., & Lee, J. (2008). The development of usability evaluation criterion for sensor based smart clothing. *The Korean Fashion and Textile Research Journal, 10*(4), 473-478.

Lee, J. (2014). Eco-friendly smart outdoor jacket production and usability evaluation. *The Korean Fashion and Textile Research Journal, 38*(6), 845-856.

Lee, H., Kim, S. H., & Park, H. S. (2020). A fully soft and passive assistive device to lower the metabolic cost of sit-to-stand. *Frontiers in Bbioengineering and Biotechnology, 8*, 966.

Miller, F. (2020). Hip and pelvic kinematic pathology in cerebral palsy gait. *Cerebral Palsy*, 1471-1487.

Orzada, B. T., & Kallal, M. J. (2021). FEA consumer needs model: 25 years later. *Clothing and Textiles Research Journal, 39*(1), 24-38.

Osoba, M. Y., Rao, A. K., Agrawal, S. K., & Lalwani, A. K. (2019). Balance and gait in the elderly: A contemporary review. *Laryngoscope investigative otolaryngology, 4*(1), 143-153.

Romeo, D. M., Specchia, A., Sini, F., Bompard, S., Di Polito, A., Del Vecchio, A., … Mercuri, E. (2018). Effects of Lycra suits in children with cerebral palsy. *European Journal of Paediatric Neurology, 22*(5), 831–836. https://doi.org/10.1016/j.ejpn.2018.04.014.

Sanders, E. B. N., & Stappers, P. J. (2014)). Probes, toolkits and prototypes: Three approaches to making in codesigning. *CoDesign, 10*(1), 5-14.

Ziegert, B., & Keil, G. (1988). Stretch fabric interaction with action wearables: Defining a body contouring pattern system. *Clothing and Textiles Research Journal, 6*(4), 54-64.

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FEASIBILITY OF CHATGPT IN GARMENT PATTERN MODIFICATION GUIDANCE

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Introduction

Large Language Models (LLMs), often represented by ChatGPT (OpenAI, San Francisco, CA) is driving innovation and efficiency even in specialized fields like business, education, healthcare, art, and design. In education, LLMs personalize the learning practices such as information discovery to match individual student needs (Murgia et al., 2023). For healthcare, they are being used to assist in diagnostics and patient care by analyzing extensive medical data (Chung et al., 2023). In the realm of design, these models can contribute to enhancing and automating creative processes, from generating novel design concepts to customizing user experiences, to guide human designers to focus on more complex and emotional aspects of the product. The adoption of LLMs, while promising, holds viability and feasibility issues (Cascella et al., 2023). One of the primary concerns is the accuracy and reliability of the information generated by these models. This can be critical in areas where errors can cause serious consequences, like the medical industry. Moreover, other ethical considerations, including copyright, bias, and privacy, remain significant hurdles. GPTs, customized version of ChatGPT by curated data and specific domain knowledge, aims to provide precise and relevant responses for professional use to enhance and applicability. These custom models serve as a bridge, combining the broad capabilities of LLMs with specific expertise required in professional domains.

Meanwhile, in apparel pattern making, tacit knowledge, which can be acquired through years of hands-on experience, has been considered crucial in the industry. This includes understanding fabric behavior, visualizing designs, achieving the desired fit, and garment construction procedures, and was often thought to be missing in students graduating from digital-focused fashion design curricula. Educating such nuanced and time-dependent skills in the current educational setting is challenging, so this highlights the importance of structuring implicit knowledge to integrate it into the limited-time learning process, which AI (Artificial Intelligence) like LLMs might be able to contribute (Baytar et al., 2022). This study aims to investigate the potential of ChatGPT, one of the most widely used LLMs, in terms of its ability to generate feasible guidance for garment pattern modifications for entry-level apparel pattern makers. In addition, we compared the ChatGPT with another GPT customized with apparel patternmaking textbooks to find out the direction of future improvements.

Literature Review

The fashion and textile industry actively adopting Generative AI models to revolutionize design ideation, trend forecasting, and customer service (Chen et al., 2023). Designers use AI to discover innovative ideas, quickly test new concepts and see their visualized results by prompting the models to generate combinations of styles, materials, trends, and concepts (York, 2023). By analyzing data from social media, fashion magazines and market, generative AI can predict upcoming trends, helping brands stay ahead of the changes (Reddy et al., 2023). LLMs are massively contributing to the communications with the online customers by answering questions, and offering personalized shopping suggestions (Kumar et al., 2023). This approach driven by AI not only streamlines operations but also enables brands to adapt to changing customer preferences and demands of the market.

Evaluating LLMs involves assessing their accuracy, ethical use, bias, and computational demands. Medical communities are active in this area as the information generated by such models can directly affect patient safety. Although many medical doctors were generally satisfied with the diagnosis generated by ChatGPT, it is important to note that a few doctors strongly disagreed with the result, which emphasizes the importance of oversight by human experts (Chung et al., 2023). In the textile industry, LLMs such as ChatGPT are being used to improve material modeling, textile pattern design, data processing, and defect detection. However, their engineering performance is not yet on par with market software, indicating room

for improvement (Xu et al., 2023). Addressing bias and ethical considerations is crucial, especially in sensitive areas when it can be involved in misuses such as fabrication of fake data, plagiarism, or abusive contents (Cascella et al., 2023). Comprehensive assessment, validation and/or oversight by human experts is necessary to ensure LLMs' responsible use and maximize the benefits across the industry.

Research Method

This study utilized ChatGPT 4.0, which enables users to generate text and images based on real-world information and customize a GPT for a specialized area. The scenario explored involves an entry-level apparel patternmaker seeking professional-level advice when no other expert with extensive tacit knowledge is available. In this scenario, the patternmaker needs 1) example patterns to achieve a requested design or 2) advice on modifying a garment pattern to address ill-fitting issues. The original ChatGPT and a customized GPT, which was provided with five patternmaking textbooks as 'Knowledge', were used (Matthews-Fairbanks, 2018; Joseph-Armstrong, 2014; Kershaw, 2013; Lincecum, 2010; Lo, 2016). The customized GPT had no other instructions but was able to utilize the provided Knowledge to generate answers. The user requested two pattern images for visual examples using the prompts - ("*Generate a 2D image of the garment pattern for the front bodice of women's wear*" and "*Generate a 2D image of the garment pattern for the front bodice of women's wear with cowl neckline*"). Additionally, three images from Google searches for ill-fitting issues were used to prompt the definition of the fit issue displayed in each image and to generate step-by-step instructions for modifying the pattern. A patternmaker with over 20 years of professional experience in the fashion industry evaluated the generated text advice on fit issues on a scale of 1 (poor) to 5 (excellent).

Results & Discussion

Both ChatGPT and the customized GPT were unable to generate feasible garment patterns for the requested designs. Figure 1A and 1B display the images generated by ChatGPT and the customized GPT, respectively, based on the requests for a basic front bodice and a front bodice with a cowl neckline. Figure 1C shows an example of images displaying ill-fitting issues provided as a query. ChatGPT provided text advice consisting of 420.3 ± 17.0 words, while the customized GPT's instructions consisted of 497.3 ± 41.0 words. The instruction from ChatGPT received a higher evaluation score from the industry expert compared to the customized one (4.3 ± 0.6 and 2.0 ± 1.0 respectively, out of 5).

Figure 1. (A-B) Basic front bodice and front bodice generated by ChatGPT and the customized GPT, (C) Example query image illustrating issues with fit (https://lindyshopper.com/2013/07/24/its-not-you-its-them-fit-and-modern-clothing/).

Conclusion

Although LLMs based on generative AI have great potential for future fashion product development, the current study has revealed a clear limitation of the present ChatGPT models in generating garment patterns. However, ChatGPT has demonstrated its ability to analyze a given fashion image, identify problematic areas, and provide satisfactory step-by-step instructions to fix the pattern. The cause of the failure of the

customized GPT with textbook knowledge to generate helpful advice is still unknown and inaccessible due to the 'black-boxed' nature of GPT. It is possible that the texts chosen had conflicting or incomplete information and that changing the amount or quality of source material would garner different results. The vast amount of data available to ChatGPT may allow for statistically insignificant conflicting data to be ignored. This highlights the need for explainable AI or highly customized AI systems specialized in garment patterns.

References

Baytar, F., Yang, Y., & Maher, M. (2022). The Importance of Deciphering Tacit Knowledge in Apparel Product Development for Explainable AI: Proposed steps for increasing digitalization in the apparel industry. Proceedings of the 12th Hellenic Conference on Artificial Intelligence, 1–5. https://doi.org/10.1145/3549737.3549806

Cascella, M., Montomoli, J., Bellini, V., & Bignami, E. (2023). Evaluating the Feasibility of ChatGPT in Healthcare: An Analysis of Multiple Clinical and Research Scenarios. Journal of Medical Systems, 47(1), 33. https://doi.org/10.1007/s10916-023-01925-4

Chen, Q., Zhang, T., Nie, M., Wang, Z., Xu, S., Shi, W., & Cao, Z. (2023). Fashion-GPT: Integrating LLMs with Fashion Retrieval System. Proceedings of the 1st Workshop on Large Generative Models Meet Multimodal Applications, 69–78. https://doi.org/10.1145/3607827.3616844

Chung, E. M., Zhang, S. C., Nguyen, A. T., Atkins, K. M., Sandler, H. M., & Kamrava, M. (2023). Feasibility and acceptability of ChatGPT generated radiology report summaries for cancer patients. DIGITAL HEALTH, 9, 20552076231221620. https://doi.org/10.1177/20552076231221620

Matthews-Fairbanks, J. L. (2018). Pattern Design: Fundamentals: Construction and Pattern Drafting for Fashion Design. Fairbanks Publishing LLC.

Joseph-Armstrong, H. (2014). Patternmaking for fashion design (Fifth edition, Pearson new international edition). Pearson.

Kershaw, G. (2013). Patternmaking for Menswear. Laurence King Publishing.

Kumar, A., Gupta, N., & Bapat, G. (2023). Who is making the decisions? How retail managers can use the power of ChatGPT. Journal of Business Strategy, ahead-of-print(ahead-of-print). https://doi.org/10.1108/JBS-04-2023-0067

Lincecum, S. (2010). Patternmaking for a Perfect Fit: Using the Rub-off Technique to Re-create and Redesign Your Favorite Fashions. Clarkson Potter/Ten Speed.

Lo, D. C. (2016). Patternmaking. Laurence King Publishing.

Murgia, E., Abbasiantaeb, Z., Aliannejadi, M., Huibers, T., Landoni, M., & Pera, M. S. (2023). ChatGPT in the Classroom: A Preliminary Exploration on the Feasibility of Adapting ChatGPT to Support Children's Information Discovery. Adjunct Proceedings of the 31st ACM Conference on User Modeling, Adaptation and Personalization, 22–27. https://doi.org/10.1145/3563359.3597399

Reddy, S., Thyagarajan, A., & Giacomelli, R. (2023). FashionGPT: Fashion Foundation Models and Training Methods to Keep Pace With Dynamic Fashion Trends. https://doi.org/10.13140/RG.2.2.13802.49603

Xu, Y., Zhi, C., Guo, H., Zhang, M., Wu, H., Sun, R., Dong, Z., & Yu, L. (2023). ChatGPT for textile science and materials: A perspective. Materials Today Communications, 37, 107101. https://doi.org/10.1016/j.mtcomm.2023.107101

York, E. (2023). Evaluating ChatGPT: Generative AI in UX Design and Web Development Pedagogy. Proceedings of the 41st ACM International Conference on Design of Communication, 197–201. https://doi.org/10.1145/3615335.3623035

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Proceedings

INTEGRATING USER NEEDS AND 3D TECHNOLOGIES INTO DESIGN OF WEARABLE ASSISTIVE FOOT SLEEVE FOR AN AGING PROFESSIONAL WOMAN WITH WALKING DISABILITY

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Introduction

Aging with a disability is an emerging contemporary issue that must be considered, as patients with disabilities experience various health problems associated with biological aging in conjunction with their existing chronic diseases (Lim, 2022). Although walking is a prominent physical constraint for individuals with cerebral palsy (CP), which commonly begins during childhood and restricts one's body movement throughout the lifespan, there is a noticeable scarcity of research addressing the deterioration of walking abilities with aging compared to active engagement in therapeutic interventions and rehabilitation during childhood. Walking is particularly crucial for individuals with CP when engaged in social activities (e.g., work), as it is an essential link to societal connectivity. Disabilities exhibit unique patterns in individuals and evolve with age, underscoring the need for tailored assistive devices that accurately address individual needs (Louie et al., 2020). Therefore, it is apparent that creating everyday wearable products for walking assistance can support people with disabilities as a conduit for connecting with society, making such efforts socially important. This study aimed to investigate the needs of a middle-aged professional woman – a college professor with CP who worked at a 4-year university in the United States – and develop a customized wearable assistive device that can aid her walking in daily life using state-of-the-art 3D technologies.

Literature Review

Ankle-foot orthoses (AFOs) are designed to facilitate walking. However, mass-produced assistive wearable devices, including AFOs, may not fulfill the needs of individual users (Aflatoony et al., 2023). Difficulties in wearing these mass-produced devices result in unmet user needs, except in extreme situations owing to discomfort and poor wearability, and their daily use leads to subpar walking performance. To develop a product that fits individual users, ergonomic design using three-dimensional (3D) technologies (i.e., 3D scanning, 3D modeling, and 3D printing) that considers wearability factors, a crucial starting point, is promising strategy along with the approach that users be included in the process of creating real objects, guiding problems, and developing context-based solutions (Sheard et al., 2019, p.24). Moreover, using ergonomic design and assessment tools that integrate user needs into apparel product development processes (Conroy & Park, 2022), would contribute to continuous usage of users through usability evaluation that meets functional or psychological balance issues benefiting from assistive wearable products.

Research Method

We adopted a single case study as described by Yin (2017), which is suitable for research cases involving specific specialties, such as individuals with disabilities. As described earlier, our single study participant was a woman in her late 40s who had CP since birth, was living independently, and had worked for a 4-year university in a metropolitan area of the Eastern United States for more than 15 years. The participant provided written informed consent prior to participating. The study followed a three-stage apparel product development process (LaBat & Sokolowski, 1999). In Stage 1, we collected the participant's anthropometric data using a 3D full-body scanner (VITUS; Vitronic, Wiesbaden, Germany) and a 3D foot scanner (InFoot; I-Ware Laboratory Co., Ltd., Osaka, Japan) and derived her specific needs from two rounds of in-depth interviews. For Stage 2, we used a wearable product kit as a tangible source to evoke the subject's thoughts on commercial products in the market and 3D printed components that we created and determined specific

functional and design preferences via a usability evaluation. In Stage 3, based on the results of the usability evaluation, firstly, we developed ergonomic patterns for a wearable assistive foot sleeve using 3D surface flattening techniques as follows (Figure 1; Table 1) by using 3D modeling software Rhino (TLM Inc., South San Francisco, California, USA): base points and line selection, grid and triangular mesh creation, and verification of the differences between patterns and the human body. Secondly, we modeled, printed, and evaluated 3D-shaped arches before inserting those into the foot sleeve. Finally, an ankle support was integrated into the final product as well.

Figure 1. (a) The base points of the foot; (b) the grid and triangular mesh creation; (c) the principle of flattening 3D triangular mesh

Table 1. Comparison of the main circumferences and lengths between 3D foot and 1st flattened pattern (pttn)

#	Items	3D	1st pttn	Difference(pttn-3D)	Rate of change (%)
1	Foot length	20.8	21.2	0.4	1.9
2	Ball girth circum.	21.2	22.4	1.2	5.4
3	Foot breadth	8.8	9.4	0.6	6.4
4	Instep circum.	19.9	22	2.1	9.5
5	Heel breadth	5.3	5.4	0.1	1.9
6	Ankle circum.	19.8	19.7	-0.1	-0.5

Grey indicates that the rate of change was more than 3%

Results & Discussion

From the interviews in Stage 1, we identified the participant's demographic and clinical backgrounds and her initial functional, expressive, and aesthetic needs for a wearable assistive device. Working as a college professor in the United States, cultural aspects and her experiences with disabilities required consideration. The main issue was physical and psychological gait instability in daily life stemming from anxiety about the risk of falling or previous ankle sprains. We primarily identified the functional needs for the wearable product as the "ability to adjust left-right asymmetry" and resolved it by reinforcing the arch and ankle (Figure 2(a)). Other needs, such as "easy to care for," "easy donning and doffing," and "enhanced wearability," were repetitively emphasized under expressive and aesthetic needs. Therefore, we considered using a synthetic material that was resistant to bacteria and odor owing to its low moisture absorption properties and easy washability, which also reduces product-related pain. The color and design were chosen to be dark (e.g., black or brown) with a simple and intuitive design that reflected the subject's social and personal needs for presence in society within the country of residence, occupation, and social situation after the pandemic. Different materials, supporting locations, and physical properties (e.g., infill density) were adopted after the second interview (Stage 2). The study participant showed interest in the overall process, particularly in the customized arch components that we created based on her 3D scanned body. An infill density of 5–15%, preferred arch support of 5%, and heel as a signifier indicating where to place her foot in the right location, both 5% and 15%, were acceptable for her; however, an evaluation of the impact on usability and pressure with the selection of commercial and customized components included in the kit, respectively, revealed the need to improve the product's usability (67.5 for commercial components, 57.5 for customized components) (Table 2). The perceived pressure was acceptable, and no negative response was received from the participant. To improve usability, we integrated components into the product.

Table 2. Usability and perceived pressure test

Item	Scale	Commercial	Customized (15% only)
Usability (SUS)	5-point Likert scale	67.5 (poor)	57.5 (poor)
Perceived pressure	CR-10 scale	1 (very easy)	2 (easy)

CR-10, Category-Ratio scale anchored at number 10; SUS, System Usability Scale

Ironically, despite the participant's extremely negative reaction to an ankle injury prevention market product owing to wearability issues, she expressed a willingness to try it. This indicates that wearability must be the starting point for wearable products; thereafter, functional performance can be addressed with appropriate location considerations. Considering the participant's personal needs and preferences, prototypes were produced with arch and ankle support, easy care, and ease of donning and doffing, while prioritizing wearability (Stage 3) (see Figure 2(b)). The customized arch components and ankle supporters were further modified according to the participant's feedback and incorporated into the final foot sleeves (Figure 2(c)).

Figure 2. Production process: (a) ideation and concept; (b) base layer creation; and (c) sleeve integration

Conclusion

This study developed a customized wearable assistive foot sleeve that reflects the needs of a single participant by adopting various 3D technologies with validation. Through user collaboration, we proposed a new type of ergonomic wearable sleeve that would not be possible without user testing. Due to the long distance between the United States and Korea, we conducted subjective evaluation with 3D customized components while prototyping in this study; however, further evaluation of developed products is desirable with the actual users physically present. This study is significant in that it highlights collaborative ways for user inclusion by customizing designs using 3D technologies, which facilitates continuous product use and paves the way for integrating assistive devices into daily use products. In the future, procedures for reducing psychological hesitation should continue to be developed by verifying the efficacy of assistive performance through the long-term use of the developed products.

References

Aflatoony, L., Lee, S. J., & Sanford, J. (2023). Collective making: co-designing 3D-printed assistive technologies with occupational therapists, designers, and end-users. *Assistive Technology, 35*(2), 153-162.

Conroy, B. & Park, J. (2022). Codesigning a ballistic body armour with an industry partner and local police officers: focused on improving ergonomic fit and comfort. *International Journal of Fashion Design, Technology and Education, 15*(3), 308-321.

LaBat, K. L., & Sokolowski, S. L. (1999). A three-stage design process applied to an industry-university textile product design project. *Clothing and Textiles Research Journal, 17*(1), 11-20.

Lim, J. Y. (2022). Aging with disability: what should we pay attention to? *Annals of Geriatric Medicine and Research, 26*(2), 61-62.

Louie, D. R., Bird, M. L., Menon, C., & Eng, J. J. (2020). Perspectives on the prospective development of stroke-specific lower extremity wearable monitoring technology: a qualitative focus group study with physical therapists and individuals with stroke. *Journal of NeuroEngineering and Rehabilitation, 17*(1), 1-11.

Sheard, L., Marsh, C., Mills, T., Peacock, R., Langley, J., Partridge, R., … & Lawton, R. (2019). Using patient experience data toolkit to improve hospital care: a mixed-methods study. *Health Services and Delivery Research, 7*(36).

Yin, R. K. (2017). Case study research and applications: design and methods (6th ed.) Sage Publishing.

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Concurrent Sessions

Oral Session 2.
Circular Fashion and Healthy Growth

Chair: Dr. Heewon Sung, Gyeongsang National University

CFHG-O-01
CROSS-CULTURAL EFFECTS OF SIZE-INCLUSIVE FASHION ADVERTISING IN CORPORATED SOCIAL RESPONSIBILITY ·· 00

Sunwoo Kim[†], Sujin Yang*

CFHG-O-02
DOES THE OTHER-BENEFIT APPEAL ALWAYS WORK IN SUSTAINABILITY ADVERTISING? EXAMINING INTERACTION EFFECTS WITH BRAND TYPES ·· 00

Yoo-Won Min*[†], Jiwoon Kim, Byoungho Ellie Jin

CFHG-O-03
CIRCULAR BUSINESS MODEL IN THE FASHION INDUSTRY: AN EMPIRICAL INVESTIGATION OF THE RECOMMERCE STRATEGIES ·· 00

Jiyoung Kim*[†], Sanjukta Pookulangara, Iva Jestratijevic, Scot Case, Caroline Bowen

CFHG-O-04
A CROSS-CULTURAL COMPARISON OF COLLABORATIVE CONSUMPTION: THE CASE OF FASHION SWAPPING ·· 00

Sukyung Seo*[†], Chunmin Lang

CFHG-O-05
THE EFFECT OF GEAR ACQUISITION SYNDROME ON CONSUMER PRIDE AND SUBJECTIVE WELL-BEING IN SPORTSWEAR ··· 00

Jiyoung Hwang[†], Minjung Park*

CROSS-CULTURAL EFFECTS OF SIZE-INCLUSIVE FASHION ADVERTISING IN CORPORATED SOCIAL RESPONSIBILITY

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Introduction

The expansion of inclusivity, which encompasses a wide range of ages, genders, races, religions, ethnicities, and body sizes, has highlighted the recent evolution of fashion advertising (Entwistle et al., 2019). One notable shift is the emergence of size-inclusive advertising, which features plus-size models. Mainly in Western fashion marketplaces, this trend has welcomed plus-size consumers who had long been marginalized in the fashion industry (Joo & Wu, 2021). Contrastingly, Eastern marketplaces have been known for their adherence to non-size-inclusive strategies (Park & Yun, 2019). Given the rising popularity of size-inclusive advertising, there has been an increase in academic research on size-inclusive advertising, specifically targeting Western consumers. However, little is known about how Eastern consumers respond to size-inclusive advertising, as well as how Western and Eastern consumers respond differently to such advertising. To fill those gaps, we investigated consumers' responses to size-inclusive advertising (vs. non-size-inclusive advertising) in the fashion industry, especially focusing on the differences in consumers' responses between US and South Korean marketplaces.

Literature Review

Extensive research on advertising has examined perceived likability (the degree of perceived appeal that consumers have for advertising models) and perceived typicality (the degree of how representative a model is perceived in the context of existing standards) of advertising models as endorsers' attributes to determine the impacts of advertising (Erdogan, 1999). Plus, employing size-inclusive models would have a long-term effect on reinforcing the image of companies that release such advertising as ethically adhering to corporate social responsibility (CSR). Hence, we expected that the influence of featuring a size-inclusive (vs. non-inclusive) model in fashion advertising on the perceived likability and perceived typicality of the model, as well as the perception of CSR of the company releasing such advertising, would be moderated by the type of marketplace (US vs. KR). Next, we developed a research framework using the S-O-R model (Mehrabian & Russell, 1974) and predicted that the perceived likability and perceived typicality of the model mediated the effect of the interaction between size inclusivity (vs. non-size inclusivity) and nationality (US vs. KR) on consumers' perceptions of CSR. Therefore, we elicited the following hypotheses:

H1a/b/c. The effect of featuring a size-inclusive (vs. non-inclusive) model in fashion advertising on (a) (a) perceived likability, (b) perceived typicality, and (c) perceived CSR will be moderated by nationality (US vs. KR).
H2a/b. The effect of the interaction between size-inclusivity (vs. non-size-inclusivity) and nationality (US vs. KR) will increase the favorable perception of CSR via the mediations of perceived likability and perceived typicality.

Research Method

We developed a set of research stimuli using an image scale that comprises nine degrees of body-size silhouettes, ranging from extremely thin to extremely obese (Bays et al., 2009). Initially, we acquired a fashion advertising image showcasing a Caucasian female model with a white T-shirt and blue jeans. After modifying the body sizes of the model into seven levels, a total of 108 South Korean women rated the sizes of the model in the seven modified advertising images through the image scale by Bays et al.

(2009). Based on the mean values obtained, we finalized two research stimuli: a non-size-inclusive model ($M_{\text{thin-size}}$=2.352, $SD_{\text{thin-size}}$=0.801) vs. a size-inclusive model ($M_{\text{plus-size}}$=6.815, $SD_{\text{plus-size}}$=1.024). Next, we collected data via an online survey with a total of 1,138 women, consisting of 515 US women and 623 South Korean women, in their 20s and 30s ($M_{\text{age\_total}}$=29.891, $SD_{\text{age\_total}}$=7.916; $M_{\text{age\_us}}$=27.743, $SD_{\text{age\_us}}$=10.325; $M_{\text{age\_kr}}$=31.369, $SD_{\text{age\_kr}}$=4.981). We applied a questionnaire with items based on prior research: three items for perceived likability (Ahearne et al., 1999), three items for perceived typicality (Lee & Lee, 2005), and five items for perceived CSR (Turker, 2009). All items were measured on a 5-point Likert scale. Participants were randomly exposed to one of the two stimuli. After gazing at the stimulus for more than 15 minutes, they answered the questionnaires. The collected data were analyzed through ANCOVA and SPSS Process Macro Model 8.

Results & Discussion

We conducted three series of ANVOVA. Regarding perceived likability (H1a), a 2 × 2 between-subjects ANCOVA ($F = 76.583$, $p < .001$, $R^2 = .213$), controlling for participants' perceived body size ($p = .182$), on perceived likability verified a significant interaction effect ($F(1,1133) = 14.232$, $p < .001$; $M_{\text{kr:inclusive}} = 2.85$, $M_{\text{kr:non-inclusive}} = 3.28$; $M_{\text{us:inclusive}} = 3.73$, $M_{\text{us:non-inclusive}} = 3.71$), with the main effects for size-inclusive advertising ($F(1,1133) = 23.246$, $p < .001$) and nationality ($F(1,1133) = 14.232$, $p < .001$). In terms of perceived typicality (H1b), a 2 × 2 between-subjects ANCOVA ($F = 74.902$, $p < .001$, $R^2 = .209$), controlling for participants' perceived body size ($p = .876$), on perceived typicality confirmed a significant interaction effect ($F(1,1133) = 12.647$, $p < .001$; $M_{\text{kr:inclusive}} = 2.54$, $M_{\text{kr:non-inclusive}} = 3.21$; $M_{\text{us:inclusive}} = 2.69$, $M_{\text{us:non-inclusive}} = 3.74$), with the main effects for size-inclusive advertising ($F(1,1133) = 253.992$, $p < .001$) and nationality ($F(1,1133) = 38.758$, $p < .001$). With respect to perceived CSR (H1c), a 2 × 2 between-subjects ANCOVA ($F = 58.717$, $p < .001$, $R^2=.172$), controlling for participants' perceived body size ($F(1,1133) = 32.469$, $p < .001$), on perceived corporate social responsibility confirmed a significant interaction effect ($F(1,1133) = 4.204$, $p < .05$; $M_{\text{kr:inclusive}} = 3.38$, $M_{\text{kr:non-inclusive}} = 2.61$; $M_{\text{us:inclusive}} = 3.45$, $M_{\text{us:non-inclusive}} = 2.89$), with the main effects for size-inclusive advertising ($F(1,1133) = 190.899$, $p < .001$) and nationality ($F(1,1133) = 18.379$, $p < .001$). Next, we tested the research framework for H2 (see Figure 1) by applying SPSS Process MACRO Model 8 (H2a/b). In the South Korean consumer group, size-inclusive fashion has an unfavorable impact on both perceived likability ($\beta = -.212$, $p < .01$) and perceived typicality ($\beta = -.337$, $p < .01$), and perceived CSR was positively influenced by size-inclusive advertising ($\beta = .499$, $p < .01$), perceived likability ($\beta = .294$, $p < .01$), and perceived typicality ($\beta = .119$, $p < .01$). In contrast, in the US consumer group, size-inclusive fashion has a negative impact on not perceived likability ($\beta = .013$) but perceived typicality ($\beta = -.529$, $p < .01$). In addition, size-inclusive advertising ($\beta = .353$, $p < .01$), perceived likability ($\beta = .294$, $p < .01$), and perceived typicality ($\beta = .119$, $p < .01$) had positive impacts on perceived CSR. Hence, all hypotheses were supported.

Figure 1. The research framework of Hypothesis 2

Conclusion

This study highlights the contrasting responses to size-inclusive fashion advertising in US and South Korean marketplaces. In the US, size inclusivity positively influences perceived CSR but negatively affects perceived typicality, indicating a complex balance between embracing diversity and traditional beauty standards. Conversely, in South Korea, size inclusivity unfavorably impacts perceived likability and typicality, reflecting a stronger adherence to traditional norms. However, it positively affects perceived CSR, suggesting an emerging appreciation for ethical advertising. These findings emphasize the importance of cultural sensitivity in global advertising strategies, underscoring that while the trend towards inclusivity is global, its reception varies significantly across different cultural contexts.

References

Ahearne, M., Gruen, T. W., & Jarvis, C. B. (1999). If looks could sell: Moderation and mediation of the attractiveness effect on salesperson performance. *International Journal of Research in Marketing, 16,* 269–284. https://doi.org/10.1016/S0167-8116(99)00014-2

Bays, H. E., Bazata, D. D., Fox, K. M., Grandy, S., & Gavin, J. R. (2009). Perceived body image in men and women with type 2 diabetes mellitus: Correlation of body mass index with the figure rating scale. *Nutrition Journal, 8*(57), 1–7. https://doi.org/10.1186/1475-2891-8-57

Entwistle, J., Frankling, C., Lee, N., & Walsh, A. (2019). Fashion diversity. *Fashion Theory: Journal of Dress, Body and Culture, 23*(2), 309–323. https://doi.org/10.1080/1362704X.2019.1567065

Erdogan, B. Z. (1999). Celebrity endorsement: A literature review. *Journal of Marketing Management, 15*(4), 291–314. https://doi.org/10.1362/026725799784870379

Joo, B. R., & Wu, J. (2021). The impact of inclusive fashion advertising with plus-size models on female consumers: The mediating role of brand warmth. *Journal of Global Fashion Marketing, 12*(3), 260–273. https://doi.org/10.1080/20932685.2021.1905021

Lee, J. H., & Lee, D. Il. (2005). The study on the influence of model attractive dimensions on model typicality and match-up of apparel advertisement. *Journal of Global Academy of Marketing Science, 15*(3), 49–65. https://doi.org/10.1080/12297119.2005.9707493

Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology.* MIT University Press.

Park, S., & Yun, S. J. (2019). Plus size models and body positivity: Focusing on online discourses around #Plussizemodel. *International Journal of Costume and Fashion, 19*(1), 27–49. https://doi.org/10.7233/ijcf.2019.19.1.027

Turker, D. (2009). Measuring corporate social responsibility: A scale development study. *Journal of Business Ethics, 85*(4), 411–427. https://doi.org/10.1007/s10551-008-9780-6

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DOES THE OTHER-BENEFIT APPEAL ALWAYS WORK IN SUSTAINABILITY ADVERTISING? EXAMINING INTERACTION EFFECTS WITH BRAND TYPES

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Introduction

Most fashion brands highlight environmental concerns in their advertising (i.e., other-benefit appeal). However, is the sole motivation for consumers to purchase sustainable fashion rooted in environmental protection? This study posits that the effectiveness of the other-benefit appeal may differ across brands such as fast fashion vs. sustainable fashion brands. We further view that highlighting benefits to consumers themselves, known as self-benefit appeal, might be more effective for certain brands. In the existing literature, the influence of benefit appeals on consumer attitudes and behaviors is inconsistent. This study addresses this ambiguity by examining different brand types, seeking to offer a more comprehensive explanation. Utilizing congruency theory, the purpose of this study is to examine the interaction effects of benefit appeals (other vs. self) and brand types (sustainable vs. fast-fashion) on consumer attitudes and electronic word-of-mouth (e-WOM) toward sustainability advertisement. Understanding this dynamic is vital for providing brands with insights into effective marketing strategies for sustainable fashion products.

Literature Review

Benefit appeals are categorized into two types: other-benefit and self-benefit. Other-benefit appeals, associated with altruism like environmental and societal concerns, typically align with sustainable products (Schorn et al., 2022). Conversely, self-benefit appeals focus on consumer comfort, including style, health, or price, and cater to individuals' tendencies to prioritize personal benefits and interests (De Groot & Steg, 2008). Existing research on sustainable fashion's benefit appeal is inconsistent (Jaeger & Weber, 2020), possibly due to the oversight of not considering brand types such as sustainable and fast-fashion brands. Congruity theory posits that individuals prefer consistency between incoming information and their existing knowledge, schemas. Therefore, in the context of sustainable advertising, benefit appeals should align with consumers' perceptions of the brand. Sustainable brands, emphasizing environmental protection, are more congruent with other-benefit appeals, while fast-fashion brands, focusing on affordability and trends, correspond better with self-benefit appeals. This congruency is expected to foster more positive consumer attitudes (H1), which in turn, significantly influence e-WOM (H2). In addition, this study posits that benefit appeals in sustainable advertisement alone may not enhance e-WOM; they should form a favorable attitude toward the advertisement to elicit positive E-WOM, proposing the mediating effect of attitude (H3). This study further tests the moderating effect of brand types on the mediation relationship (H4). Taken together, Figure 1 presents the research framework and four hypotheses are proposed as follow:

H1. The relationship between benefit appeals and attitude toward sustainability advertisement is moderated by brand types; Sustainable (vs. fast-fashion) brands with other-benefit (vs. self-benefit) appeals elicit more positive attitude.

H2. The relationship between benefit appeals and e-WOM is moderated by brand types; Sustainable (vs. fast-fashion) brands with other-benefit (vs. self-benefit) appeals elicit greater e-WOM.

H3. Attitude towards the sustainability advertisement mediates the relationship between benefit appeals and e-WOM towards sustainability advertisements.

H4. H3 effect will be moderated by brand types.

Research Method

This study employed a 2 (benefit appeals: other-benefit vs. self-benefit) x 2 (brand type: sustainable vs. fast-fashion) between-subject experimental design. For the other-benefit appeal, participants were informed that purchasing the brand's sustainable item (i.e., t-shirts) would offer environmental protection and support worker' dignity. Conversely, the self-appeal highlighted personal benefits, such as skin comfort from toxin-free fibers. Patagonia, recognized for its environmental sustainability initiatives, and Zara, known for its rapid production cycle, were selected to represent sustainable and fast-fashion brands, respectively. A total of 177 data were collected from the US consumers aged 18 and above via an online survey company. The measurement items in this research were adapted from previous studies and measured on a 7-point Likert scale. All constructs demonstrated satisfactory reliability (> .90).

Results & Discussion

A two-way ANOVA found a significant interaction of benefit appeals and brand types on attitude ($F_{(1,176)} = 5.407$, $p = .021$) and e-WOM ($F_{(1, 176)} = 8.523$, $p = .004$). However, contrary to H1 and H2, sustainable brands with self-benefit appeals both increased attitude and e-WOM while fast-fashion brands with other-benefit appeals only enhanced e-WOM, not attitude, rejecting both H1 and H2. Next, a moderated mediation analysis using PROCESS revealed a significant full mediation effect of attitude between the benefit appeals and e-WOM (effect = -.226, bootSE = .100, CI = [-.440 to -.055]) for sustainable brand, but not for fast-fashion brand. For sustainable brands, self-benefit appeals (vs. other-benefit appeals) indirectly increased e-WOM through attitudes toward the sustainability advertisement, partially supporting H3. Finally, we found a significant moderated mediation effect, confirming a significant moderating role of brand types on the mediation effect of attitude towards the sustainability advertisement between benefit appeals and e-WOM (index = -.301, bootSE = .154, CI = [-.643 to -.041]), thus supporting H4.

Conclusion

This study sheds light on the intricate relationship between benefit appeals, brand types, and their influence on consumer attitudes and e-WOM within sustainability advertising. Contrary to our expectations, the findings revealed that sustainable brands receive higher e-WOM from self-benefit appeals, whereas fast-fashion brands experience an enhancement in e-WOM from other-benefit appeals. Grounded in Heider's (1958) balance theory, these findings suggest that advertisements that emphasize values lacking in sustainable/fast-fashion brands can help resolve consumers' psychological imbalance related to each brand type. Consumers might perceive a deficiency in personal benefits when purchasing sustainable brands that primarily emphasize environmental and societal protection. Conversely, they may experience feelings of guilt and ethical concerns when opting for fast-fashion brands traditionally associated with disposable clothing. Advertisements featuring complementary benefit appeals can assist in transforming such initial negative sentiments into positive ones and provide justification for selecting the brand.

This study contributes to the literature by highlighting that other-benefit appeals (i.e., environmental sustainability) may not always be viable across all brands. Instead, it confirms the often-overlooked advantages of self-benefit appeals in sustainability advertising. It also challenges the conventional wisdom that exclusively links sustainable brands with other-benefit appeals and fast-fashion brands with self-benefit appeals by presenting the opposite result. This underscores the critical role of leveraging benefit appeals that complement the inherent characteristics of a brand. Regarding sustainable brands, since they already

encompass others' welfare, consumers are attracted when benefits directed towards them are also provided. Similarly, for fast-fashion brands, the significance of other-benefit appeals emerges by mitigating ethical concerns. By assisting brands in addressing and showcasing these overlooked aspects, they can foster a more positive consumer attitude, ultimately contributing to a more favorable discourse about the brand.

References

De Groot, J. I., & Steg, L. (2008). Value orientations to explain beliefs related to environmental significant behavior: How to measure egoistic, altruistic, and biospheric value orientations. *Environment and behavior*, *40*(3), 330-354.

Heider, F. (1958). *The psychology of interpersonal relations*. Psychology Press.

Jaeger, A. K., & Weber, A. (2020). Can you believe it? The effects of benefit type versus construal level on advertisement credibility and purchase intention for organic food. *Journal of Cleaner Production*, *257*, 120543.

Schorn, A., Vinzenz, F., & Wirth, W. (2022). Promoting sustainability on Instagram: How sponsorship disclosures and benefit appeals affect the credibility of sinnfluencers. *Young Consumers, 23*(3), 345–361.

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CIRCULAR BUSINESS MODEL IN THE FASHION INDUSTRY:
AN EMPIRICAL INVESTIGATION OF THE RECOMMERCE STRATEGIES

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Introduction

Circular Economy (CE) represents an emerging economic model that aims to transform the current linear take-make-waste economy, by closing the loop to maximize material reuse, with accompanying energy and water savings throughout the life cycle of the products (Jestratijevic, 2023). In the fashion industry, the model of recommerce has gained great attention in the past 5 years as one of the ways to achieve CE and has been established as a viable and profitable Circular Business Model (CBM). Recommerce refers to the practice of selling pre-owned goods via both physical and online platforms, through organized take back, trade-in, or upcycling initiatives where consumers can return their gently used products and receive compensation in the form of money or store credit (Kohan, 2023). Driven by the principles of CE, the recommerce sector experienced notable expansion in recent years as a method of redirecting waste away from landfills.

Previous studies on CBM in the fashion industry mainly focused on the holistic concept of circularity (e.g., Rinaldi et al., 2022) or defining and classifying CBMs (e.g., D'Itra & Aus, 2023) and has paid little attention to specific CBMs as implemented by companies. Thus, the knowledge gap exists in several aspects. First, the current literature lacks in-depth discussion on the unique CBM model in the fashion industry, the recommerce model. Various approaches exist within the recommerce market, especially regarding the level of brand involvement, customer involvement, capital investment, and the means of value creation. These models offer fashion retailers and brands opportunities for innovation and customization within the CBM framework. Second, co-creation within the supply network is an integral component of CE. While the importance of collaboration within the supply network has been well acknowledged in the previous literature (Pal et al., 2019), the discussion on how retailers create co-creation of value with the various entities including wholesalers, service providers, consumer, and other stakeholders in the recommerce market remains under-investigated. Third, detailed exploration of the role the digital technology plays is missing in the current body of research. To fill the identified knowledge gap, this paper provides in-depth investigation of the recommerce strategies as a manifestation of the CBM, identifying the core element of successful recommerce model and the challenges of applying the principles of circularity. Using a qualitative in-depth interview approach based on the case of 8 US-based industry experts, the evolution of the recommerce model is further explored.

Literature Review

Scholarly exploration of CE gained significant momentum since the late 2010s, particularly focusing on the Circular Business Models (CBM) which integrate CE principles, and the managerial implications associated with adopting CE approaches within the companies (Merli et al., 2018). CBM in the textile and fashion industry is based on circular strategies including remanufacturing, resale, reuse, and recycling which not only generate significant cost savings but also promise significant negative impact reductions (Geissdoerfer et al., 2020). Hence, for obvious benefits, there is an urgency for adoption of the circular strategies among retailers. In academic literature recommerce has been recognized as one of the most popular, and scalable CBM that involves organized take-back, trade-in, resale and upcycling initiatives (Kohan, 2023) which prolong the life of already produced garments, bringing them back in the circulation and diverting textile

waste from the landfills. Yet, current recommerce strategies in textile and fashion industry, their benefits and challenges are relatively underexplored.

Research Methods

We employed an explorative approach involving in-depth interviews with multiple stakeholders. The circular strategies and their application are still in their relative infancy which urges granular, and investigative approach (Colucci & Vecchi, 2021). The interview was conducted with eight purposively selected retail industry stakeholders; directors/managers of sustainability and circularity at international fashion, home furnishings retailers, CEO of international luxury recommerce wholesaler, founders of digital recommerce service providers, and a VP of Sustainability from US based retail trade association. Selected stakeholders were deliberate choices given the scope of the study, high diversity of selected CBM. A comprehensive and exhaustive overview of recommerce strategies in this study was achieved through triangulation of different standpoints of the participants involved, helping researchers address both research validity (Yin, 2018) and reliability (Farquhar et al., 2020). To increase comparability of the findings, researchers followed a structured interview protocol with each of the 8 interviewees. The interviews were conducted by two researchers, who independently coded the interview transcripts (Tracy, 2013). Researchers then collaboratively grouped codes into categories, and themes following principles for qualitative analysis (Tracy, 2013).

Results and Discussions

Results of the study confirm that depending on the size of the company and the business strategy, recommerce models can be created in many ways (e.g., in-house resale channels, externally through third party dedicated resale platforms, collaboratively partnering with recommerce service providers). Yet, findings also show that a core element of successful recommerce model lies in value co-creation and delivery. In this, a specific symbiotic relationship value is generated within the interaction involving at least two actors. Within these relationships, each actor contributes to the creation and delivery of value. Therefore, it becomes more difficult to differentiate businesses and consumers, as commonly both sides act as sellers and buyers. Contrary to the more traditional separation between business and consumers, in the recommerce model, each actor plays an equally important and irreplaceable role. Therefore, the conventional concept of a "production entity (business)" and "consuming entity (consumers)" becomes obsolete. Specifically, further analysis reveals that this shift towards the actor-to-actor model is actualized through the change along the three themes.

Asset management. Recommerce CBM commonly views customer closet as an asset which places consumers in the role of an asset holder who can co-create value by supplying the product to the retailer. Unlike the traditional LBM, value creation in the scope of asset control and management heavily relies on the asset holder. Hence, from the retailer's perspective, consumers should be viewed, not as a passive recipient of value, but as an active value co-creation partner. In such symbiotic relationship both businesses and consumers should collaborate as equal contributors in value generation. Caveat is that the quality of the inventory/asset depends on how well the consumers care for their product during initial product usage.

(Co)Ownership of Process. Recommerce CBM often relies on the co-ownership of the process between retail brands and service providers that supply customized service for the recommerce channel. Recent development of digital technology allows there to be various models of co-ownership (e.g., retail brands allowing C2C interaction on their platform). In each of them, service can be optimized depending on the size and resources available as well as the preferred level of control and ownership that can be given to participating brands and customers. However, operational challenges exist in these various levels of co ownership models. Hence, for a recommerce CBM to be successful, determining the right balance between in-house/outsourced services should be critical.

Supplier network interaction. Recommerce CBM often relies on reverse network interaction between companies and their suppliers. In those cases, success of recommerce CBM highly depends on support from the supply network members. However, co-creating value among underdeveloped, and fragmented post-consumer supply chain networks represents a daunting task especially when sourcing goods from

international suppliers. The costs might be high due to the labor-intensive processes with numerous partners (e.g. collectors, sorters, distributors, upcycleres, menders, merchandisers) that might represent different companies.

Conclusion

The acceptance and accountability of the three themes result in distinct implementation strategies for different recommerce models. The analysis result provides managerial implications for the retail brands seeking to launch or grow their recommerce business. However, the shift in model thinking comes with unique challenges posed for the recommerce model.

References

Colucci, M., & Vecchi, A. (2021). Close the loop: Evidence on the implementation of the circular economy from the Italian fashion industry. *Business Strategy and the Environment*, *30*(2), 856-873.

Farquhar, J., Michels, N., & Robson, J. (2020). Triangulation in industrial qualitative case study research: Widening the scope. *Industrial Marketing Management*, *87*, 160-170.

Geissdoerfer, M., Pieroni, M. P., Pigosso, D. C., & Soufani, K. (2020). Circular business models: A review. *Journal of cleaner production*, *277*, 123741.

Jestratijevic, I. (2024). *The Business of Sustainability in Fashion- Following the Threads*. Denton: UNT Press.

Kohan, S. (2023, April 21). Recommerce grows as more consumers make eco-friendly purchases. Forbes. Retrieved from https://www.forbes.com/sites/shelleykohan/2023/04/21/recommerce-grows-as-more-consumers-make-eco-friendly-purchases/?sh=217a3b8147b1

Merli, R., Preziosi, M., Acampora, A., 2018. How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production. 178*, 703e722.

Pal, R., Shen, B., & Sandberg, E. (2019). Circular fashion supply chain management: exploring impediments and prescribing future research agenda. *Journal of Fashion Marketing and Management, 23* (3), 298-307.

Rinaldi, F. R., Di Bernardino, C., & Cram-Martos, V. (2022). Traceability and transparency: enhancing sustainability and circularity in garment and footwear. *Sustainability, 18*(1), 132-141.

Tracy, S. J. (2013). *Qualitative research methods*. West Sussex: Wiley-Blackwell

Yin, R. K. (2018). *Case study research and applications* (Vol. 6). Thousand Oaks, CA: Sage.

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A CROSS-CULTURAL COMPARISON OF COLLABORATIVE CONSUMPTION: THE CASE OF FASHION SWAPPING

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Introduction
Environmental concerns resulting from excessive fashion consumption have been significantly increasing worldwide (Karpova et al., 2022). According to Igini (2023), 100 billion garments are produced, and 92 million tons end up in landfills on a yearly basis. Especially, the USA and China produce the most textiles and, at the same time, largely contribute to the thrown-away trend (Igini, 2023; Lang et al., 2019). China has the most annual textile waste (20 million tons) in the world (Ruiz, 2023). In the USA, over 17 million tons of textile waste is discarded in landfills each year (Igini, 2023). To address negative environmental impact, collaborative consumption (CC) has been emerging as an effective socio-economic model to increase product usage and lifecycle rather than a new product acquisition (Lang et al., 2019). CC focuses on sharing over owning using pre-owned fashion items through swapping, renting, and resale (Lang & Armstrong, 2018). Although fashion swapping is one of the common forms of CC, many past studies have primarily focused on fashion renting (Armstrong et al., 2016; Lang et al., 2019) and resale (Chu & Liao, 2010; Turunen & Pöyry, 2019). Studies on fashion swapping behavior are lacking (Karpova et al., 2022). Therefore, the purpose of this study was to examine motivations and risks of fashion swapping in the major fashion consumption countries: USA and China. Furthermore, the study aimed to identify differences in fashion swapping between American and Chinese consumers.

Literature Review
Swapping fashion involves "a transfer of ownership permanently, which focuses on the redistribution of unwanted or underused products, increasing the usage and lifespan of these products" (Lang & Armstrong, 2018, p. 39)". Swapping does not involve monetary transaction for the exchanged garment and/or fashion items, whereas renting takes place when "one party offers an item to another party for a fixed period of time in exchange for a fixed amount of money" (Lang & Armstrong, 2018, p. 39). Currently, fashion swaps frequently occur in both on and offline platforms including regular local swapping, in-person swap meets, or online fashion swap sites (e.g., Swap Society). Past studies identified major drivers of CC including financial benefits, social interaction, and sustainability (Armstrong et al., 2016; Karpova et al., 2022; Matthews & Hodges, 2016). Salient barriers to CC included quality and hygiene of items, lack of ownership and trust in provider (Becker-Leifhold & Iran, 2018). Overall, consumers have favorable attitudes towards fashion swapping, but this does not necessarily lead to actual behavior (Karpova et al., 2022). To encourage reluctant consumers, there is a strong need to examine how consumer perceptions of fashion swapping influence attitudes and intention in the two major fashion consuming countries.

Research Method
Upon IRB approval, an online survey was conducted to collect data in both the USA and China. In the USA, the questionnaire was set in Qualtrics and the service was purchased from an online research company to collect data. Individuals who received the email invitation and completed the survey received compensation from the research company. In China, the questionnaire was set in an online data-collection website, named Wenjuanxing. To recruit participants, an invitation message was sent to potential participants through WeChat, a popular Chinese social media app. Survey questions were adopted from existing scales and modified (Hsu & Lin, 2008; Kang & Kim, 2013; Kasser, 2005; Teo & Noyes, 2011) all of which have acceptable reliability (α > .80), and using a 5-point Likert scale. A total of 774 usable responses were received (US: n=452, China: n=322). The age distribution of the US respondents was more balanced, while half of the Chinese respondents were less than 35 years old. In terms of education, the majority of both

samples had a college degree. Structural equation modeling, multiple t-tests, and multi-group analysis were used to test the proposed conceptual model (Figure 1).
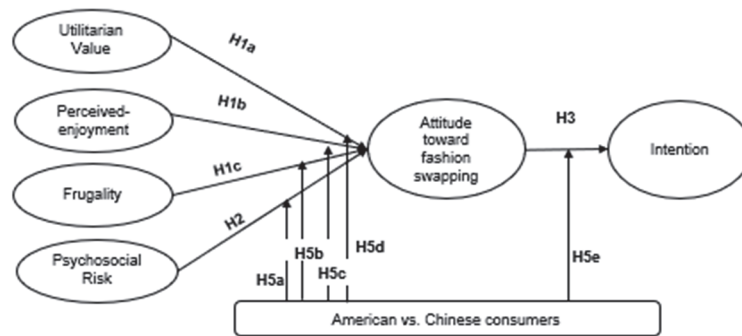

Figure 1. Conceptual Framework

Results & Discussion

Fit indices of both the measurement model (χ^2/df = 3.26; GFI = .93; TLI = .96; SRMR= .05; RMSEA = .05) and the structural model (χ^2/df = 3.67; GFI = .92; TLI = .96; SRMR= .05; RMSEA = .06) indicated that the model fit the data. Composite reliability (all above .80) and AVEs (all above .50) exceeded the minimum criteria, providing evidence of convergent validity. Furthermore, all the squared inter-construct correlations were lower than all the AVEs, supporting the discriminant validity. The SEM results indicated that (a) utilitarian value, (b) perceived enjoyment, and (c) frugality had a strong positive effect on attitude toward fashion swapping (H1a: γ= .06, p< .05; H1b γ= .70, p< .01; H1c γ= .12, p< .01), whereas psychosocial risk had a significant negative impact on attitude (H2: γ= -.22, p< .01), supporting both H1 and H2. Attitude, in turn, served as an antecedent to intention toward fashion swapping (H3: β= .75, p< .01), supporting H3. As shown in Table 1, the results of multiple t-tests indicated significant differences between the two samples in utilitarian value (H4a: t= 2.61, p□01), perceived enjoyment (H4b: t= -5.09, p□001), frugality (H4c: t=14.95, p□001), and psychosocial risk (H4d: t= -4.02, p□001), and attitude toward fashion swapping (H4e: t=2.18, p□05), supporting H4. Measurement invariance was tested based on configural and metric criteria for determining CFA model (Brown, 2006). The results indicate that the overall CFA model fits the data well (χ^2/df □2, a SRMR ≤.05, RMSEA ≤.10, and CFI and TLI □09) in both samples. The results of non-significant value (p>.01) on a chi-square difference test ($\chi^2\Delta$= 19.73 with dfΔ= 16) supported metric invariance across models. Finally, the results of the multi-group comparison revealed that the influence of psychosocial risk ($\Delta_{x(1)}$=7.39, p□01) on the attitude was significantly different between the two groups, supporting H5a. However, the remaining hypotheses (H5b-e) were not supported.

Table 1. Results of Multiple T-tests

	USA			China			t-value	Sig
	α	Mean	Std.	α	Mean	Std.		
Utilitarian Value	.80	4.03	.68	.88	3.86	0.98	2.61	.01
Perceived Enjoyment	.95	2.50	1.01	.96	2.89	1.17	-5.09	□001
Psychosocial Risk	.92	2.70	.96	.91	3.00	1.10	-4.02	□001
Frugality	.75	3.77	.72	.79	2.85	0.93	14.95	□001
Attitude	.95	3.03	1.04	.97	2.86	1.09	2.18	.03
Intention	.43	2.73	.95	.65	2.89	1.18	-2.01	.05

Conclusion

This study was the first cross-cultural comparison research to test the link between consumers' attitude toward fashion swapping and their intentions. Results provide empirical evidence of the ways that consumers' value and perception of fashion swap influence attitude and intention in USA and China.

Utilitarian value, perceived enjoyment, and frugality were positively related to attitude in both countries, whereas psychosocial risk was negatively associated with the attitude. Attitude then led to the intention to fashion swap. Although significant differences existed between American and Chinese consumers in their values, perceptions, attitude, and intention toward fashion swapping, there were no significant differences in the influence of those factors on attitude and intention to engage in fashion swapping except for psychosocial risks. This study extends a body of literature on CC in general, fashion swapping in particular. The results of the study provide managerial insights for retailers and local communities to design customized marketing plans and communication strategies that focus on fashion swapping. A limitation is that this study focused on intention toward fashion swapping to measure behavior. It will be meaningful to conduct a long-term study to investigate the model in relation to behavior.

References

Armstrong, C. M., Niinimäki, K., Lang, C., & Kujala, S. (2016). A use-oriented clothing economy? Preliminary affirmation for sustainable clothing consumption alternatives. *Sustainable Development, 24*(1), 18–31.

Becker-Leifhold, C., & Iran, S. (2018). Collaborative fashion consumption – drivers, barriers and future pathways. *Journal of Fashion Marketing and Management, 22*(2), 189–208.

Brown, T. (2006). *Confirmatory factor analysis for applied research* (D. A. Kenny, Ed.). The Guilford Press.

Chu, H., & Liao, S. (2010). Buying while expecting to sell: The economic psychology of online resale. *Journal of Business Research*, *63*(9), 1073–1078.

Hsu, C.-L., Lin, J. C.-C.(2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & Management*, *45*(1), 65-74.

Igini, M. (2023, August 21). *10 Concerning fast fashion waste statistics.* Earth. Org https://earth.org/statistics-about-fast-fashion-waste/

Kang, J., & Kim, S. H. (2013). What are consumers afraid of? Understanding perceived risk toward the consumption of environmentally sustainable apparel. *Family and Consumer Sciences Research Journal, 41*(3), 267–283.

Karpova, E. E., Jestratijevic, I., Lee, J., & Wu, J. (2022). An ethnographic study of collaborative fashion consumption: The case of temporary clothing swapping. *Sustainability, 14*(5), 1–17.

Kasser, T.(2005). Frugality, generosity, and materialism in children and adolescents. In K. A. Moore & L. H. Lippman (Eds.), *What do children need to flourish: Conceptualizing and measuring indicators of positive development*, *3*(1), 357-373.

Kuk, J., Schachter, A., Faber, J. W., & Besbris, M. (2021). The Covid-19 pandemic and rental market: Evidence from Craiglist. *American Behavioral Scientist*, *65*(12), 1623–1648.

Lang, C., & Armstrong, C. M. J. (2018). Collaborative consumption: The influence of fashion leadership, need for uniqueness, and materialism on female consumers' adoption of clothing renting and swapping. *Sustainable Production and Consumption, 13*, 37–47.

Lang, C., Seo, S., & Liu, C. (2019). Motivations and obstacles for fashion renting: A cross-cultural comparison. *Journal of Fashion Marketing and Management, 23*(4), 519–536.

Matthews, D., & Hodges, N. N. (2016). Clothing swaps: An exploration of consumer clothing exchange behaviors. *Family and Consumer Sciences Research Journal*, *45*(1), 91–103.

Ruiz, A. (2023, April 11). *17 Most worrying textile waste statistics & facts.* theRoundup.org https://theroundup.org/textile-waste-statistics/

Teo, T. & Noyes, J.(2011). An assessment of the influence of perceived enjoyment and attitude on the intention to use technology among pre-service teachers: a structural equation modeling approach. *Computers & Education.* 57, 1645-1653.

Turunen, L. L. M., & Pöyry, E. (2019). Shopping with the resale value in mind: A study on second-hand luxury consumers. *International Journal of Consumer Studies*, *43*(6), 549–556.

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THE EFFECT OF GEAR ACQUISITION SYNDROME ON CONSUMER PRIDE AND SUBJECTIVE WELL-BEING IN SPORTSWEAR

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Introduction

In 2023, the global sportswear market is sized at \$185.9 billion, showing an average annual growth rate of 6.9% and it is predicted to surpass \$356 billion in size by the year 2032 (Min, 2023). In Korea, as consumers' awareness of the importance of health care increases after the pandemic, their interest in sportswear and activewear is also increasing. In this trend, the term 'Gear Acquisition Syndrome (GAS)' has emerged, referring to the psychological inclination to open one's wallet even when acquiring high-priced equipment or purchase more equipment than necessary. GAS, termed by guitarist Walter Becker in 1996, originally applied to acquiring 'Guitars' but has since spread to encompass other hobbies like photography (Arias, 2013; Herbst & Menze, 2021). Thus, GAS is described as a combined concept involving distinct interest and investment in gear, with a strong desire to acquire and own specific items (Herbst & Menze, 2021).

Purchasing equipment such as guitars for leisure activities can be considered material consumption, as it involves owning and possessing physical goods. Simultaneously, such actions can also be viewed as experiential consumption, as they evoke emotions like satisfaction from engaging in leisure activities such as playing music with new equipment, as well as expectations or enjoyment stemming from the experience of using different equipment from what was previously used. When it comes to sports activities, not only do consumers value technical equipment, but they also value fashionable sports outfit tailored to sports activities. The act of purchasing sportswear is primarily considered material consumption as it involves acquiring physical goods for sports activities. However, the satisfaction derived from wearing sportswear and aspects such as design or material quality affecting athletic performance suggest a partial association with experiential consumption. Therefore, it is also possible to apply the concept of GAS to the context of sportswear needful for sports activities.

GAS is considered a potentially problematic phenomenon because it can lead to problems such as excessive consumption, excessive accumulation of goods and negative emotions such as competition and relative deprivation. However, there are also positive aspects to consider due to this phenomenon. For example, this is also demonstrated in a previous study by Lee and Hwang (2020), where it was found that the higher the leisure-related consumption associated with the purchase of equipment and the higher the satisfaction derived from leisure, the greater the level of happiness.

Although the term 'GAS' is commonly used in everyday life, academically, only a few studies have been conducted in the field of musicology, where the concept of GAS first originated. Moreover, there has been no research conducted in the domestic context that has introduced and explored this concept. Therefore, it was deemed meaningful to conduct an empirical study that identifies the psychological needs of consumers with the tendency of GAS, a term mostly used negatively in real life. It was also thought that the academic approach to the positive psychological impact of GAS on consumers in the field of fashion retailing and marketing could be a novel study. Hence, this study attempted to explore the positive impact of sportswear consumers' needs on consumer GAS propensity, consumer pride, and consumer subjective well-being.

Literature Review

Consumers have several needs for continuously collecting or purchasing equipment and tools related to hobby activities. Consumers have a desire to appear or behave like the role-models they admire (Ki & Kim, 2019), which is referred to as consumer's need to mimic. According to a study by Choi and Lee (2011) on the motivations of participation in DSLR camera clubs, individuals engaging in club activities tend to exhibit a tendency known as GAS, where they become envious of other members' high-quality

equipment. Furthermore, consumers seek to enhance their self-esteem by obtaining a sense of achievement through desired products or rewarding themselves through consumption, known as the need for self-esteem. In a study on consumer behavior by Arndt et al. (2004), it was revealed that purchasing products can enhance self-esteem by bolstering one's sense of self-respect. Moreover, acquiring new equipment serves as a motivating factor encouraging practice, which aids in long-term development (Herbst & Menze, 2021). In the context of sports activities, the desire to update records or hone skills is referred to as the need for performance improvement. Herbst and Menze (2021) stated that purchasing new equipment serves as a motivating factor encouraging practice and contributes to long-term improvement. Bloch (1982, 1993) argued that consumers express themselves through purchasing items such as accessories, aiming to showcase their social status and economic capabilities. This desire of consumers to display themselves is referred to as the consumer's need to show-off. According to the findings of Lee (2012), consumers participating in socially oriented sports like golf use high-end golf apparel from luxury brands to portray their image to the fullest, display their status, and uphold their dignity, demonstrating social functions beyond the sport itself. Based on previous studies, consumers with such desires are presumed to demonstrate a higher inclination towards GAS about sportswear.

Pride encompasses a psychological sense of satisfaction involving products, brands, possessions, consumption experiences, and consumer activities (Ahuvia et al., 2018). The level of consumer pride increases based on the resources, such as money, time, or effort, expended to acquire an object (Ahuvia et al., 2018; Kirk et al., 2015; Pierce et al., 2003). GAS, characterized by a constant desire and acquisition of new equipment, can be understood as an extension of materialistic consumption. Moreover, subjective well-being can be defined as an individual's overall evaluation of their current quality of life according to their own standards (Wang et al., 2022). Wright (2006) suggests that when individuals envision equipment in their minds, they imagine not only the rest of their lives with that equipment but also how much more skilled, happy, and satisfied they could be with it. Conversely, they imagine how incomplete and dissatisfied their lives would be without the equipment. Therefore, it is assumed that consumers' tendencies towards GAS relating sportswear may positively impact their pride and subjective well-being.

Lastly, affordability refers to the financial comfort where individuals do not feel financially constrained when engaging in all necessary activities for a comfortable lifestyle. Depending on an individual's financial situation, the amount of money available for equipment purchases determines the relationship with GAS, based on how they manage their budget (Herbst & Menze, 2021). Therefore, it is anticipated that the relationship between tendencies towards GAS about sportswear, pride, and subjective well-being will vary depending on consumers' affordability.

Research Method

This study surveyed domestic adult consumers who had purchased sportswear and goods for real sports activities within the last three months, collecting a total of 200 valid responses. Data analysis was conducted using SPSS 27.0 and AMOS 25.0 statistical packages.

Results & Discussion

The consumer's need to mimic (β = .225, p <.01), the need for performance improvement (β = .192, p <.01), and the need to show-off (β = .571, p <.001) were identified as factors with a positive and significant impact on GAS. However, it was found that consumer's need for self-esteem did not have a significant positive impact on GAS (β = .022, p >.05). GAS was found to have a positive and significant impact on both pride (β = .675, p <.001) and subjective well-being (β = .300, p <.01). Moreover, it was determined that pride has a statistically significant positive impact on subjective well-being (β = .229, p <.05). The results of the verification of the moderating effects of consumer's affordability on the relationships among consumer's needs, GAS, consumer pride, and subjective well-being are as follows. Only in the relationship between the consumer's need for self-esteem and the GAS, there was a statistically significant difference according to the consumer's affordability. In other words, compared

to the group with low affordability, the higher the consumer's need for self-esteem in the group with high affordability, the higher the propensity for GAS (β_{low}= -.143 < β_{high}= .260, χ^2d(1)=5.131, *p*<0.05).

Conclusion

This study increases academic contribution in that it is the first empirical study in Korea to explore the psychological needs of sportswear consumers by introducing the concept of GAS to the literature on fashion clothing and sports brands. In addition, it is meaningful that the research area has been expanded within the context of fashion consumer psychology literature by investigating the impact of consumption influenced by the inclination towards GAS, which carries a negative nuance, on positive emotions and life happiness. Additionally, this study emphasizes that GAS related to fashionable and highly equipped sportswear has a positive relationship with consumer pride and subjective well-being. This finding is expected to be valuable in formulating marketing strategies for consumers exhibiting GAS tendency.

References

Ahuvia, A., Garg, N., Batra, R., McFerran, B., & Lambert de Diesbach, P. B. (2018). Pride of ownership: an identity-based model. *Journal of the Association for Consumer Research*, *3*(2), 216-228.

Arias, Z. (2013). *Photography Q&A: Real Questions. Real Answers*. San Francisco: New Riders.

Arndt, J., Solomon, S., Kasser, T., & Sheldon, K. M. (2004). The urge to splurge: A terror management account of materialism and consumer behavior. *Journal of Consumer Psychology*, *14*(3), 198-212.

Bloch, P. H. (1982). Involvement beyond the purchase process: conceptual issues and empirical investigation. *Advanced in Consumer Research, 9*(1)*, 413-417.

Bloch, P. H. (1993). Involvement with adornments as leisure behavior: An exploratory study. *Journal of Leisure Research*, *25*(3), 245-262.

Choi, H. W., & Lee, C. W. (2010). Motivation for participating in digital leisure activities: DSLR camera club membership. *Journal of Leisure Studies*, 8(1), 27-43.

Herbst, J. P., & Menze, J. (2021). *Gear Acquisition Syndrome: Consumption of Instruments and Technology in Popular Music*. United Kingdom: University of Huddersfield Press. https://doi.org/10.5920/gearacquisition.02

Ki, C. W., & Kim, Y. K. (2019). The mechanism by which social media influencers persuade consumers: The role of consumers' desire to mimic. *Psychology & marketing*, *36*(10), 905-922. https://doi.org/10.1002/mar.21244

Kirk, C. P., Swain, S. D., & Gaskin, J. E. (2015). I'm proud of it: Consumer technology appropriation and psychological ownership. *Journal of Marketing Theory and Practice*, *23*(2), 166-184.

Lee, B. K. (2012). The Effect of Conspicuous Consumption by Golf consumers' Chemyeon on Luxury Goods and Luxury Brands Purchasing Intention. *The Korean Society of Sports Science, 21*(4). 635-644.

Lee, Y. J., & Hwang, S. H (2020). The Effect of Bicycle Hobbyists' Conspicuous Leisure Consumption on Happiness: Moderating Effect of Self-esteem, Leisure Satisfaction, and Recreational Specialization. *The Korean Journal of Physical Education, 59*(2), 243-258. https://doi.org/10.23949/kjpe.2020.3.59.2.243

Pierce, J. L., Kostova, T., & Dirks, K. T. (2003). The state of psychological ownership: Integrating and extending a century of research. *Review of general psychology*, *7*(1), 84-107.

Min, E. J. (2023, April 17). *Global sportswear market exceeds 462 trillion by 2032*. Korea Textile news. https://www.ktnews.com/news/articleView.html?idxno=128134

Wang, K., Li, Y., Zhang, T., & Luo, J. (2022). The relationship among college students' physical exercise, self-efficacy, emotional intelligence, and subjective well-being. *International Journal of Environmental Research and Public Health*, *19*(18), 11596.

Wright, J. (2006). *GAS! Living with Guitar Acquisition Syndrome*. Raleigh: Lulu.

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  Email: minjungpark@ewha.ac.kr

Concurrent Sessions

Oral Session 3.
Emerging Technologies and Consumer Behavior

Chair: Dr. Minjung Park, Ewha Womans University

* : Corresponding author
† : Presenter

BECOMING THE IDEAL SELF IN THE METAVERSE NAVIGATING SELF-EXPANSION IN CROSS-CULTURE PERSPECTIVES

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Introduction

The metaverse, a virtual realm for exploration and interaction, stands out for its unique feature—avatar customization. Users can personalize their avatars, similar to real-life dressing and accessorizing, making these digital representations extensions of their identities. This has led to a thriving market for virtual items, such as digital clothing and accessories. However, questions remain regarding why consumers buy virtual products and whether they impact physical product purchases. Furthermore, the impact of culture on these behaviors is relatively unexplored. Drawing from self-expansion theory (Aron et al. 2013) and cross-cultural perspectives, this study explores the relationships between ideal self/avatar congruency, self-expansion, continuance intention, and purchase behavior (PI) within the metaverse. This study examines the U.S. and Korea, both with significant metaverse user populations, that represent contrasting cultural values.

Literature Review

Self-expansion theory posits that individuals have an inherent drive to expand their self-concept, engaging in behaviors such as acquiring resources, broadening perspectives, and constructing new identities (Aron et al., 2013). In the metaverse, participants can customize and adorn their avatars, allowing them to adjust their virtual selves to align with their ideal self-image. This ability to inhabit an enhanced or idealized self in a unique virtual space offers a novel experience that enables individuals to broaden their self-definition. These experiences, which encourage the adoption of new perspectives, promote self-expansion, leading to **H1**: Perceived ideal self/avatar congruence increases self-expansion. Consumers experiencing self-expansion tend to increase their commitment to environments that facilitate such growth (Lee et al., 2019), affecting their intention to continue their use and leading them to purchase virtual products to express their enhanced selves. Hence, we propose **H2**: Self-expansion increases continuance intention (H2a) and PI of virtual products (H2b). A strong intention to continue using the metaverse suggests user loyalty and satisfaction, often leading to increased purchases of virtual products to enhance their experience. This leads to **H3**: The continuance intention increases the PI of virtual products. Avatars are often viewed as personal extensions (Vasalou & Joinson, 2009); thus, acquiring virtual items for these avatars can lead to an increase in purchasing actual items for themselves. Therefore, we propose **H4**: The PI of virtual products increases the PI of physical products.

This study posits that the relationships among self-expansion, continuance intention, and purchasing behaviors vary across cultures in the metaverse. In the U.S., known for its individualistic culture, where personal independence and unique identity are emphasized (Hofstede, 2011), individuals may actively express and expand their ideal selves through avatars in virtual reality. Hence, we propose **H5**: The positive relationship between ideal self/avatar congruence and self-expansion is stronger in individualistic (US) than in collectivistic consumers (KR). In individualistic cultures, the focus is on personal autonomy and unique identity, encouraging people to stand out and prioritize personal growth. Individuals are more motivated to engage in activities that align with their personal goals and self-concept. This leads to **H6a**: The positive relationship between self-expansion and continuance intention is stronger in individualistic (US) than in collectivistic consumers (KR). Moreover, this drive for individual distinction can extend to purchasing behaviors; in the metaverse, individuals from individualistic cultures may be more inclined to buy virtual items that enable further differentiation and personalization. Thus, we propose **H6b**: The positive relationship between self-expansion and PI of virtual products will be stronger in individualistic (US) than in collectivistic consumers (KR). In collectivistic cultures, where appropriate attire and presentation are key
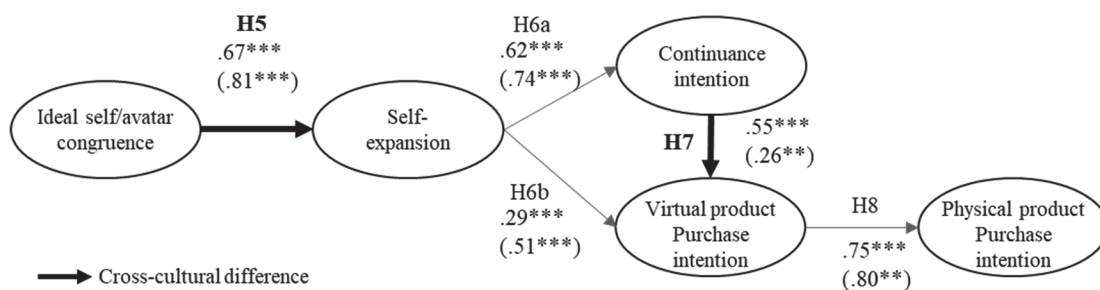
in social interactions, this emphasis may extend to the metaverse. Specifically, a greater commitment to engaging with the metaverse could reflect an increased inclination to invest in various virtual products, facilitating appropriate social interactions (i.e., track suits for a running game or lovely dress for a virtual tea time). Hence, we propose **H7**: The positive relationship between continuance intention and PI of virtual products will be stronger in collectivistic (KR) than in individualistic consumers (US). Cultural differences in indulgence (enjoyment-seeking) and restraint may influence the transition from virtual experiences to real-world purchases. In indulgent cultures, enjoyment is a priority, often leading to the purchase of physical items similar to virtual experiences, while restraint cultures tend to make more cautious consumption choices. Therefore, we propose **H8**: The positive relationship between virtual and physical product PI will be stronger among consumers in indulgence cultures (US) than in restraint cultures (KR).

Research Method

This study conducted an online survey with 243 US and 240 Korean consumers over aged over 18 years (including a broad age range from teenagers to individuals in their 60s) with experience using metaverse platforms (e.g., Roblox, Zepeto, Minecraft, etc.), chosen for their distinct cultural traits: the U.S. with a high individualism score (91) and Korea with a notable collectivism score (18) (Hofstede Insights, n.d.). Because Non-Fungible Tokens (NFTs) hold distinct economic value for consumers, the survey explained NFTs and then restricted its focus to non-NFT products. All constructs were measured using well-established items borrowed from previous studies.

Results & Discussion

First, SEM was conducted, and model fit indices revealed a satisfactory fit ($\chi2 = 1145.80$, df = 372, p < .001, $\chi2$/df = 3.08, CFI = .93, TLI = .92, NFI = .91, RMSEA = .07). H1–H4 are accepted. Second, multigroup SEM analysis was performed to test the moderating effect of culture. Figure 1 illustrates the results of H5–H8. Bold lines in Figure 1 show the moderating effects of cultures accepting H5 and H7. The findings revealed that the more people perceive their avatars as congruent with their ideal selves, the more self-expansion they experience, which, in turn, drove continued metaverse engagement and virtual product purchases. Additionally, purchasing virtual products appeared to drive physical products purchases. We confirmed the moderating effect of culture in the relationship between ideal self/avatar congruence and self-expansion. That is, ideal self/avatar congruence was more important in an individualistic culture (US). Furthermore, in Korea, characterized by a collectivistic culture, the link between continuance intention and virtual product purchase was more pronounced, indicating a tendency to place a high value on proper attire for social interaction, even within virtual settings.

Notes: the values of US are represented in parentheses under the values of Korea. Control (Age, gender, education, income, favorite metaverse platform, frequency of metaverse usage, duration of use)

Figure 1. Hypotheses testing results

Conclusion

This study explores the metaverse as a space for self-concept expansion through avatar customization. We confirmed that aligning ideal selves with avatars fosters self-expansion, impacting metaverse commitment and virtual product purchases. Cultural distinctions further underscore the significance of these findings. Overall, this study offers a foundational understanding of cross-cultural consumer behavior in the metaverse, paving the way for additional theoretical and practical insights.

References

Aron, A., Lewandowski, G., Mashek, D., & Aron, E. (2013). The self-expansion model of motivation and cognition in close relationships. In J. A. Simpson & L. Campbell (Eds.), The Oxford handbook of close relationships (pp. 90-115). Oxford University Press.

Lee, S., Busser, J. A., & Park, E. (2019). The influence of self-expansion on pop-star fans' leisure constraints, commitment, involvement and future intention. Leisure/Loisir, 43(1), 79-101.

Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. Online Readings in Psychology and Culture, 2(1). Article 8.

Hofstede Insights. (n.d.). Country comparison tool. Retrieved from https://www.hofstede-insights.com/country-comparison/south-korea,the-usa/

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THE EFFECT OF ENCLOTHED AVATAR IDENTIFICATION IN THE METAVERSE ON IDENTITY AUGMENTATION AND PURCHASE INTENTION

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Introduction

The Metaverse, a groundbreaking frontier of digital interaction, arises from the convergence of enhanced virtual and persistent physical realities. It has been spurred by the recent proliferation of internet technology. This immersive environment affords consumers the opportunity to participate in a spectrum of activities, predominantly through the use of customized digital avatars that mirror their unique identities. The burgeoning interest in the Metaverse and avatar personalization has catalyzed a surge in research investigating consumer behavior, preferences, and motivations within this virtual setting. Key areas of focus include the impact of avatar aesthetics on self-perception, the role of self-presentation in avatar selection, and the cognitive influence of avatar embodiment. Concurrently, virtual economies have flourished, underpinned by consumers' real-world expenditure on virtual goods, notably avatar apparel. This has prompted inquiries into the drivers of purchase intentions and their underlying psychological constructs. Central to managing virtual identity is the practice of dressing avatars, where consumers actively shape their virtual personas. The current study delves into the decision-making process and psychological mechanisms of consumers in the Taobao Life Metaverse when selecting avatar clothing. It thereby contributes to the understanding of consumer behavior in immersive virtual environments.

Literature Review

Recent research primarily focuses on consumers' reactions to virtual reality experiences, specifically the impact of different types of virtual reality or technological features on psychological responses such as interest, immersion, and pleasure (Lau et al.,2013; Van Kerrebroeck et al.,2017). Within the discipline of fashion marketing, some studies have also examined the impact of virtual reality shopping experiences on consumer reactions and behaviors. In the realm of virtual fashion within the virtual world, Veerapen (2011) relied on Hollander (1993) and Entwistle (2000) for definitions of fashion. These scholars all view virtual fashion as an operating system. The fashion system in the Metaverse essentially mimics real-life fashion practices, such as showcasing collections, commercial concepts, and, of course, focusing on producing designs that customers would purchase. On the other hand, research on avatars has consistently shown that individuals often create characters that reflect essential aspects of themselves. For instance, Vasalou and Joinson(2009) discovered that avatars generally reflect the creators' self-image, leading creators to believe that their avatars share similarities with them, irrespective of the context of avatar creation. Studies have also found that consumers identify with avatars similar to themselves on both psychological and physiological levels (Ratan&Dawson,2016). Prior research indicates that the Metaverse is actively thriving, and consumers are more inclined to use the platform by leveraging the similarity of virtual images. However, the specific role of the virtual avatar wearing the consumer's chosen clothing remains unexplored. This study aims to extend conventional theories of self to the context of the virtual Metaverse by considering clothed avatars. Furthermore, while the Metaverse has become a trendy topic in the fashion retail industry, there is limited understanding of consumers' perceptions and experiences with these new applications (Dwivedi et al.,2023). Additionally, previous research has established a relationship between virtual characters and real consumers, but these were primarily limited to Massively Multiplayer Online Role-Playing Games (MMORPGs) before the advent of the Metaverse (Lowe,2016; Papagiannidis et al.,2008; Wu & Hsu,2018). Given the socially interactive nature of the Metaverse, more research on consumers' consumption and behavioral patterns is needed. Moreover, unlike consumers in MMORPGs, who often pursue unrealistic characters, Metaverse consumers warrant studies related to those who adorn themselves with virtual products they may encounter in reality (Dwivedi et al.,2022). While existing

research mainly focuses on consumers' psychological responses to virtual reality experiences (Wei et al.,2019), the relationship between the purchase intention of virtual fashion items in the Metaverse and the purchase intention of physical products remains to be thoroughly explored. Therefore, this study investigates the relationship between consumer identification with clothed avatars in the Metaverse context, identity augmentation, and the impact on consumer purchase intentions for both virtual and physical products.

Research Method

To create a concise list of avatar attire items, our study primarily focused on male and female consumers between the ages of 20 and 30 who have experience using the Metaverse and show a relative interest in the fashion field for a pre-test. A total of 50 participants, including 24 males and 26 females, took part in the survey. During the pre-test, the researcher selected virtual clothing from the 760 fashion top-bottom sets displayed in the Taobao Life Metaverse based on the current season (winter) at the time of the survey. In the end, consumers selected 28 fashion top-bottom sets they liked from the pre-test. These sets were used as stimuli for the main study. The main study required participants to be "Taobao Life Metaverse consumers aged 18 to 39 living in Beijing, Shanghai, Zhejiang, or Guangdong provinces in China". All participants must own their own avatar in Taobao Life. A total of 329 data points were used for statistical analysis. By employing structural equation modeling (SEM) and macro process analysis, we uncovered the relationship between enclothed avatar identification, self-expansion, self-extension, and the purchasing intentions of virtual and physical goods in the Metaverse. To validate the hypothesis that the effect of enclothed avatar identification on identity augmentation is moderated by self-concept clarity, we conducted an analysis of moderation effects using the SPSS Macro Process (Hayes,2017).

RQ1. To verify the impact of enclothed avatar identification on purchase intention, mediated by identity augmentation, in the Metaverse.

RQ2. To verify that the effect of enclothed avatar identification on consumers' identity augmentation in the Metaverse varies depending on individual self-concept clarity.

Results & Discussion

This study conducted Structural Equation Modeling (SEM) analysis to test the effect of enclothed avatar wishful identification and enclothed avatar actual identification on self-expansion and self-extension when using their avatar in the Taobao Life Metaverse and to test how each factor would influence purchase intention of virtual and real goods. The analysis showed that the model's fit is satisfactory (χ^2= 592.864, df=359, p<.001, NFI=.908, CFI=.961, TLI=.956, IFI=.962, RMSEA=.045). This study also utilized the Macro Process Model 83 to analyze whether self-concept clarity (SCC) moderates the effect of enclothed avatar identification on identity augmentation. Findings revealing a significant interaction between avatar actual identification and SCC($F_{(1, 324)}$ = 12.26, p<.001). This effect varied with SCC level, more potent at lower SCC(β=.292, p<.001) and insignificant at higher SCC(β=.078, p=.110). Similarly, SCC's moderating role in the relationship between enclothed wishful identification and self-expansion was validated, with stronger effects on self-expansion as SCC level reduced (from .205 to .405), accounting for 39.4% of the variance (R^2=.394).With actual identification as the independent variable, the model significantly predicted self-extension, accounting for 62.3% of the variance ($F_{(4, 324)}$=133.9166, p<.000). The enclothed avatar actual identification and self-concept clarity interaction, however, did not significantly predict self-extension (p=.998). The model with wishful identification as the independent variable showed that approximately 58.5% of the self-extension variance can be significantly attributed to the predictors (p<.000). The interaction between wishful identification and self-concept clarity, though, did not significantly impact the model (p=.701).

Conclusion

This study uncovers the relationship between enclothed avatar identification, self-expansion, self-extension, and the purchasing intentions of virtual and physical goods. It reveals that actual identification

with an enclothed avatar enhances self-extension without significantly influencing self-expansion, hinting at the necessity for additional factors to foster self-expansion. Conversely, wishful identification boosts both self-extension and self-expansion, underscoring the aspirational aspect of this phenomenon. Self-expansion and self-extension have a substantial impact on purchase intentions for both virtual and physical products, suggesting that avatar identification significantly influences consumer behavior. By examining the complex interplay of these variables, our research contributes to a more comprehensive understanding of consumer behavior in the rapidly evolving landscape, elucidating the correlation between user interactions within the Metaverse and their purchasing behaviors in the real world.

References

Dwivedi, Y. K., Hughes, L., Wang, Y., Alalwan, A. A., Ahn, S. J., Balakrishnan, J., ... & Wirtz, J. (2023). Metaverse marketing: How the Metaverse will shape the future of consumer research and practice. *Psychology & Marketing, 40*(4), 750-776.

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CONSUMER RESPONSES TO FASHION RETAIL SERVICES USING INTERACTIVE RETAIL TECHNOLOGIES

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Introduction

New technologies are radically reshaping the world. The retail environment is also transforming with these rapid changes by so-called retail technologies that have been recently introduced. Fashion brands or companies use technologies to provide various services to consumers for creating rich experiences and new values in the consumer-centric direction. As technological innovation plays an important role in reshaping the retail sector, this study examines the importance of new retail technologies in the field of interactive fashion retail services, which require high consumer participation. In previous studies about new retail technologies, innovation acceptance was mostly viewed as a positive decision based on innovation diffusion, technology acceptance or reasoned action theory. A few studies have covered negative reactions toward technologies, but technological acceptance and resistance are mostly not considered in one framework. People's motivation to accept innovation and the reasons for resistance are not opposite, only different in quality and affect decision making in completely different ways. Considering various nuances of positive and negative technology characteristic factors, with positive or negative consumer reactions within one framework, thus seems necessary.

The purpose of this study is to investigate the impact of various characteristics of retail technology applied in fashion retail services on consumers' positive and negative emotional responses, considering the importance of experiences highlighted by the changing landscape of fashion consumption environments and the evolving roles of consumers. By examining these aspects, the study aims to propose effective strategies for the application of fashion retail technology.

Literature Review

One of the main characteristics of technology-based new retail is the increased role of customers. After Vargo and Lusch (2004) proposed the service-dominant logic (SD-L), the concept of customer experience or customer participation began to draw attention. From the SD-L perspective, the introduction of new fashion retail technologies enables fashion consumers to become an important factor in service production and serve as value co-producers through interactions using technologies. Prahalad and Ramaswamy's (2000) study on co-creation similarly observes the evolution and change in consumer roles, describing the shift from a 'passive audience' to an 'active player'. As the role of consumers undergoes changes, new demands can lead to stress, typically encompassing role conflicts, role overload, and ambiguity (Eatough et al., 2011). According to Chang and Taylor (2016), participating in such collaborative service development poses a significant challenge for consumers, as it constantly demands creativity and the expression of their needs. In these challenging situations, consumers experience role stress, and this role stress is known to lead to negative emotions and lower service performance (Blut et al., 2020).

Our objective is to comprehend consumer beliefs regarding technology-based fashion retail services and examine the impact of these beliefs on consumer reactions and behavioral intentions, specifically within the realm of technology-based interactive fashion retail services. We chose to apply the Job Demands-Resources model(Bakker & Demerouti, 2007) because, given the expanding role of consumers and their involvement in co-creating value, we find it reasonable to extend this model to consumers as partial organizational members. Additionally, we aim to assess the influence of role ambiguity, a form of role stress, and investigate the moderating effect of procedural fairness. This approach allows our study to offer strategic insights for mitigating the adverse effects of fashion retail technologies.

Research Method

In Study 1, one-on-one in-depth interviews were conducted with consumers who have experienced retail technology services within the last six months to determine various consumer beliefs about fashion retail technology services. In Study 2, an online survey was performed to identify the effects of consumer beliefs about fashion retail technology services on consumer responses quantitatively. Specifically, in the context of two types of fashion retail technology services, the augmented reality (AR)-based virtual try-on service and the artificial intelligence-based fashion product customization service, this study attempted to verify the effects of consumer beliefs of novelty, convenience, limited autonomy, and privacy risk on consumer response and usage intention. For the quantitative study, X-generation consumers who are in their late 30s–50s were asked to experience certain online services and were given questionnaires to answer.

Results & Discussion

According to the result of Study 1, consumer beliefs about fashion retail services using technologies were found to be eight categories: playfulness, innovativeness, convenience, privacy risk, complexity, limited autonomy, alienation, and technological incompleteness. Consumer roles, such as active information seeker, communicator as a marketer, co-producer, and incubator, were derived. Consumers are confirmed to play an active role, rather than a passive one. When using fashion retail technology services, people expressed positive and negative responses. They indicated a sense of satisfaction or pride in using and participating in new systems with technologies. They also showed their interest in brands. Positive reactions, such as brand interest, and negative reactions, such as stress, fatigue, repulsion, burdensome, disappointment, and relative deprivation, were also observed.

For the study 2, in the context of the AR-based try-on service, novelty had a significant effect on engagement but had no significant effect on negative emotion. Convenience and limited autonomy had significant effects on negative emotion and engagement. The higher the perceived convenience, the lower the negative emotion and the higher the engagement. Privacy risk showed a significant negative effect only on negative emotion. In addition, negative emotion and engagement led to usage intention. Unlike the context of AR technology, in the context of product customization service, no significant effect of limited autonomy was found. It can be understood as a unique characteristic of the customization service, which originally involves the process of determining design elements by oneself. Engagement and negative emotion led to intention to use the same AR technology. Usage intention was confirmed to increase when engagement increases or when negative emotion decreases. In the case of role ambiguity, the effect of limited autonomy was found only in the high role ambiguity group. If consumers cannot clearly understand what the technology requires them to do, then consumers may feel limited in their choices and actions, which can lead to negative reactions. In the case of procedural fairness, when procedural fairness was high, novelty increased engagement, privacy risk and limited autonomy increased negative emotion, and convenience increased engagement while reducing negative emotion. In the case of low procedural fairness, only privacy risk and convenience had effects on negative emotion.

Conclusion

This research identified the structures of consumer beliefs about technology-based fashion retail services and investigated the effects of these beliefs on consumer reactions and behaviors in the context of interactive fashion retail services by technologies. In addition, role ambiguity and procedural fairness were treated as variables, which could moderate these relationships. Unlike previous studies focusing on successful technological acceptance, our work attempted to understand consumer reactions and behaviors broadly through a dual process. Understanding the structures of consumer beliefs about fashion retail technology services, breaking away from the variables suggested by existing innovation and behavioral theories, and deriving new concepts that can be used in the context of fashion retail technology services are possible, thereby extending the theoretical framework. This research also highlighted negative aspects, such as limited autonomy, alienation, and stress, which can occur with an active consumer participation. Considering that these negative aspects or negative customer experiences can be reduced and moderated,

useful implications can be provided for fashion brands and retailers to establish valuable strategic plans for new fashion retail technologies in the near future.

References
Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: State of the art. Journal of managerial psychology, 22(3), 309-328.

Blut, M., Heirati, N., & Schoefer, K. (2020). The dark side of customer participation: when customer participation in service co-development leads to role stress. Journal of Service Research, 23(2), 156-173.

Chang, W., & Taylor, S. A. (2016). The effectiveness of customer participation in new product development: A meta-analysis. Journal of Marketing, 80(1), 47-64.

Eatough, E. M., Chang, C. H., Miloslavic, S. A., & Johnson, R. E. (2011). Relationships of role stressors with organizational citizenship behavior: a meta-analysis. Journal of Applied Psychology, 96(3), 619.

Kim, G. (2020). Study on the Korean fashion industry. The Journal of Fashion, 15(3), 120-135.

Prahalad, C. K., & Ramaswamy, V. (2000). Co-opting customer competence. Harvard business review, 78(1), 79-90.

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LEVERAGING USER COMMENTS FOR ENHANCED AND EFFICIENT PERSONALIZED FASHION STYLE SEARCH SYSTEMS: ADOPTING EMBEDDING TECHNIQUES

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Introduction

Fashion enthusiasts express sentiments and preferences through user comments, offering valuable context beyond product descriptions (Kim et al., 2012). Analyzing these comments provides nuanced details about specific fashion items and reflects social influence and emerging trends (Roy and Dutta, 2022). However, traditional keyword-based search systems, widely utilized, are inadequate in capturing meaningful details from user comments, thus limiting personalized recommendation efficacy. The reliance on explicit keyword matching, while once robust, falls to grasp the nuanced context and semantic richness of user queries. Our research bridges this gap by exploring two distinct avenues: leveraging user comments and transcending the confines of traditional keyword-based systems. By combining these complementary approaches, our research aims to revolutionize fashion recommendation systems and improve search efficiency. Our research question is: How can we leverage user comments and transcend the confines of traditional keyword-based systems to enhance recommendation and search experiences?

Literature Review

Traditional keyword-based search systems encounter several challenges that hinder their effectiveness in retrieving relevant information. Limited Contextual Understanding is a significant issue (Grossman & Frieder, 2004), wherein queries like "apple" may return diverse results, spanning both fruit and technology domains. This lack of contextual discernment often leads to irrelevant outcomes, causing user frustration. Additionally, Rigidity and Rule-Based Matching constrain adaptability (Singhal, 2001), evidenced when searches for "fast cars" may overlook related content due to stringent keyword criteria. Moreover, Monotony and Error-Prone Manual Review processes (Frakes & Baeza-Yates, 1992) exacerbate inefficiencies, especially in large document collections. To mitigate these issues, a growing emphasis is placed on leveraging Natural Language Processing (NLP) and embedding techniques. NLP techniques, such as semantic analysis and entity recognition, enhance contextual comprehension, thereby improving search result relevance and accuracy(Guo et al., 2021).

Research Method

Consumer review texts were collected from Musinsa (www.musinsa.com), a renowned online shopping platform in South Korea, employing a custom web crawling bot devised by the researchers. The data collection spanned from May 25 to June 24, 2023, comprising pairs of product images alongside consumer reviews and fashion style recommendations curated by Musinsa's professional marketers, allowing for multiple reviews per product. The consumer review texts underwent morpheme extraction using KoNLPy's Okt (formerly Twitter) tool, supplemented by a customized word dictionary developed by the researchers to improve extraction accuracy. Subsequently, three distinct embedding techniques, ChatGPT, BERT, and Word2vec, were employed to convert both user comments and fashion style recommendations into vector representations, facilitating a nuanced analysis of the textual data.

In the subsequent phase, sample user queries initiated similarity searches for each embedding technique, aiming to retrieve relevant user comments. Manual reviews were then conducted to assess and compare the

satisfaction results, serving as a crucial measure to evaluate the effectiveness and accuracy of the implemented search algorithms.

Results & Discussion

Our study highlights the superior effectiveness of NLP-based Search systems leveraging techniques such as ChatGPT, BERT, and Word2Vec, compared to traditional Keyword-Based Search methods in the domain of personalized fashion style search. NLP-based Search systems enable more natural language queries and deliver contextually relevant results, outperforming Keyword-Based Search systems in understanding user intent and providing relevant outcomes, even with vague queries. Comparative analysis affirms the superior performance of NLP-based techniques in capturing semantic meanings and contextual information from text data. Moreover, our efficiency analysis reveals significant cost implications for each embedding technique. While ChatGPT and BERT offer sophisticated capabilities, their effectiveness is tempered by proprietary constraints and high computational costs. Conversely, Word2Vec shows promise for personalized fashion search systems, balancing between performance and computational efficiency. These findings guide the selection of embedding techniques, emphasizing the importance of factors like model parameters and domain-specific adaptability.

aspect	Keyword-Based Search	NLP-Based Search		
		ChatGPT	**BERT**	**Word2Vec**
Search Prompts	Requires specific keywords or phrases to retrieve relevant results.	Allows for more natural language queries, including synonyms and context.		
Example Prompt	"Black dress women long sleeve"	"I'm looking for a long-sleeve black dress for women"		
Search Results	Miss relevant items or no results on multiple keywords	More contextually relevant, capturing the meaning behind the query		
Efficiency(Cost)	Expensive	High	Moderately expensive	Low
Performance	Good performance for precise queries.	Good performance in understanding user intent.		

Conclusion

This study proposes a tailored solution for enhancing personalized semantic search in the fashion domain, leveraging open-source embedding techniques such as BERT and Word2Vec. By transcending the constraints of traditional keyword-based systems and avoiding resource-intensive nature of models like ChatGPT, our approach integrates NLP, efficient search algorithms, and domain-specific training to set a new standard for fashion item search systems. This amalgamation enhances search functionality and user satisfaction. While Word2Vec may not consistently outperform advanced models like ChatGPT and BERT, its simplicity, efficiency, and focus on local context make it valuable for tasks requiring domain-specific knowledge and computational efficiency. Our research contributes to specialized domain search systems by highlighting effective embedding techniques, enhancing search efficiency and user satisfaction. In summary, our findings underscore the transformative potential of NLP-based search systems in revolutionizing personalized fashion style search. By utilizing techniques such as Word2Vec, researchers and practitioners can improve user experiences in personalized search systems, delivering more precise and relevant results while mitigating operational costs.

References

Camacho-Collados, J., & Pilehvar, M. T. (2020, December). Embeddings in natural language processing. In *Proceedings of the 28th international conference on computational linguistics: tutorial abstracts* (pp. 10-15).

Frakes, W. B., & Baeza-Yates, R. (Eds.). (1992). *Information retrieval: data structures and algorithms*. Prentice-Hall, Inc..

Grossman, D. A., & Frieder, O. (2004). *Information retrieval: Algorithms and heuristics* (Vol. 15). Springer Science & Business Media.

Guo, W., Liu, X., Wang, S., Kazi, M., Wang, Z., Fu, Z., ... & Long, B. (2021). Deep natural language processing for linkedin search. *arXiv preprint arXiv:2108.13300*.

Kim, H. W., Han, K., Mun, Y. Y., Cho, J., & Hong, J. (2012). Moviemine: personalized movie content search by utilizing user comments. *IEEE Transactions on Consumer Electronics*, *58*(4), 1416-1424.

Roy, D., & Dutta, M. (2022). A systematic review and research perspective on recommender systems. *Journal of Big Data*, *9*(1), 59.

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BEYOND NEGATIVITY BIAS: AN ANALYSIS ON SENTIMENT ENTROPY IN E-WOM

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Introduction

Online platforms have become the primary source of information and recommendations, facilitating electronic word-of-mouth (e-WOM) and empowering consumers to provide and seek consumption-related advice via online reviews (Yayli & Bayram, 2012). Yet, the proliferation of online reviews presents a challenge for consumers in distinguishing authentic and useful information from the vast volume of reviews available. Filtering valuable insights from the noise is important for both consumers and businesses. The current study aims to shed light on the nuanced interplay between sentiment composition and the perceived helpfulness of online reviews, complementing the theory of negativity bias.

Literature Review

Researchers have extensively investigated the characteristics that contribute to helpful reviews. One stream of literature discusses how the presence of certain elements facilitates review helpfulness. For example, emoji usage can also improve helpfulness perception (Wu et al., 2022). Consumers also perceive reviews accompanied by visuals (images and videos) to be more helpful (Wu et al., 2021). Consequently, businesses are actively promoting the submission of visual content by consumers following their consumption experiences.

Another stream of research discusses how the sentiment of the review relates to review helpfulness. This stream of literature supports the negativity bias phenomenon, which refers to a general propensity to attend to, learn from, and use negative information far more than positive information (Vaish et al., 2008). For example, Xu et al. (2023) found that consumers perceived reviews expressing anger and anxiety to be more helpful. Another article discovered that negative emotion correlated with review helpfulness regardless of its rating (Kim & Hwang, 2020).

Recent literature employs entropy to describe the diversity of elements within review contents (Dong et al., 2024). A previous study used sentiment entropy to measure the diversity of reviews with different sentiments at the product level and discovered its positive relationship with sales (Lee et al., 2015). The current research is the first to further apply this concept to denote the convergence of positive and negative sentiment inside each review.

Research Method

To acquire initial results for the relationship between sentiment entropy and review helpfulness, we conducted a field data analysis. We collected over 1 million reviews from Yelp.com, covering reviews for 1,200 restaurants from the 5 most-populated cities in the US. For each review, the recorded information included the star ratings and text content from the reviewer, and the useful/fun/cool ratings from the review reader.

Next, we quantified the sentiment of the review text using the Vader package in Python. Vader is a lexicon and rule-based sentiment analysis tool that returns the positive, neutral, and negative sentiment score of each text review. Furthermore, the regression analysis was conducted using Ordinary Least Squares regression via the Statsmodel package in Python. We first regressed the helpfulness rating by the positive, neutral, and negative sentiment, and then added an interaction term between positive and negative sentiment in the second model. The interaction term between positive and negative sentiment denotes the sentiment entropy within each review, whereby a higher value signifies a balanced amount of positive and negative sentiment, and a lower value indicates a tendency towards polarization in sentiment expression.

Results & Discussion

The first regression model predicting review helpfulness with positive, neutral, and negative sentiment showed a marginal effect of negative sentiment (β = 11.70, p = .104), replicating the negativity bias. However, in the second model with the interaction term between positive and negative sentiment introduced, the effect of negative sentiment diminished (p = .174), while the interaction is significant (β = 12.61, p < .001). The results of the regression models provide initial evidence for the impact of sentiment entropy on review helpfulness: readers perceived reviews incorporating both positive and negative emotions to be more helpful.

Conclusion

This analysis of field data provides preliminary support for the positive effect of review sentiment entropy. Additional experimental studies are planned to validate this phenomenon in controlled lab settings and to explore its underlying mechanisms and boundary conditions. Current research enhances existing literature on negativity bias and entropy. It furnishes consumers with insights to discern valuable information while also offering guidance to practitioners on how to derive actionable insights from useful reviews to improve consumption experiences.

References

Dong, X., Zhang, Z., Zhang, Y., Ao, X., & Tang, T. Y. (2024). Post diversity: A new lens of social media WOM. *Journal of Business Research*, *170*, 114329.

Kim, J. M., & Hwang, K. (2020). Roles of emotional expressions in review consumption and generation processes. *International Journal of Hospitality Management*, *86*, 102454.

Lee, J., Park, J., & Jung, S. (2015). The impact of the Entropy of review text sentiments on movie box office sales. In *Proceedings of the 17th International Conference on Electronic Commerce 2015* (*pp. 19*): ACM.

Vaish, A., Grossmann, T., & Woodward, A. (2008). Not all emotions are created equal: the negativity bias in social-emotional development. *Psychological Bulletin*, *134*(3), 383.

Wu, R., Chen, J., Wang, C. L., & Zhou, L. (2022). The influence of emoji meaning multipleness on perceived online review helpfulness: The mediating role of processing fluency. *Journal of Business Research*, *141*, 299-307.

Wu, R., Wu, H. H., & Wang, C. L. (2021). Why is a picture 'worth a thousand words'? Pictures as information in perceived helpfulness of online reviews. *International Journal of Consumer Studies*, *45*(3), 364-378.

Xu, C., Zheng, X., & Yang, F. (2023). Examining the effects of negative emotions on review helpfulness: The moderating role of product price. *Computers in Human Behavior*, *139*, 107501.

Yaylı, A., & Bayram, M. (2012). E-WOM: The effects of online consumer reviews on purchasing decisions. *International Journal of Internet Marketing and Advertising*, *7*(1), 51-64.

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Concurrent Sessions
Oral Session 4. New Fashion Design Method

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A COMPARATIVE STUDY ON THE FASHION DESIGN PROCESS UTILIZING SMART AND CONVENTIONAL TEXTILES: IMPLICATIONS FOR THE INDUSTRY AND EDUCATION

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Introduction

The emergence of smart textiles represents a significant milestone in the textile industry, merging advanced fibers with innovative functionalities. This development reflects the intersection of technology and material science and holds the potential to revolutionize fashion design (Tang & Stylios, 2006). However, the fashion industry and designers, who were used to conventional textiles has been hesitant to embrace these innovations. This may stem from a lack of familiarity with the intricacies and potential of smart textiles, indicating a knowledge gap that necessitates further exploration. Despite extensive research in the field, smart textiles were often seen as lacking stylistic appeal for fashion products (Han et al., 2021). The emphasis was predominantly on the technological aspects rather than the design, which led to limited accessibility and marketability in the industry. It becomes clear that there is a pressing need for design and marketing strategies to ensure a presence for smart textiles in the fashion market. This study aims to compare the design process involving conventional textiles with smart textiles. Through this exploration, this study intends to establish strategies for the effective utilization of smart textiles in fashion design. To achieve this goal, the influence of textile choice in design process was analyzed by examining design duration, sequence, sketch quantity, and use of resource. The findings are anticipated to provide deeper insights into designers' perspectives on smart textiles and to propose substantial implications for fashion industry practices and educational approaches, ultimately enhancing the integration of smart textiles into the fabric of contemporary fashion.

Literature Review

Despite the diverse applications in fashion and healthcare, the fashion industry faces challenges integrating smart textiles aesthetically and commercially (Wu & Li, 2019). Among smart textiles, Shape Memory Polymers (SMPs) have shown its potential in fashion, offering garments that can change shape in response to environmental triggers such as temperature, enhancing both comfort and design versatility (Lendlein & Kelch, 2002). These polymers can be programmed for specific transformations and are integrated into textiles through methods such as lamination and weaving, pushing the boundaries of conventional garment capabilities (Vili, 2007).

Research Method

This study engaged 22 participants who either hold an undergraduate or master's degree in fashion or have current or previous professional experience as fashion designers. The experimental procedures involved with two design tasks, each with a designated completion time ranging from 30 minutes to one hour. The initial task required designing a creative dress using a conventional textile, while the subsequent task involved designing a dress utilizing smart textiles with shape-memory properties. Visual representations of both textiles were provided via images and videos displayed on a screen, ensuring consistency and removing any visual bias. Participants were equipped with an iPad loaded with various apps for research, including search engines, image and video platforms, and fashion-related apps. The materials provided for the tasks included blank sketch paper, paper with templates for technical drawings, pencils, pens, erasers, and pencil sharpeners. Following the completion of the experimental tasks, one-on-one semi-structured in-depth interviews were conducted to extract detailed insights from the participants' experiences. The data collection for this research included visual references, utilized search terms, frequency of searches, time allocated to design tasks, and quantity of sketches created for both textile types. Challenges encountered

by designers with smart textiles, alongside their satisfaction and perceived task difficulty, were also evaluated in contrast to their experiences with conventional textiles.

Results & Discussion

In the analysis of the design process, designers exhibited different design sequences. the majority of designers(n=10) followed a sequential design process, starting by gathering references, progressing to sketching, and then advancing to technical drawing without returning to gather more references. In contrast, some designers interwove reference gathering and sketching. Participants utilized various online platforms for inspiration and the primary sources used by participants were Pinterest, followed by Google and YouTube. When it comes to the frequency of searching, designers working with conventional textiles searched an average of 5.4 times. In contrast, those working with smart textiles searched slightly less, averaging 4.8 times. A few designers(n=4) bypassed searching process when working with conventional textiles due to familiarity. When working with smart textiles, a larger group (n=7) similarly opted not to engage in further data collection, which is a decision influenced by the novelty of smart textiles, uncertainty about which keywords would yield relevant information, and a belief that the necessary information might be difficult to find. The reduced dependency on online resources for smart textiles suggests the need for more accessible, inspirational, and practical resources pertinent to smart textiles. In terms of design time, conventional textiles took an average of 40 minutes and 8 seconds, while smart textiles took longer, averaging 45 minutes and 16 seconds. The increased time with smart textiles was mainly attributed to the complexity of visualizing the fabric's transformation. This indicates a need for a specialized training or tools for designers that could streamline the design process with smart textiles. Despite the extended time, the number of sketches remained similar for both textile types, with an average of 3.5.

Designers experienced varying levels of challenges and satisfaction when working with smart and conventional textiles. Some participants found smart textiles challenging due to their transformative nature, but also felt a sense of accomplishment. Challenges while designing with smart textiles included insufficient knowledge, difficulty in depicting shape-changing properties, and a lack of practical experience. Additionally, many designers had an unclear understanding of smart textiles, highlighting the need for standardized education and classification in this field. For conventional textiles, the familiarity breeds a different type of challenge—differentiating the design to stand out despite the fabric being commonplace. Here, the difficulty is not in understanding the textile but in reinventing it in a way that is fresh and engaging. The results of this study illuminate the distinct processes and challenges that designers face when working with both conventional and smart textiles, suggesting an urgent need for more accessible, inspirational, and practical resources to support the unique challenges of working with smart textiles.

Conclusion

In light of the findings, it becomes evident that a collaborative effort across three key sectors—manufacturing, design, and education—is essential for the mainstream adoption of smart textiles in fashion. The role of manufacturers extends beyond production; they are essential facilitators of innovation. Manufacturers should offer designers and consumers comprehensive resources, including interactive tutorials and standardized classifications, to demystify the intricacies of smart textiles. Simultaneously, they must ensure user safety and ease of maintenance with advanced mass production techniques. Designers need to study and pioneer the aesthetic and functional incorporation of these innovative textiles, creating garments that resonate with contemporary trends and consumer expectations. Educational institutions must enhance their curricula with hands-on modules that facilitate direct interaction with smart textiles. Comprehensive courses covering the latest advancements in smart textile technology and interdisciplinary programs that blend design principles with science and technology are crucial to prepare students for the fast changing industry. By addressing these strategic areas, smart textiles can be smoothly integrated into the fabric of the fashion industry, redefining the boundaries of functionality and fashion.

References

Han, A., Wohn, K., & Ahn, J. (2021). Towards new fashion design education: learning virtual prototyping using E-textiles. *International Journal of Technology and Design Education*, *31*(2), 379–400. https://doi.org/https://doi.org/10.1007/s10798-019-09558-w

Lendlein, A., & Kelch, S. (2002). Shape-memory polymers. *Angewandte Chemie International Edition*, *41*(12), 2034–2057.

Tang, S. L. P., & Stylios, G. K. (2006). An overview of smart technologies for clothing design and engineering. *International Journal of Clothing Science and Technology*, *18*(2), 108–128.

Vili, Y. Y. F. C. (2007). Investigating Smart Textiles Based on Shape Memory Materials. *Textile Research Journal*, *77*(5), 290–300. https://www.proquest.com/scholarly-journals/investigating-smart-textiles-based-on-shape/docview/236482108/se-2?accountid=6802

Wu, J. X., & Li, L. (2019). An introduction to wearable technology and smart textiles and apparel: Terminology, statistics, evolution, and challenges. In *Smart and functional soft materials*. IntechOpen.

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AN ANALYSIS OF CONSUMER SENSORY AND SENSIBILITY FACTORS FOR PLANNING CONDUCTIVE FABRIC CLOTHING

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Introduction

E-textiles and smart wearable devices are receiving attention and experiencing increased demand due to the changing lifestyles of people today. This phenomenon contributes to the promotion of growth in the conductive fabric market. Conductive fabric, which is a type of e-textile, means that the fabric can conduct electricity. In 2028, it is reported that the volume of the conductive fabric market will reach $46 billion [1].

Research on conductive fabric is mostly focused on enhancing fabric functionality, safety assessment, and experiments on the applicability of the fabric to clothing. However, research focusing on the practical applications to develop various fashion products using conductive fabric is significantly insufficient. Therefore, the ultimate purpose of this research is to analyze the complex sensory and sensibility factors of consumers, providing fundamental data to assist in suggesting the planning of clothing products with conductive fabric. To achieve this purpose, the first research question involves quantitatively evaluating and analyzing every complex sensory and sensibility factor of consumers related to conductive fabric. Also, the second research question involves investigating the relationship between the sensory and sensibility factors of consumers and their purchasing preferences.

Experimental

The conductive fabrics used as specimens were composed of 6 variations, diversified in terms of composition, resistance, type, and construction. To effectively incorporate already diversified conductive fabrics into clothing, commercialized specimens were selected in achromatic colors. Participants were provided 6 specimens, each measuring 25cm x 25cm square.

A tool for evaluating sensory and sensibility factors was developed referring to precedent research. Then, the questionnaire, composed of 24 sensory factors and 31 sensibility factors, was developed through peer debriefing with four relevant researchers. The sensory factors consist of 'bulky', 'cool', 'crispy', 'dry', 'electrostatic', 'flabby', 'flat', 'flexible', 'flimsy', 'hard', 'heavy', 'insulating', 'light', 'matt', 'rough', 'rugged', 'sandy', 'sleek', 'smooth', 'soft', 'spongy', 'stiff', 'thin', and 'warm'. The sensibility factors consist of 'active', 'comfortable', 'conservative', 'crude', 'delicate', 'dignified', 'elegant', 'even', 'feminine', 'fresh', 'genteel', 'graceful', 'high-quality', 'interesting', 'masculine', 'mature', 'modern', 'natural', 'ordinary', 'personal', 'refined', 'refreshing', 'romantic', 'rural', 'sexy', 'simple', 'stuffy', 'traditional', 'unique', 'urbane', and 'young'. Participants' responses to each factor were evaluated using a seven-point scale(e.g., 0: not heavy; 7: heavy). Furthermore, it included questions regarding the willingness to purchase various clothing categories made from conductive fabric.

The study participants were recruited from women in their 20s and 30s majoring in clothing science, who were Korean nationals, residing in South Korea, and proficient in Korean. As a result, 51 individuals who responded to the questionnaire throughout the evaluation period were recruited. A questionnaire and 6 specimens for evaluation were provided in a random order. The sensory and sensibility adjectives, which served as the evaluation criteria, were explained before the evaluation. Then, the participants evaluated each specimen after freely experiencing its tactile properties. Statistical analysis was done using 51 participants' data after re-coding and data cleaning with SPSS 29.0. Frequency analysis, sample t-tests, chi-square tests, one-way ANOVA, and simple linear regression analyses were conducted.

Results & Discussion

For conductive fabric overall, the key sensory factor is 'electrostatic', and the primary sensibility factors include 'even, 'not crude', 'mature', 'modern', 'refined', and 'urbane'. Among the specimens, only the fabric(specimen D), composed of 100% silver fiber and made with a knit structure weighing $34g/m^2$, does not indicate 'not matt' and 'sleek' as sensory factors, and 'high-quality' as sensibility factors.

Among the specimens, only D does not indicate 'not matt' and 'sleek' as sensory factors, and 'high-quality' as sensibility factors. The statement suggests that conductive fabric with a glossy, smooth surface may convey exclusivity and high quality. It is also considered to be effective in clothing product categories that emphasize femininity, as it aligns relatively well with a more feminine sensibility rather than a masculine one.

The sensory and sensibility factors of conductive fabric exhibit statistically significant differences when categorized by fabric type, including knit and film($p<.05$). The sensory factors of the knit-type are highly associated with adjectives such as 'flabby', 'flexible', 'light', and 'soft'. When it comes to film-type, sensory factors such as 'crispy', 'stiff', and 'rugged' are emphasized. The sensibility factors of knit-type are predominantly 'feminine', 'sexy', 'delicate', and 'romantic', while those of film-type are highly associated with 'genteel', 'dignified', 'not crude', 'masculine', and 'refined'. Consequently, it can be explained that knit-type conductive fabric reveals more practical characteristics, such as comfort and natural qualities. However, since the film-type is closely connected with sensory factors that create independent silhouettes from the body line, it is expected to be matched with formal, stubborn, and masculine images.

Participants tended to perceive that knit-type silver-coated conductive fabric based on nylon is more insulating and formal than the same fabric based solely on silver fiber. When it comes to the fabric made with silver fiber only, a sense of coolness predominated. However, in terms of sensibility factors, participants experienced exclusive and elegant feelings from film-type made with silver fiber only. It implies that using film-type conductive fabric based solely on silver fiber for the summer season and using silver-coated knit-type fabric based on nylon for the winter season to produce clothing products expressing a formal and high-quality appearance would be effective. To design casual and informal clothing products, it would be suitable to use knit-type fabric made with silver fiber for the summer season and silver-coated film-type fabric made with nylon for the winter season.

According to the analysis of differences in sensory factors based on composition, it was observed that conductive fabric made from 100% nylon exhibits high versatility in developing clothing products. Also, the results based on independent resistance values indicated that choosing knit-type among conductive fabric made from nylon would be effective for applying it to clothing products designed for formal and ceremonial purposes. It also appears to have an effect in reducing the generation of static electricity.

Finally, the preference for clothing products made from conductive fabric revealed that blouses, shirts, dresses, and t-shirts were highly ranked. Especially, knit-type conductive fabric appears highly suitable for developing clothing, as it exhibits the highest preference for various clothing products. Thus, actively applying knit-type conductive fabric on a preferential basis is expected to be effective in introducing conductive fabric into the clothing market and stimulating product development.

Conclusion

Overall, for conductive fabric, consumers were unconsciously aware that senses were related to electricity and conduction. Since conductive fabric appeared to be modern and sophisticated in terms of sensibility, the entry of conductive fabric into the current clothing market is considered positive. It is especially expected to be more appealing to female consumers than male consumers. Of the two main types produced from conductive fabric, the knit type was directly linked to sensibilities that are generally closely related to women. Therefore, in addition to the sportswear category where conductive fabric has been actively produced, it will be effective to actively develop general clothing for women and various fashion items using the knit type. In this instance, the preference for the knit type can be further increased if its constructions are used according to the season and atmosphere. For example, when women's clothing is developed with knit-type conductive fabric, casual clothing is proposed for the fabric woven only with a

single silver fiber for summer when a cool hand feel is required. For the conductive fabric of the nylon background, formal clothing for winter is proposed owing to the positive sense of the insulation effect. In the case of men's clothing, the film type is judged to be suitable when conductive fabric is utilized for traditional and classic fashion products. Conductive fabric will also be effective according to the season as with women's clothing. Since the production of clothing from conductive fabric is in the early stage, however, it is judged to be appropriate to produce winter top clothing for women first based on the result that showed more versatility of knit-type conductive fabric with nylon background.

Partially applying conductive fabric to clothing products that do not exhibit high consumer preferences will be desirable. For example, film-type conductive fabric, which has low absolute preferences but consistently shows higher preferences for outer clothing than the knit type does, is partially and properly applied to anorak, jacket, coat, and gilet, and could be expanded to various clothing products. In other words, while the active use of the knit type, which is relatively familiar to consumers, is proper for clothing products that directly contact the skin, the partial application of the film type, which is relatively unfamiliar to consumers, to outer clothing that does not directly contact with the skin can contribute to making clothes with the film type. As a representative example, in the case of anorak, inserting conductive fabric into some areas of the back and chest in consideration of the patterns of incision can provide warmth through the application of low voltage and current without damaging the aesthetics of the design itself. Further, based on the fact that conductive fabric can effectively prevent static electricity, the use of film-type conductive fabric as a lining for outer clothing, such as anorak, jacket, coat, and gilet, to prevent the static electricity caused by friction between the coat and clothes inside the coat in winter is also proposed as a method to familiarize consumers with film-type conductive fabric as a clothing fabric.

Sensory and sensibility factors of the proposed fabric are believed to offer an important guideline for those who develop clothing products made of conductive fabric to satisfy consumer needs. Further, the academic implication of this study is that it is one of the earliest ones to examine whether the sensory and sensibility factors of conductive fabric can help determine a research design of other relevant studies in the future providing useful basic data.

Based on the findings of this study, the direction for follow-up research is proposed as follows. Further research should be conducted on fabric as a two-dimensional object. It is also necessary to expand conductive fabric to three-dimensional products, such as clothes and miscellaneous goods, by producing clothing from it, and research on mechanical properties that may occur during the clothing production process and sensory and sensibility factors should also be conducted.

References

IMARC. (2023). Conductive Textiles Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2023-2028, IMARC.

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BEYOND BOUNDARIES: EXPLORING SPATIAL EXTENSIONS OF LUXURY FASHION BRANDS THROUGH TRANSMEDIA STORYTELLING

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Introduction

The meaning of fashion is expanding from possessions to experience, strengthening the lifestyle field. These changes reflect the tendency for emotional connections between consumers and brands, such as the product story and brand experience, to become more important than purchasing the product. Luxury fashion brands are broadening their physical boundaries by expanding the realm of experiences such as living, cafes, restaurants, and hotels by leveraging their powerful brand capital and emotional image of the brand (Cho et al., 2015). Considering Marshall McLuhan's concept that 'media is an extension of human beings' (McLuhan, 2001). According to this idea, media functions as a medium to expand human consciousness and activities. In light of this, the lifestyle space of fashion brands can be particularly meaningfully interpreted through transmedia storytelling extension. Transmedia storytelling allows content expanded by media to be consumed in an independent form, and a world view that can integrate the whole is shared (Jenkins, 2008). Space can play a role as media beyond the brand's expansion perspective. In its physical existence, space becomes a place of interaction between brands and consumers. Particularly, hotels and F&B spaces reflect lifestyles that are key to how individuals organize and experience their lives in a socio-cultural environment. The purpose of this study is to explore how elements of storytelling are implemented in the process of luxury fashion brands expanding their reach into hotels and F&B spaces through the application of transmedia storytelling.

Literature Review

Brands utilize the diversified media environment to provide differentiated experiences amid fierce market competition. Henry Jenkins defined transmedia as that as digital technology advances, multiple media platforms can collectively tell and experience a single story. The components of storytelling are divided into five elements: narrative, subdivision, continuity, complexity, and scalability (Jenkins, 2006). Looking at each characteristic, the narrative is to experience the story and convey it through various media. At this time, segmentation with symbolic meaning depending on the delivered medium and continuity that connects according to certain rules to create an overall story can appear. Complexity appears through stories that appear in combination with the consumer's experience, and scalability refers to stories that appear through relationships with consumers in online virtual reality or offline spaces (Chang et al., 2013). In the fashion industry, transmedia content is led by luxury fashion brands or fast fashion brands due to the need for a lot of capital and manpower and limited accessibility in the commercialization process (Song & Jeon, 2023). Consequently, the expansion of the brand space and the integration of digital technology can interact with consumers. Through this connected story-sharing worldview, customers can experience the brand with different emotions or values (Chang et al., 2013).

Research Method

The research method was to apply Henry Jenkins' theory to set up an analysis frame, and then analyze how brands use various storytelling elements in physical spaces through examples. This research reclassified Jenkins' three components of storytelling among Jenkins' five components of storytelling: narrative, connectivity, and delivery. Then, it analyzed how luxury fashion brands use storytelling components in extended spaces. In other words, the space of the expanded brand was analyzed by dividing the three elements of transmedia storytelling. The three categorized attributes were identified as embodying a brand story, a story connected to a brand, and sharing through interaction. The visual design

elements of each space were analyzed together and how luxury fashion brands form storytelling. Design elements were analyzed by referring to previous studies to how the story is formed through the medium of revealing the spatial identity in brand expansion such as color, logo, symbol, furniture, and interior accessories (Cho et el., 2015).

In this study, the scope of the study was limited to luxury fashion brands that are expanding from hotels to F&B as the lifestyle area. This is because the story of a luxury brand can be quickly shared as a visual image beyond the concept of space through images of space (Choi et al., 2021). As for the criteria for selecting the analysis targets in this study, luxury fashion brands that are expanding their business into hotels and F&B were selected as the case targets by referring to the method of collecting each in previous studies (Cho et el., 2015; Choi et el., 2021). After that, the latest articles and brand promotion materials were searched and finally selected by adding brands that were actively delivered through the media. The brands selected as luxury fashion brands that expanded the scope of hotels and F&Bs are Bulgari, Armani, Christian Louboutin, Dior, Gucci, and Louis Vuitton. The case study used each brand's online content, promotional materials, and media posts for analysis.

Results & Discussion

The research results are as follows. First, the brand space embodies a story by reflecting regional characteristics. The Bulgari Hotel concept appears differently, reflecting the characteristics of each region around the world. For example, Bulgari Tokyo presents a sophisticated interior design centered around Zen gardens and lighting reminiscent of folding screens. While Bulgari Rome presents a design that combines the past and present. The design that reflects the image of the city and the exterior of the temple reveal the symbolism of Rome. In this way, Bulgari Hotel extends brand storytelling beyond visual identity, reinforcing the narrative with design elements that reflect the cultural and historical contexts of each region. This becomes an important factor for customers to have a deeper experience through interaction with the brand.

Second, storytelling was developed based on brand philosophy and aesthetics, emphasizing the brand's connectivity. In this process, the Christian Louboutin Hotel clearly revealed its brand identity by applying its signature colors of red to furniture, wallpaper, floors, and tiles. This highlights the brand's uniqueness by allowing hotel visitors to experience first-hand Louboutin's iconic design elements. Additionally, it provides consumers with the opportunity to immerse themselves in the world of Louboutin and strengthens their memory of the brand. In this way, brand storytelling leaves a strong impression on customers' emotions.

Third, brands are expanding their stories abundantly through space design and lifestyle business expansion. Brands develop their own lifestyle product lines into furniture and cutlery and use them in their hotels and restaurants. For example, the Armani Hotel used Armani Casa products to design the space itself to be a living catalog. In addition, Dior Café conveys the sophistication and creativity of the brand even from a cup of coffee by decorating the brand logo with latte art on Dior's tableware. This makes it possible to experience the culture and values that the brand has created. Brands broaden contact points by providing customers with the experience of being a part of their brand story. Whenever customers sleep in a hotel room or drink coffee at a cafe, they immerse themselves in the brand's narrative, leading to a deeper understanding and attachment to the brand. As such, brands are reinterpreting the concept of storytelling in various ways that strengthen emotional connections with customers and increase brand loyalty.

The research results show that the brand story naturally expands by providing customers with an integrated brand experience. In particular, interaction with consumers has become possible through spatial experience. The boundaries of diverse media areas have become blurred. The story of the brand space can be further strengthened through consumer experiences in the era of convergence.

Conclusion

Using transmedia storytelling in fashion not only allows contact with numerous customers, but also conveys the design elements of a luxury fashion brand's space. By delivering photos or videos through

social media, it can have a powerful effect in building a brand image and expressing aesthetic value. Visual elements such as logos, symbols, and colors that reveal brand identity enable storytelling beyond the brand experience in space. It plays an important role as a connection in the value-oriented era that move the hearts of consumers. Hotels and F&Bs serve as platforms that convey brand stories to spaces, and media expansion through spaces can be another strategic factor in enhancing brand visibility. Previous studies tend to focus on research on expanding brands' online platforms or new fashion products in analyzing fashion brands' storytelling strategies. However, this study has academic significance in that it went beyond the existing media paradigm of fashion brands. It also focuses on the role of media as a physical extension of the offline space of luxury fashion brands.

References

Cho, D. W., Lee, E. J., & Lee, J. J. (2015). Research for the brand extension through space: Focused on space identity reflecting fashion lifestyle brand. *Korean Society of Fashion Design, 15*(4), 83-102.

Choi, D., Lim, S., & Kim, J. (2021). A study on luxury brand space identity strategies for business expansion. *Journal of the Korea Institute of the Spatial Design, 16*(7), 141-152.

Jenkins, H. (2006). *Convergence culture: where old and new media collide.* New York: NYU Press.

McLuhan, M. (2001). *Understanding media*: *The extensions of man.* Routledge.

Park, S. H., & Chang, D. R. (2019). Place branding framework with transmedia storytelling. *A Journal of Brand Design Association of Korea*, *17*(4), 119-130.

Song, M., & Jeon, H. (2023). A study on Louis Vuitton's brand communication strategy: With a focus on the transmedia storytelling strategy of fashion shows. *Cross-Cultural Studies*, *69*(0), 175-205.

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MOTIFS EXPLORATION WITH INSPIRATION OF THE THREE KINGDOMS OF KOREA APPLIED THROUGH SURFACE TEXTILE TECHNIQUES FOR GARMENT

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Introduction

Visual image has always been among human's way of receiving information from their surroundings, making clothing, as part of their necessities, an ideal way to comprehend each other. Clothing serves as indirect communication in showing one's value and believes along as a presentation of their emotions (Saravanan & Venkatasamy, 2015). The research focuses on the idea and takes inspirations from one of humans' history, the Three Kingdoms of Korea, a period of time during the Korea Peninsula was ruled under three major kingdoms of Goguryeo, Baekje, and Silla. The people of Korea have been known to this day for being homogenous in genetics (Kim, et al., 2020), making the period a significant time in which the people are divided into three civilizations. The three kingdoms portrayed the importance of identity as each becomes ally and enemy of others continuously throughout their standing. Taking the stories that have survived across the time, the research aims to make use of motifs as a media incorporating the identity of each kingdom along with applications of surface textile techniques to enhance the characteristics onto garments.

Literature Review

In 37 B.C. to 668 A.D. the Korea Peninsula was divided into three kingdoms, with Goguryeo ruled the North while Baekje and Silla ruled the South, respectively on the left and right side (Park & Ok, 2016). The Kingdom of Goguryeo showed strong military activities, clearly shown through the kingdom's enormous ruling area, with activities such horse riding and archery shown through tomb paintings left from the kingdom (Lee, 1984). Baekje Kingdom made use of their sea access and created connections with neighboring countries outside the peninsula, known to have brought Buddhism to Wa (Japan) leading to proper civilization for the country (Ha, 1968). While the Kingdom of Silla developed slower, they are known for their significant leap, among was the structured social system dividing their people based on family line known as the "bone-rank system". One of Silla's prominent legacy was *Hwarang*, a group of highly-ranked families' descents trained and educated in military craft, which eventually became the kingdom's strength in unifying the Three Kingdoms of Korea [(Lee, 1984); (Park & Ok, 2016)]. The Three Kingdoms of Korea is also known to be the beginning period of *hanbok* or Korean traditional clothing, with rather quite the difference to the general image of current *hanbok* (of the later *hanbok* development). The *hanbok*, constructed of long *jeogori* (top) with wide sleeve and paired with *chima* (skirt) and/or *baji* (pants) widening towards the end, creating the silhouette similar to A-line (The Korea Foundation, 2013). The research looked through treasures of the kingdoms and a visual adaptation method (Sunarya, 2014) was used by breaking down visual elements in consideration of design principles of the objects. The study on the topics and method were done to reach proper understanding of the history of Three Kingdoms of Korea, which was used to determine characteristics and highlight inspirations from each kingdom before developing the results of the research.

Research Method

The research conducted a study on historical events through literature resources and a visual study on the Three Kingdoms of Korea treasures, focusing on 'roof-end tiles' artifacts with 'lotus' and 'demon' pattern each from Goguryeo, Baekje, and Silla (collections of National Museum of Korea and Yoogeum Museum). The study looks through the treasures' visual elements to figure characteristics of each kingdom, focusing on the structure/composition of the objects, comparing such as shapes, spaces, depths, and proportions. The visual characteristics were then used to implement the stories of each kingdom

during the motif explorations taking inspiration from each kingdom's historical events and treasures. Digital textile printing was determined to best present the details and precision of the motifs as the basic techniques for application and another exploration was then done to determine which surface textile techniques could best point out the characteristics of each kingdom.

Results & Discussion

The research produced nine groups of motifs, each consisting of three representations of Goguryeo, Baekje, and Silla. The motifs are created following the visual characteristics of each kingdom found through visual study and took inspiration from historical events and treasures from the kingdoms. Below are 9 out of 27 motifs grouped in three according to the theme used for inspiration (each section, from left to right represent Goguryeo, Baekje, Silla),

| Lotus | Weapons | Story of Lovers |

Along with the motifs are found surface textile techniques to match each kingdom best: embroidery for Goguryeo motifs to point main pattern from decorations; quilting with hand-embroidery for Bakeje motifs to further emphasize embossed surface; and gold foil on screen printing for Silla to highlight the kingdom's prosperity in gold. The motifs alongside the surface textile techniques are used in the creation of three collections of Goguryeo, Baekje, and Silla. Designs were made adapting the silhouette of A-line hanbok found in the Three Kingdoms of Korea period. Below are the final results of the garments alongside the surface textile applied,

| "불" – Goguryeo | "비" – Baekje | "바람" – Silla |

Conclusion

The research found historical events and treasures from the Three Kingdoms of Korea can be used in creation of motifs while considering each kingdom's characteristics in design principles. Through its application on garments, the motifs show the identity and story of Goguryeo, Baekje, and Silla, portraying each as wearable tales. Final output of the research, the garments collection, can be worn as sets or individually combined with more casual or fancy clothing, while hopefully double for educational purpose. Although resources are limited in accessibility, the research might perhaps form the starting point of further research possibilities on presenting human history through motifs and clothing.

References

Ha, T. (1968). *Guide to Korean Culture.* Seoul: Yonsei University Press.

Kim, J., Jeon, S., Choi, J., Blazyte, A., Jeon, Y., Kim, J., . . . Bhak, J. (2020). The Origin and Composition of Korean Ethnicity Analyzed by Ancient and Present-Day Genome Sequences. *Genome Biology and Evolution, 12*(5), 553-565. doi:https://doi.org/10.1093/gbe/evaa062

Lee, K. (1984). *A New History of Korea.* Seoul: Ilchokak.

Park, K., & Ok, G. (2016). Martial Arts and Ideology of Hwarang, the Ancient Korean Warrior. *The International Journal of the History of Sport, 33*(9), 951-962. doi:10.1080/09523367.2016.1218332

Saravanan, D. D., & Venkatasamy, N. (2015). Fashion Trends and Its Impact on Society. *Bannariamman Institute of Technology.* Sathyamangalam.

Sunarya, Y. Y. (2014). *Strategi Adaptasi Visual Dalam Ragam Hias Batik Sunda.* [Dissertation] Faculty of Art and Design, Institut Teknologi Bandung.

The Korea Foundation. (2013). *Hanbok: Timeless Fashion Tradition.* Seoul: Seoul Selection.

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Concurrent Sessions

Oral Session 5. Textile Science and Technology

Chair: Dr. Sunhee Lee, Dong-A University

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EVALUATION METHOD OF REMOVAL RATE ON PARTICLES ON THE FABRIC

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Introduction

In this study, we propose an image analysis method to quantitatively evaluate the solid particle removal rate of fabrics and aim to validate its reliability. Initially, we fused images to ensure reproducible and reliable color signals. While image fusion techniques with a photometric stereo system have been validated for fabric pattern recognition [1] or density detection [2], there has been no reported application in studies related to fabric detergency. Secondly, digital K/S values for all pixels in the fused images of the original, contaminated and washed fabric surface were calculated, and the particle removal rate (%) [3] was determined using the digital K/S values. The resulting particle removal rate was compared with the quantitative result of thermogravimetric analysis to verify its reliability. We assessed the superiority of the proposed method compared to results obtained through the conventional surface reflectance method and binary image analysis. Additionally, we explored the optimal variable parameter for calculating digital K/S values and image acquisition conditions to enhance evaluation accuracy by increasing signal sensitivity for particles and minimizing color distortion due to fabric structural characteristics, such as porosity, translucency, and shading.

Literature Review

Woven fabrics have three-dimensional structures formed by intersections of warp and weft, causing a fabric surface image to have blind spots, resulting in incomplete and distorted information about its structural characteristics and color. [4] Therefore, image fusion techniques have been utilized in fabric image analysis. [1] [2] One such method is photometric stereo proposed by Woodham [5], where the object and camera positions are fixed, and a series of 2D images are fused by changing the illumination direction. This approach allows for more accurate analysis of fabric texture and color by preserving the excessive or insufficient light reflection caused by the direction and intensity of the light source, which leads to the distortion in surface information. [1] [2]

Research Method

Matlab software was used for image analysis calculating the particle removal rate. For the region of interest, the acquired images were all cropped to a size of 512×512 pixels. The discrete wavelet transform was used as image fusing method. After preprocessing, the images were converted into the XYZ color image. From the images, the Y values for all pixels were extracted, and the $(K/S)_D$ for all pixels were calculated using Eq.1.

$$K/S_{DY} = (1 - Y)^2/2Y \times 100 \qquad \text{Eq.1}$$

$(K/S)_{DY}$: Digital K/S value calculated from XYZ color image using Y signal for R_λ
Y: Y value of each pixel comprising XYZ color image

The $(K/S)_D$ for the original, contaminated and washed fabric images were averaged for each, and the particle removal rate (%) was calculated using Eq.2.

$$\text{Particle removal rate (\%) by (K/S)}_D = \frac{\mu(K/S)_{DS} - \mu(K/S)_{DW}}{\mu(K/S)_{DS} - \mu(K/S)_{DI}} \times 100 \qquad \text{Eq.2}$$

$\mu(K/S)_{DI}$: Average $(K/S)_D$ of original sample image pixels
$\mu(K/S)_{DS}$: Average $(K/S)_D$ of contaminated sample image pixels
$\mu(K/S)_{DW}$: Average $(K/S)_D$ of washed sample image pixels

Results & Discussion

The fused image using photometric stereo system exhibited more reliable image quality compared to images captured with a single light source. The intrinsic three-dimensional surface structure of the fabric was preserved and reflected in the digital image, effectively compensating for color distortion.

The solid particle removal rate of the fabric obtained through the proposed image analysis method closely matched the results of TGA, with an average error rate (Error(%)) of 16.49% and an average absolute error (Error(abs)) of 6.37. This demonstrates a significantly enhanced accuracy compared to surface reflectance measurement whose Error(%) 161.23% and Error(abs) 49.79, or binary image analysis method of Error(%) 166.38% and Error(abs) 52.78.

When using red-colored iron oxide particles, instead of the Y from the XYZ color model, the R signal from the RGB color model was used. The error rate decreased by 3.17% when using the R signal compared to when using the Y signal, whose average error rate was 5.54%. This is because when the particle is red, the R (red) signal is more sensitive than the Y (brightness) signal to intensity variation of pixel color.

Conclusion

In conclusion, the proposed method is a non-contact and objective approach that quantitatively and accurately analyzes the removal rate of solid particles unevenly attached to fabrics. It eliminates the need for additional tracing materials, enabling a direct assessment of the target contaminants. There is no requirement for cumbersome chemical analysis or expensive spectrophotometer system. The investigation into optimal signal parameter for $(K/S)_D$ and image shooting conditions can serve as foundation data for standardizing the proposed method. The results of this study are anticipated to significantly aid in assessing fabric self-cleaning properties and garment care performance.

Acknowledgements

References

J. Li, W. Wang, N. Deng and B. Xin. (2020) A novel digital method for weave pattern recognition based on photometric differential analysis. *Measurement*, 152, 107336.

Z. Xiang, K. Chen, M. Qian and X. Hu. (2020) Yarn-dyed woven fabric density measurement method and system based on multi-directional illumination image fusion enhancement technology. *The Journal of The Textile Institute*, 111, 10, 1489-1501.

E. Kissa. (1971) A reproducible method for the evaluation of soil release. *Textile Chemist & Colorist*, 3, 10, 49-55.

W. Wang, N. Deng, B. Xin, Y. Wang and S. Lu. (2020) Investigation of image registration method for the multi-directional image fusion of woven fabrics. *The Journal of The Textile Institute*, 111, 4, 586-596.

R. Woodham. (1980) Photometric method for determining surface orientation from multiple images. *Optical engineering*, 19, 1, 139-144.

K. Sugita and M. Oya. (2022) Improvement of the image analysis method for quantifying low-polarity oily stains on fabric. *Textile Research Journal*, 92, 5-6, 649-659.

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  Email: sungmin0922@snu.ac.kr

A NEW PARADIGM OF GARMENT CLEANING: CARBON DIOXIDE

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Introduction

In general, consumers have two choices when it comes to clothing care. The most prevalent option is to use a water washing machine and tumble dryer at home. Although it is convenient for everyone to use, it discharges detergent and microfibers into wastewater during washing, contributing to ocean pollution [1], and dryer damages fabric [2]. The second choice is to take dry cleaning services. A dry cleaning process involves no water but uses harmful organic solvents to remove dirt from clothes. While minimizing fabric damage, organic solvents contaminate the air, water and soil, which have a serious impact on ecosystems. In addition, such pollution can also have negative effects on human health [2]. Given this reality, sustainable cleaning methods have emerged as alternatives to protect human health and conserve resources. The purpose of this study is to explore a new paradigm of garment cleaning from both an ecological and consumer perspective. Our findings revolutionize the way garments are cared for while minimizing the potential to harm human health and the environment.

Literature Review

K. Fletcher published a paper on the sustainable clothing care procedures, stating that the fashion industries contribute to approximately 10% of global greenhouse gas emissions [3]. When consumers take care of their clothing, including washing, drying, ironing, and other maintenance, it consumes the largest portion of energy throughout the entire lifecycle of textile products, contributing to 39% of greenhouse gas emissions. To transform the current clothing care procedures into a sustainable one, a radical shift in washing methods is imperative.

Various solvents that are in the practical stage as environmentally-friendly alternatives are widely known. Silicon-based alternative, called D5 (Decamethylcyclopentasiloxane), and Acetal are popularly employed as substitutes for PERC (Perchloroethylene), yet they come with the risks of insufficient evidence regarding their impact on the environment and harmlessness to human health [4] [5]. Wet cleaning, which uses water, is competitive in labor and cost but still struggles with issues related to fabric shrinkages [6]. Carbon Dioxide (CO_2) is an arguably the most promising choice as an alternative solvent since it poses no risk to humans or the environment, and using it means recycling industrial waste, exempting it from regulations [2][7].

Initiated with the textile industry's exploration of supercritical fluid dyeing in 1991, The Clorox Company conducted research on liquid and supercritical carbon dioxide dry cleaning systems in 1994. Tohoku Graduate School into integrating CO_2 technology into dry cleaning unveiled promising prospects for commercial application [7]. Furthermore, TERSUS Solutions developed and demonstrated a liquid carbon dioxide (CO_2) cleaning solution for cleaning military textiles and garments[8]. Despite these advancements, existing studies primarily concentrate on either the mechanical design of CO_2 machines or initial research for using CO_2 as a laundry solvent, thus necessitating comprehensive research for practical commercial utilization.

Research Method

Considering actual consumer use, the impacts of CO_2 Cleaning are compared with existing clothing care procedures for various textiles. Of particular interest is the comparison of fabric wear levels according to the type of cleaning (water washing, dry cleaning and CO_2 Cleaning), detergent and laundry time.
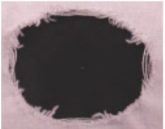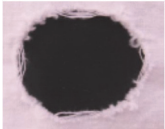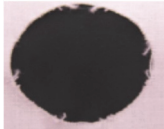
SWISSATEST's EMPA 108 test strip, which is a test strip according to IEC/EN 60456 (IEC 5th edition) is used as the standard test strip. For mechanical action evaluation, WFK's MA Testcloth (Danish) 40 x 40 cm is used. For the shrinkage evaluation, wool 100% knit is used. For research under actual

conditions of consumer use, front loader washing machine and heat pump dryer both manufactured by SAMSUNG, Dry Cleaning DF2000 (Hydrocarbon) and CO2 Cleaning machine manufactured by TERSUS Solutions, based in the USA, are used. The results of the CO2 cleaning are averaged from multiple conditions. Additionally, the impacts on ecosystems of each type of cleaning, particularly in terms of emission of microfiber are analyzed. The potential benefits of CO2 Cleaning for consumers are also discussed. Table 1 summarizes the conditions for CO2 cleaning.

Table 1 – Conditions for CO2 Cleaning					
	Load(lb.)	Pressure(Psi)	Detergent	Laundry Time (min)	Remark
1			ClipCOO 500 ml	10	
2	8	750	-	10	No pre or post processing
3			ClipCOO 500ml	30	

Results & Discussion

It has been proved that CO2 Cleaning significantly reduces textile damage and microfiber emissions during garment cleaning process as shown in Table 2. Since liquid CO2 evaporates instantly after cleaning, it eliminates the need for high-speed spinning and drying, thus minimizing textile damage and microfiber emissions even further. Microfiber emission is calculated from weighing the clothes to ppm, before and after washing.

Table 2 – Results of Various Cleaning Method				
	Water Washing + Flat Dry	Water Washing + Dryer	Dry Cleaning	CO2 Cleaning
Shrinkage rate(%)	- 5.5	- 13.3	+ 4.5	- 0.4
5 hole MA Cloth(ea.)	11.2	14.5	3.2	3.4
Microfiber emission(ppm/kg)	435	1,633	2,940	< 0.1

With its high penetration capabilities, CO2 Cleaning enables shorter cleaning times and lower mechanical forces, allowing for the damage-less cleaning of various textiles that even cannot be handled by conventional water washing or dry cleaning methods as summarized in Table 3. Level of odour strength is according to ISO 17299-1 standard.

Table 3 – Effects of CO2 Cleaning				
Item	Index	CO2 Cleaning		Remark
		Before	After	
Sports Gear (Kendo gloves)	Level of odour strength	5	2.5	Hard to care
Firefighting suit	Residual Toxicity	15.4 mg/kg	4.95 mg/kg	Cannot be handled by water

Moreover, based on the experiment, the washing performance of CO2 is equivalent to that of Hydrocarbon dry cleaning techniques. When compared to water-washing techniques, as a lipophilic solvent, CO2 cleaning excels in removing lipophilic soil, yet it struggles with water-soluble soil. The washing performance of CO2 cleaning has improved with detergent and longer washing time, while it has improved in all soil except water-soluble soil as shown in Figure 1 and Table 4. The washing performance(Detergency: K/S, Kubelka-Munk) is calculated by Equation 1 and 2.

$$\frac{K}{S} = \frac{(1-R)^2}{2R} \quad (1)$$

,where K is Absorption Coefficient, S is Scattering Coefficient, D is Detergency and R is Spectral Reflectance.

$$D(\%) = \frac{(K/S)_S - (K/S)_W}{(K/S)_S - (K/S)_O} \times 100 \quad (2)$$

,where $(K/S)_O$, $(K/S)_S$ and $(K/S)_W$ are the K/S values based on pre-contaminated raw cloth(white cloth), contaminated cloth before washing and contaminated cloth after washing, respectively.

Fig. 1 – Detergency of Various Cleaning Method and Various Contamination
(CO_2 Cleaning with Clip COO, wash time 10 minutes)

Table 4 – Detergency of Various Cleaning Method					
	Water Washing	Dry Cleaning	CO2 Cleaning		
Detergent	Persil	P-51	No detergent	ClipCOO	ClipCOO
Wash Time(min)	-	-	10	10	30
Detergency(%)	48.8	16.2	13.5	16.9	19.7

Conclusion

CO_2 Cleaning will be a game-changer in the field of garment cleaning. It provides a safe and effective cleaning solution for delicate textiles without causing any damage, while also significantly reducing environmental pollution.

Despite its promising features, this technology faces certain limitations such as size and weight. In response, it is inevitable to develop a more compact, lightweight, and affordable version of the machine. Moreover, improvements in washing performance are crucial, particularly concerning the removal of water-soluble soil.

Acknowledgement

References

1. European Chemicals Agency (ECHA). (2019). Annex XV Restriction Report—Proposal for a Restriction: Intentionally Added Microplastics., 10-11
2. Kim Seong-ryeon (2017), Science of Detergents and Laundry / Written by Kim, Seong-ryeon (3rd Edition). Paju: Gyomunsa, 221-275
3. Fletcher, K. (2013). _Sustainable fashion and textiles: design journeys_. Routledge., pp.3-6.
4. Kwak, S. K., Sang, J. S., & Park, M. J. (2019). Detergency improvement of hydrophilic soils in dry cleaning process. _Journal of the Korea Fashion and Costume Design Association_, _21_(4), 213-220.

5. Ceballos, D. M., Fellows, K. M., Evans, A. E., Janulewicz, P. A., Lee, E. G., & Whittaker, S. G. (2021). Perchloroethylene and dry cleaning: it's time to move the industry to safer alternatives. *Frontiers in Public Health*, *9*, 638082.
6. Mun, J., & Lee, J. (2023). Ultrasonic Washing Performance Analysis for Eco-friendly Wet Cleaning. *Journal of the Korean Society of Clothing and Textiles*, *47*(2), 353-370.
7. Inomata, H. (2005). Development of CO2 dry cleaning system. AIST Today, 18, 10-11.
8. Madsen, S., Robbins, C. and Robbins A., 2021, Carbon Dioxide-based Cleaning of Military Textiles. California Energy Commission CEC-500-2021-056.

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EXPLORATION OF ABACA FIBER CHARACTERISTICS THROUGH WEAVING FOR CLOTHING

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Introduction

The fashion industry's production process has consumed 79 billion cubic meters of water, released 1,715 million tons of CO_2, and produced 92 million tons of non-biodegradable fabric waste (Arqam, 2021). In response to these issues, fashion designers are encouraged to create clothing using fabric materials made from natural fibers, one of which is abaca fibers. Abaca fiber comes from an endemic banana plant in the Sangihe Talaud region, North Sulawesi. This research focuses on exploring the characteristics and properties of abaca fiber through weaving for clothing. The abaca fiber is weaved into the fabric and involves material exploration through pleats. The attributes of woven abaca fabric can help create new silhouettes and three-dimensional shapes, thereby providing a new visual alternative to conventional textiles. The output of this research is a fashion collection made from abaca fibers named "Manu' Niu."

Literature Review

The indigenous people of Sangihe Talaud have long used abaca for various handicrafts, including the traditional Kofo fabric; however, it has become extinct since the 1970s due to production issues (Sumolang, 2011). Therefore, this research produces various types of woven abaca fabric using the plain weave technique to revive the Sangihe people's traditions. The advantages of abaca fiber include its strength, durability, and biodegradability. In addition, the cultivation process does not require specific irrigation and pesticide systems, making it a more sustainable option than conventional materials (Suantara & Oktaviani, 2015). Summary from a few kinds of literature that focuses on the use of abaca fiber; (1) there are three stages in processing abaca fiber: the refinement stage, the bonding technique stage, and the preservation stage (Victoria, 2016); (2) the amount of abaca fiber fabric used can be adjusted according to the application for various interior products from tablecloths to partitions (Kuslambang, 2019); (3) the most suitable material for interior products is woven abaca fabric with a mixture of 50% cotton using supplementary weft weaving and kepper weaving techniques (Jahroo, 2022). Most of the research on abaca fiber is related to its application in interior products. This research focuses on the potential of abaca fibers used for clothing to introduce renewable alternative materials for fashion practitioners.

Research Method

Primary data is obtained through material testing to understand abaca fiber's characteristics and physical properties. Characteristics are qualities or attributes of a material that differentiate it from other materials. Meanwhile, properties such as elasticity, strength, resilience, and water absorption need to be obtained to determine the potential of abaca fiber. Furthermore, the result of material testing will help the design process. Three different kinds of testing were conducted simultaneously on cotton yarn as a comparison, and it serves as the warp thread in woven fabric. Tensile tests on abaca fiber and woven abaca fabric will determine the fiber's strength and flexibility. Density testing will determine the mass per volume of the fiber. Lastly, absorbency testing aims to assess the water absorption capacity of abaca fiber. Secondary data is gathered from material exploration using pleats techniques, making woven abaca fabric, and composing the material in designing the final product.

Results & Discussion

The sample used for tensile testing was 25 abaca filament and cotton yarn (± 200 mm), while the tensile test for woven abaca fabric used a length of ± 25 mm consisting of abaca spun for warp and cotton yarn 80/2 for weft. Lastly, density and absorption tests were conducted using 25 abaca filaments (≤ 3 mm). These are

the summary results of materials testing revealing the properties of abaca fiber and, cotton yarn, and abaca woven fabric:

Table 1. Material Testing Result on Abaca Fiber and Cotton Yarn

Specimen	Density (gr/cm^3)	Absorption (%)	Maximum Force (N)	Tensile Strain at Break (%)
Abaca Fiber	1,26606	92,492	13.6147	8.61
Cotton Yarn	1,53105	108,250	3.0987	28.44

Table 2. Material Testing Result on Abaca Woven Fabric

Average Result	Warp (Cotton Yarn)		Weft (Abaca Fiber)	
	Strength (N)	Strain (%)	Strength (N)	Strain (%)
	130,298	40,08	539,312	7,44

The tensile test shows that abaca fiber and woven abaca fabric have a great capacity to hold weight up to 13.6147 N. Still, it exhibits stiffness, indicated by a lower elongation value than cotton yarn. Density test results conclude that the volume weight of abaca fiber is similar to cotton yarn. Lastly, abaca fiber demonstrates a high absorption capacity, proven by the ability to absorb up to 90% of its initial weight. In conclusion, abaca fiber has good potential in weaving fabric and can be applied in fashion.

The following table illustrates the characteristics of woven abaca fabric applied in clothing design based on various techniques:

Table 3. Abaca Woven Fabric Characteristics

Technique Applied	Result	Analysis
Pleats 0.5 cm on abacawoven fabric towards the warp (Cotton yarn)		Pleats are neat and consistent due to the more flexible nature of the cotton yarn. Woven abaca fabric also could maintain its shape due to its ability to absorb water (Table 1).
Pleats 0.5cm on abaca woven fabric towards the weft (Abaca fiber)		Fabric has a distortion effect and uneven folds due to the direction of pleats against abaca fiber, causing breakage in several parts, proving abaca fiber is rigid and has a low flexibility (Table 2).
Added structure and fabric layering on clothing		Added surface textile technique doesn't make the garments heavy shown by its light mass volume (Table 1). The stiff nature of abaca woven fabric allows to achieve the desired silhouettes.

Conclusion

Based on the material testing, it can be concluded that the properties of abaca fiber make it highly suitable for weaving. Tensile tests on abaca fiber and woven abaca fabric reveal that abaca is more robust than cotton yarn. Still, it has a low level of flexibility, so it is more prone to breaking. Despite the added structure, the density test shows that abaca fiber is lightweight and will not make garments heavy. Lastly, the absorbency test of abaca fiber demonstrates its ability to absorb water well, as shown by its ability to maintain the pleat's shape. Based on its characteristics, abaca fiber and woven abaca fabric exhibit strength, durability, and a shiny appearance. Woven abaca fabric can add volume to garments to achieve a three-dimensional silhouette; woven abaca fabric can maintain pleats well and is easy to drape. Therefore, designing a high fashion/couture garment with voluminous silhouettes and structured designs is recommended.

References

Arqam, A. N. (2021). Analisa Purchase Intention Terhadap Produk Sustainable Clothing di Indonesia Menggunakan Structural Equation Modeling. Repository Universitas Hasanuddin.

Jahroo, W. (2022). Eksplorasi Ornamen Sangihe Pada Serat Pisang Abaka Untuk Produk *Home Decor.* Perpustakaan Digital Institut Teknologi Bandung.

Kuslambang, E. P., Kusumarini, Y., & Suprobo, F.P. (2019). Eksperimen Potensi Kain Serat Pisang Sebagai Material Produk Pelengkap Interior. Jurnal Intra. 7(2). 954-963.

Suantara, D., & Oktaviani, E. (2015). "Pemanfaatan Serat Kelapa Dan Serat Abaka Sebagai Bahan Baku Papan Partikel." *Arena Tekstil*, 30(1). doi:10.31266/at.v30i1.1947.

Sumolang, S. (2011). Kain Tenun Tradisional "Kofo" di Sangihe. Direktorat Tradisi, Direktorat Jenderal Nilai Budaya, Seni dan Film, Kementerian Kebudayaan dan Pariwisata.

Victoria, W. (2016). Pemanfaatan Serat Abaca Pada Desain Produk (Furnitur) Dengan Teknik Makrame. from https://katalog.ukdw.ac.id/1413/1/62120027_bab1_bab5_daftarpustaka.pdf accessed on 12th of January 2024.

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A COMPARATIVE STUDY ON THE DRYING MECHANISMS AND CHARACTERISTIC CHANGES OF FABRICS ACCORDING TO HEAT TRANSFER PRINCIPLES

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Introduction

Drying is a complex unit operation that involves simultaneous heat and mass transfer accompanied by physicochemical transformations. Based on the heat transfer mechanism employed, drying is categorized into direct (convection), indirect (conduction), radiant (radiation), and dielectric (radio frequency) drying. (Acar et al., 2022). Currently, common methods for drying clothes include natural convection and hot-air drying. Although hot air drying accelerates the process and results in soft clothes, it poses challenges such as fabric shrinkage, heat damage, and low energy efficiency. Conversely, recent studies have explored fiber drying using radio frequency (RF) methods (Zhang et al., 2020; Fu et al., 2019). Low-temperature vacuum microwave drying has emerged as a promising alternative, demonstrating minimal changes in the mechanical properties of fibers and improved drying efficiency compared to hot-air drying. Despite the valuable insights and potential applications identified for dielectric drying of textiles, further research is needed to effectively implement this method in domestic dryers. In this study, the drying mechanisms of fabrics were analyzed, and the mechanical properties and dimensional changes of the fabrics were compared using three different drying methods: hot air drying, dielectric drying, and natural drying. This study aims to confirm the possibility of fabric drying using electromagnetic waves to minimize fabric deformation while improving drying efficiency.

Research Method

A flat-type drying system designed with the same volume and size employed different heat transfer methods through hot air and dielectrics. Heat was applied from a fan or magnetron located at the top of either the hot-air or the dielectric drying systems (2.45 GHz, 200 W). Specifically, within the dielectric drying system, two conditions were considered: non-periodic microwave irradiation until the fabric was completely dried and periodic irradiation, which periodically alternated between irradiation and suspension. Knitted cotton fabrics were cut into 15 cm × 15 cm, and water was applied to the fabrics using dipping and misting methods, adjusting the initial moisture regain to 60%. The loaded samples consisted of a single layer (0.78 mm), stacked samples with thicknesses of 0.5 cm (five samples) and 1.0 cm (eleven samples). To evaluate the drying performance, the samples located at the top, middle, and bottom of the stacked specimens were selected as representative samples. After each operation of the drying system, the surface temperature and weight of the samples were measured at specific times to confirm the moisture regain. The drying process was halted when the moisture regain remained nearly constant. For natural drying, the samples were laid indoors at room temperature (25 °C, 50% RH, 24 h). To assess the changes in the fabric properties based on the drying method, the tensile strength (ASTM D5034), bending rigidity (ASTM D1388), and dimensional change (AATCC 138) were measured before and after drying.

Results & Discussion

The drying rates varied depending on the drying method; hot-air drying exhibited a faster drying time than dielectric drying for a single fabric. During dielectric drying, the surface temperature of the fabric was consistently kept below 30 °C, and the final moisture regain was 7%, conversely, hot air drying resulted in an elevation of the surface temperature of the fabric exceeding 70 °C (Fig. 1a), and the final moisture regain was under the standard value (~ 6 %). For stacked samples, both 0.5 and 1.0 cm thick fabrics dielectrically dried required a shorter drying time than those that were hot-air dried, although the surface temperature of fabrics dried by the dielectric method was lower than those dried by the hot-air method (Fig. 1b). Negligible variations in moisture regain were observed across different locations within the stacked samples in

dielectric drying; however, in hot air drying, discernible differences in moisture content were observed, in the order of middle > bottom > top, based on the sample location. In dielectric drying, microwaves directly irradiate or penetrate wet fabrics, increasing the temperature of the water to reach the boiling point and leading to an accelerated drying rate. However, in hot-air drying, heat is generated externally from the treated product and transmitted through conduction or convection (Zhang, et al., 2015). Thus, this method requires a long time for heat to reach the central part of the material from the surface. Regarding the changes in fabric characteristics, fabrics subjected to hot air drying exhibited the highest dimensional change of up to 8.3%, primarily owing to thermal shrinkage. In contrast, fabrics dried using dielectric and natural drying showed relatively low dimensional changes of approximately 7% and 6.5%, respectively (Fig. 2). In the case of dielectrically dried fabrics, despite the lower surface temperature compared with hot-air-dried fabrics, it was assumed that rapid moisture extraction led to a dimensional change (Chen et al., 1952). In terms of bending rigidity, fabrics dried naturally and dielectrically were similar to pre-dried fabrics; however, those subjected to hot air drying increased by 7% and became stiffer. Tensile strength demonstrated comparable behaviors in naturally and dielectrically dried values (95−98 %), which were almost the same as those before drying. However, fabrics dried with hot air only decreased by 15% compared to the pre-dried fabrics. This difference can be attributed to hot-air drying, wherein the evaporation of all residual moisture in the fabric causes certain portions of the fabric to absorb significant energy during the evaporation process, resulting in fabric damage. However, dielectric drying directs energy primarily towards evaporating water molecules, thus minimizing the impact on the fabric itself (Fu et al., 2019). The drying efficiency of dielectric drying was higher than that of hot-air drying.

Fig. 1. Drying time and fabric surface temperature depending on drying method; (a) a single fabric and (b) the representative fabric of stacked fabrics (0.5 cm and 1.0 cm).

Fig. 2. Dimensional change of stacked fabrics depending on drying method; (a) 0.5 cm and (b) 1.0 cm.

Conclusion

This study aims to assess the feasibility of different drying methods for textiles to minimize fabric damage and preserve the physical properties of dried textile products while enhancing drying efficiency. According to the research findings, dielectric drying enhanced the drying efficiency by increasing the moisture content

in the fabric and preventing alterations in fabric properties and fiber degradation. The tensile strength and bending rigidity of the dielectrically dried fabrics were comparable to those achieved by natural air drying. Conversely, hot-air drying proved to be effective for smaller quantities of fabric; however, its efficiency decreased with increasing moisture content in the fabric. Moreover, the elevated fabric surface temperatures owing to hot air led to increased dimensional changes and decreased tensile strength. In conclusion, dielectric drying is a promising approach for obtaining high-quality dried fabrics with low energy consumption, offering new possibilities in the field of domestic appliances.

Acknowledgements

References

Acar, C., Dincer, I., & Mujumdar, A. (2022). A comprehensive review of recent advances in renewable-based drying technologies for a sustainable future. *Drying Technology*, 40(6), 1029-1050.

Zhan, L., Yang, Y., Li, W., Wang, G., Li, Y., & Wang, N. (2020). Drying kinetics and mechanical properties of low temperature microwave dried cashmere fibers. *Textile Research Journal*, 90(23-24), 2745-2754.

Fu, W., Deng, J., & Li, X. (2019). Microwave drying of fabrics. *Journal of Microwave Power and Electromagnetic Energy*, 53(1), 12-23.

Zhang, F., Zhou, T., Liu, Y., & Leng, J. (2015). Microwave synthesis and actuation of shape memory polycaprolactone foams with high speed. *Scientific Reports*, 5(11152), 1-12.

Chen, M. C., Ree, T., & Eyring, H. (1952). Stress relaxation and shrinkage in fibers. *Textile Research Journal*, 22(6), 416-423.

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A STUDY ON THE WEAVING TECHNIQUE OF KYUNG-GEUM(經錦) IN ANCIENT KOREA AND THE ETYMOLOGY OF SERICIN

Jisu Kim[*], Inha University, Korea

Introduction

This study aims to revisit the history of the Silk Road and to inform the history of Korea, which is not well known about silk of ancient Korea, the leading role of the Silk Road. The background of the study was noted that the etymology of silk originated from the Goguryeo word of 'Sil-kkury'. This study focuses on silk, which is the core of the Silk Road, and attempts to reveal how Kyung-Geum(經錦) of Gojoseon, which at that time required a high level of technology that was difficult to replicate in other countries, was woven. Research questions to find out the correlation between the Silk Road and ancient Kyung-Geum in Korean are as follows.First, this study investigates the characteristics of Kyung-Geum fabrics excavated in and around ancient Korea. Second, this study analyzes Kyung-Geum's advanced weaving technology. Third, this study investigates the etymology of sericin in silk.

Literature Review

Kyung-Geum is a pattern woven with colored warp threads. Kyung-Geum is made by double or triple overlapping two or more pairs of warp yarns dyed in different colors.

Research Method

As for the research method, various approaches were attempted to analyze ancient books, books, thesis, and relics excavated in historical sites. As for the data on the relics, the secondary data collected from various books and thesis and photos of the relics were analyzed through the Internet.

Results & Discussion

1. The Chinese character Geum(金) was created by combining Geum and baek(帛) which is a generic term for silk. Geum's earliest remains were excavated in Chaoyang, Liaoning Province, China. At that time, this area was included in Gojoseon. In Korea, the earliest record is that the Buyeos in the Buyeo Period wore Geum when they went abroad. Geum along with plain silk fabric was excavated from the living remains of Buyeos in Moa Mountain in Changchun, Jilin Province, China. The people of Baekje and Silla also produced Kyung-Geum, which was a special product sent as a souvenir to China and Japan. It can be said that it was a characteristic product and it can know the level of production of scarce silk in neighboring countries. Kyung-Geum is a pattern woven by overlapping color warp layers, so it is thick and dense and stiff, and is worn in cool or dry weather. It was a fabric that was completely different from the thin silk of Jungwon, and was a special product exported to Jungwon and Japan. Gojoseon developed the world's first Kyung-Geum and spread it to the West through the Silk Road meadow. In addition to Kyung-Geum, which was woven with various colored threads, it produced leno

silks such as La and Sa, and various kinds of fabrics such as Geum woven with woolen cloth, and hemp cloth. This can be seen with drop spindles of various sizes. Kyung-Geum had its weaving method spread to Western Asia after BC. There is a correlation between Gojoseon's splendid clothing life and Kyung-Geum in ancient Korea. Since Korean cloth with stripes of many colors has various colors of warp threads, this is influenced by Kyung-Geum. Due to the strict Kyung-Geum weaving method, Wi-geum, which uses weft as color yarn, is developed in Western Asia. Horeung similar to Kyung-Geum in Goguryeo were produced in the Sogd and the Singang region of Central Asia. It is proved that silk production was insufficient, which was the stage where Goguryeo's sil-kkury was active.

2. Gojoseon's Kyung-Geum requires advanced weaving technology. Since it is very difficult to weave with ordinary looms, a horizontal loom was invented that periodically lifts warp threads to create the color that makes up the pattern. The horizontal loom is in the form of a horizontal and there are more square frames on top. It is easy to input weft when the loom is horizontal and the opening is large, and
the loom of Gojoseon was such a horizontal loom. The looms excavated in the ancient tomb murals of Daean-ri in Goguryeo have a gentle slope. This loom was inherited from the loom of Gojoseon. Unlike the looms of Gojoseon, the Chinese looms used during the same period had a steep slope. The difference in the structure of looms between ancient Korea and China means that Korean produced textiles through unique looms for a long time. The yarn loom shown in Pictorial Stones is completely different from the horizontal loom of Gojoseon and has a very steep slope. The shape of the loom is equipped with a base, and a rectangular base with warp and fabric is placed obliquely on a flat base. The weaver is supposed to sit in front of the flat base of the loom and weave. There are two steppings under the loom, Danjonggwang was used, and the shape of the body was not found. Such a loom is difficult to weave in a curved shape, and in order to produce a curved shape, it is a weaving technology that is only possible
with the horizontal loom of Gojoseon.

3. The word 'sericin', a silk fiber protein, originates from 'Seres and Sereca'. Seres does not refer to the Chinese Qin Dynasty, but the Huns' language is correct. It is reasonable to view the Huns that bring sil-kkury, that is, as a northern horseback race, riding a horse and traveling through the grasslands of South Siberia from east to west, possessing virtue and not stingy, representing Shilla/Sira/(Go) Joseon/Jusin/Juice. Currently, there is a view that the Beijing region is regarded as Ceres. This place, which was renamed Beijing in the modern era, was originally called Bukpyeong, and until the 2nd century BC, when Gojoseon

was reduced, it was the territory of the Gojoseon alliance. Silla's old names are 'ㅅㄹ' as Seora, Sara, Saro, Shira, Sere, and Sara, so Seres or Serica is considered to mean the land of Silla and Silla. From the 8th century B.C. to the 3rd century B.C., Scythians, nomads who lived in the grasslands of the northeastern part of the Black Sea, exported crafts and trinkets produced by themselves or imported from Persians and Greece to the East. It actively carried out intermediary trade activities to transport gold from the Altai region and textiles from the East to the West.

Conclusion
Based on these findings, the history of the Silk Road was re-examined. The history of silk in ancient Korea, which was the protagonist of the Silk Road, was revealed. It is meaningful and important to inherit and develop silk, the fruit of efforts ancestors in the past. However, it is also important to understand the value and meaning of silk and use it now. In Korean historical research, there are many cases where Koreans accept the research contents of Chinese and Japanese scholars as they are without criticizing and analyzing them. Despite being excavated from the Gojoseon area, there are many marked as relics of China. Looking at these relics, we all need to grasp the truth with an eye that can be perceived as belonging to Gojoseon and Goguryeo. The results were based on historical facts that analyzed the weaving techniques of Kyung-Geum and that ancient Korea was the owner of ancient silk. This study will be able to re-examine Korea's history and contribute to the development of silk and clothing.

References
Hwang, N. P., & Cheon. C. C. (2016). *Seven thousand years of Chinese silk history.* Paju: Korean academic information, 123-124.

Kim, J. S., & Na, Y. J. (2018). The Origin and Emotion of Saekdong in Our Surroundings. *Science of Emotion and Sensibility, 21*(1), 99-114.

Na, Y. J., & Kim, J. S. (2019). GoJosen's Geum, the oldest brocade in East Asia. The Asian International Journal of Life Sciences, 19(3), 1-23

Park, S. H. (2012). Old Joseon culture and the origin of seals shown during the Hongsan culture excavation. Asian Comparative Folklore Society, 49, 45-99.

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2024 International Conference on Clothing and Textiles

제48회 정기총회

2023년도 사업보고

(2023.1.1 ~ 2023.12.31.)

1. 학술지 발간

 1) 한국의류학회지(KCI, SCOPUS) 발간
    총 6회 발간 : 47권 2, 4, 6, 8, 10, 12호, 국·영문 혼용
    총 수록논문 편수 : 71편
 2) Fashion and Textiles(KCI, SCOPUS, SCIE) 발간
    총 수록논문 편수 : 44편

2. 학술활동

 1) 춘계학술대회
  - 일 시 : 2023년 4월 15일(토) 09:00 ~ 18:00
  - 장 소 : 중앙대학교 310관(100주년기념관)
  - 주 제 : 패션과 새로운 공간의 힘

            Fashion and the Power of Emerging Space
  - 참가인원 : 교수, 일반 140명 + 대학원생 179명 + 비회원 5명 = 324명
  - 조직위원장   : 이규혜 (한양대)
   부조직위원장 : 이유리 (서울대)
   조 직 위 원 : 강여선 (덕성여대), 구수민 (연세대), 권하진 (서울여대),
                김동은 (이화여대), 김순영 (전북대), 김영삼 (중앙대),
                김용주 (한성대), 김주연 (서울대), 노주현 (충남대),
                문희강 (배재대), 박민정 (이화여대), 여은아 (계명대),
                우홍주 (연세대), 유신정 (경희대), 윤창상 (이화여대),
                이선희 (동아대), 이예진 (충남대), 최수아 (단국대)
  - 주제강연 및 Special Topic Session:

   · 주제강연 I.
    - 주 제 : '더 현대 서울 성공사례'
    - 강연자 : 정지영 부사장 (현대백화점)
    - 사회자 : 이규혜 FTEX 편집위원장

· 주제강연 II.
  - 주　제 : 'Iconic Space'
  - 강연자 : 정구호 아트 디렉터
  - 사회자 : 이유리 한국의류학회지 편집위원장

· Special Topic Session I.
  - 주　제 : 의류소재의 새로운 확장
  - 강연자 :
    ·다시 태어나기 위한 되돌림:
    박노만 부장 (효성티앤씨 나일론 폴리에스터 Performance Unit)
    ·비건소재 기술동향: 이도현 수석연구원 (DYETEC)
    ·목재 자원 및 농업 폐기물 등을 활용한 스피노바의 친환경 섬유 개발
    김은영 책임연구원 (Spinnova)
  - 사회자 : 김주연 교수, 김유겸 본부장

· Special Topic Session II.
  - 주　제 : 패션 X 공간, 새로운 전략적 함의
  - 강연자 :
    ·현실과 가상 공간의 연결: 미러시티(Mirror City): 최형욱 부사장 (시어스랩)
    ·플래그쉽 스트어, 그 비효율의 아름다움에 관하여: 장윤일 대표 (계선)
  - 사회자 : 이유리 교수, 최수아 교수

· 분과별 학술발표회 : 구두발표-14편, 포스터발표- 116편

· 2023년도 춘계학술대회 우수논문발표상 수상자

〈구두부문〉

분　과	제　목	성　명(소 속)
패션마케팅	패션 버티컬 플랫폼 개인화 추천시스템의 사용자 경험에 관한 연구	박민지*·박현희·구양숙 (경북대)
의류소재시스템	TPU 소재를 이용한 3D 프린팅 로봇 손의 제어기 설계에 관한 연구 - A Study on the Controller Design of 3D Printed Robot Hand using TPU Material -	최영림*·박예은·이선희· 김종욱 (동아대)
의류설계생산	신축성 직물과 자수를 이용한 3차원 섬유구조물 제작	안지선*·강영훈·김성민　(서울대)
한국·아시아복식	백제 유물의 자수 문양을 활용한 의류 금박 개발	최 정 (원광대)

〈포스터부문〉

분 과	제 목	성 명(소 속)
패션마케팅	메타버스에서의 자기 확장 -인지된 상호작용성과 가상·실물제품 구매의도를 중심으로-	안서영·진병호*·조희경 (North Carolina State University)
	패션 소비자들의 리테일 기술 수용도에 대한 메타분석 연구 -기술수용모델(TAM)을 중심으로-	위지원*·이애우·임수연·료초교·이윤정 (고려대)
의류소재시스템	수분 전달 성능과 항균성을 갖춘 복합기능성 텍스타일 개발	이세림·이승신* (연세대)
의류설계생산	실물착의와 가상착의 시 의복압에 영향을 미치는 변인 탐색	김남임*·이효정 (공주대)
패션디자인	Development of customized textile design using AI technology	정다울*·서성은 (가천대)
한국·아시아복식	2020년 전후 중국 '신중국풍' 여성복 패션디자인 특성 연구 -스캠퍼(SCAMPER) 기법을 적용하여-	오육용*·김순영 (전북대)

2) 추계학술대회
- 일 시 : 2023년 10월 21일(토) 09:00 ~ 18:00
- 장 소 : 서울대학교 글로벌공학교육센터(38동)
- 주 제 : "The Power of Fashion Education: the Key to the Future
　　　　　패션 교육의 힘: 미래를 여는 열쇠"
- 참가인원 : 교수, 일반 119명 + 대학원생 202명 + 비회원 4명 = 325명
- 조직위원장 : 하지수 (서울대)
　부조직위원장 : 이규혜 (한양대)
　조 직 위 원 : 김세진 (창원대), 김순영 (전북대), 김은영 (충북대),
　　　　　　　　노정심 (상명대), 윤창상 (이화여대), 이예영 (고려대),
　　　　　　　　이정임(배재대), 최미영 (덕성여대), 최수아 (단국대), 최정 (원광대)

- 주제강연 및 Special Topics:

· 주제강연 I.
　- 주 제 : '패션 교육에 대한 함의: 산업인력개발학의 관점에서'
　- 강연자 : 정철영 교수 (서울대학교)
　- 사회자 : 하지수 수석부회장

· 주제강연 II.
　- 주 제 : '글로벌 환경변화에 따른 Vendor의 역할'
　- 강연자 : 황일서 상무 (세아상역 사업담당)
　- 사회자 : 홍희숙 부회장

· 주제강연 Ⅲ.
 - 주 제 : '럭셔리 브랜드 사업환경 변화와 요구되는 인재상'
 - 강연자 : 김태형 (Head of Retail, CHANEL Korea 패션시계보석사업부)
 - 사회자 : 이경화 부회장

· Special Topic Session I.
 - 주 제 : 패션산업 스마트팩토리와 물류 시스템
 - 강연자 :
   ·패션산업을 위한 스마트공장의 이해와 지능정보기술 응용:
   이두원 대표 ((주)아니스트)
   ·봉제 생선 라인의 디지털 전환 적용 기술 및 사례:
   김태강 대표 ((주)이아이시스템)
 - 사회자 : 최수아 교수

· Special Topic Session II.
 - 주 제 : K-패션의 미래 패션소재기획
 - 강연자 :
   ·2024년 소비자 환경과 패션소재 트렌드: 이은희 대표 ((주)트렌드인코리아)
   ·에콜로지, 글로벌 트렌드 소재기획: 김정규 기술고문 (창의물산(주))
 - 사회자 : 노정심 교수
 - 토론자 : 서성은(가천대), 이정수(이화여대), 이재경(가천대), 윤창상(이화여대)

· Special Topic Session Ⅲ.
 - 주 제 : 각급 교육기관에서의 패션교육현황과 현안
 - 강연자 :
   ·일반계열 고등학교의 의류관련교육현황과 현안: 위은하 교수 (전남대)
   ·특성화 고등학교의 패션교육현황과 현안: 전현주 연구부장 (성동글로벌고등학교)
   ·2·3년제 대학 의류학 전공에서의 NCS 활용 현황 : 김태연 교수 (서원대)
 - 사회자 : 손수영 교수
 - 토론자 : 권유진 (교육과정 평가원)

· Special Topic Session Ⅳ.
 - 주 제 : 한국적 spirit의 개발과 적용
 - 강연자 : 박선옥 대표 디자이너 (생성 공간 여백)
 - 사회자 : 김순영 교수

· 분과별 논문발표 : 구두발표- 24편, 포스터발표- 83편

· 2023년도 추계학술대회 우수논문발표상 수상자

〈구두부문〉

분 과	제 목	성 명(소 속)
패션마케팅	Exploring the Impact of Aha! Moments on Brand Experiences -A Study on Distant Domain Concept Stores-	Jin Rongren·Eunsoo Baek (Hanyang University)
의류소재시스템	직물의 젖음성과 오염이 세균 부착에 미치는 영향	홍혜림·김주연 (서울대)
의류설계생산	여군의 근골격계 질환 예방을 위한 기능성 웨어 착용 효과	이옥경·박선희·이예진 (충남대)
패션디자인	패션제품의 업사이클링 디자인 단계에 따른 선호도 -Z세대 소비자와 Re;code를 중심으로-	서유나·신현경·이지안·윤초롱·이윤경 (부산대)
한국·아시아복식 (구두+포스터)	국가등록문화유산 색복장려깃발의 제작 및 수리 시기 추정	박성희·안보연·윤창상 (이화여대·국립문화재연구원)

〈포스터부문〉

분 과	제 목	성 명(소 속)
패션마케팅	메타버스 점포의 가상성이 창의적 소비에 미치는 영향 -몰입 경험의 매개효과와 창의적 제품 추구 성향의 조절효과 검증-	김우빈·이하경 (코넬대·충남대)
	Exploring the Impact of Background Inconsistency on Consumers' Negative Feelings toward Virtual Influencers	Minjoo Song·Jeeweon Wee·Namhee Yoon·Yoon-Jung Lee (Korea University)
의류소재시스템	스크린 프린트 텍스타일 회로의 기판 원단과 메쉬 크기에 따른 저항 특성	임효빈·노정심 (상명대)
의류설계생산	A Survey on the Consumer Status for the Development of Handmade Shoes Ordering System	Jongkyu Lee·Hosun Lim (Sookmyung Women's University)
패션디자인	수용미학 관점에서 살펴본 패션 유튜브 콘텐츠 분석	이지선·박주하 (서울대)

3) 분과 및 지부 학술행사

〈패션마케팅분과〉
(1) 2023년도 패션마케팅분과 동계세미나 개최
 - 일시: 2023년 1월 17일(화) 10:00~11:30
 - 장소: 온라인 ZOOM (Live Streaming)

- 주제: 패션인터스트리의 기술혁신과 IP전략
- 강연자: 고영희 (서울과학종합대학원 경영대학원 교수)
- 대상: 한국의류학회 회원 및 대학원생 50명

(2) 2023년도 패션마케팅분과 하계세미나
- 일시: 2023년 6월 23일(금) 오전 10:30~12:20
- 장소: 온라인 Zoom 세미나
- 주제: Chat-GPT, AI 시대 생존전략-
  패션비지니스 전략 수립을 위한 Chat-GPT에 대한 이해 및 활용사례 공유
  1) Chat-GPT에 대한 이해와 AI 트렌드 생태계
    (강연자: 고려대학교 인공지능학과 이상근 교수님)
  2) AI 시대, 패션 비즈니스 생존전략 수립을 위한 Chat-GPT 활용 어디까지?
    (강연자: PFIN firstviewkorea 유수진 대표님)
- 참석인원: 144명

(3) 하계워크샵
- 일시: 2023년 8월 28일(월) 오전 11:00-12:30
- 장소: 청담동 RE;CODE 플래그쉽 스토어
- 주제: RE;CODE 청담 플래그쉽 스토어 견학 및 RE;TABLE 체험
    강연자: 한란, 코오롱 FNC RE;CODE
- 참석인원: 패션마케팅분과 운영위원 17명

〈의류설계생산분과〉
(1) 2023년 한국의류학회 의류설계생산분과 동계세미나
- 일시: 2023년 2월 23일 (목) 14:00~17:00
- 장소: 온라인 (Zoom)
- 주제
  세션 1: Adobe Substance 3D: 3D 가상 의류와 그 확장성
  세션 2: VMOD 3D Library-IRL 패션과 URL 패션의 경계를 허물다
- 참석인원: 70명

(2) 하계세미나 (1)
- 일시: 1차) 2023년 7월 7일(금) AM 10:00~12:00
        2차) 2023년 7월 21일(금) AM 10:00~12:00
- 장소: 온라인
- 주제 및 강연내용: 메타버스와 디지털 패션 교육

- 참석인원: 45명

(3) 하계세미나 (2)
　- 일시: 2023년 7월 14일(금) AM 10:00~12:00
　- 장소: 온라인
　- 주제 및 강연내용: 패션 이미지데이터 활용능력 강화를 위한 전문가 초청 세미나
　- 참석인원: 23명

(4) 하계세미나 (3)
　- 일시: 2023년 7월 28일(금) AM 10:00~12:00
　- 장소: 온라인
　- 주제 및 강연내용: 메타버스 활용 가상 의류개발 실습 교육
　- 참석인원: 31명

(5) 하계세미나 (4)
　- 일시: 2023년 8월 28일(월) AM 10:00~17:00
　- 장소: 온라인
　- 주제 및 강연내용: 예비 여성과학기술인 대상 메타버스 크리에이터 교육
　- 참석인원: 40명

(6) 여성과총 단체지원사업 워크샵
　- 일시: 2023년 7월 25일(화) 12:00~14:00
　- 장소: 리샨 삼성타운점
　- 주제 및 강연내용: 여성과총 단체지원사업 워크샵 "Ally skills workshop"
　- 참석인원: 15명

〈패션디자인분과〉
(1) 패션디자인분과 하계세미나
　- 일시: 2023년 6월 3일(토) 오전 10시 ~ 12시
　- 장소: 온라인 Zoom
　- 주제 및 강연내용: 무신사 ESG 경영과 패션장학프로그램
　· 지속가능한 패션 생태계 선순환 기여를 위한 '무신사의 EGS활동'
　· '무신사 패션 장학 프로그램'의 목적과 취지 및 활동혜택
　· 패션 특화 공유 오피스 '무신사 스튜디오' 소개
　　- 참석인원: 총 140명

〈한국·아시아복식분과〉

(1) 하계세미나
  - 일시: 2023년 8월 25일(금) 오전 10:00~12:00
  - 장소: 전북대학교 생활과학대학(7-1) 312호
  - 주제 및 강연내용: 한국 전통누비 체험(무명누비필통 만들기)
  - 참석인원: 17명

〈부산·울산·경남 지부〉

(1) 학술세미나
  - 일시: 2023년 5월 12일 오후 1:30 ~ 3:30
  - 장소: 더 파티 센텀점
  - 주제: 패션, 또 하나의 확장
  - 참석인원: 참석 24명

(2) 학술세미나
  - 일시: 2023년 11월 10일 오후 1:30 ~ 4:00
  - 장소: 부산패션비즈센터
  - 주제: "Fashion's Dual Landscape"
  - 참석인원: 참석 63명

〈대구·경북 지부〉

(1) PID 전시회
  - 일시: 2023년 3월 2일(목) ~ 4일(토)
  - 장소: EXCO 1층 전시장
  - 내용: 2023 PID 한국의류학회 교수작품 초대전
  - 주제: 경상도 골무제작기법을 응용한 소품이야기

〈해외 지부〉

(1) 해외 지부는 올해 Linkedin에 해외 지부 소모임 그룹을 만들어서 활동 중:
  현재 33 멤버가 가입하였고, 이 공간을 통해서 한국의류학회 관련된 소식과
  (ITAA-KSCT 심포지엄) 온라인 참석 가능한 행사 정보를 공유

3. 조직강화
  - 정회원   : 658명
  - 평생회원 : 4명

4. 재정강화

1) 한국의류학회지 후원 : 한국과학기술단체총연합회 11,080,000원
　　　　　　　　　　　　　우양신소재 3,000,000원

　찬조(광고협찬) : 영원무역 20,000,000원, 글로벌세아 10,000,000원
　　　　　　　　　한국섬유수출입협회 6,250,000원

2) Fashion & Textiles 후원 : 한국과학기술단체총연합회 14,580,000원

3) 학술대회 후원
　- 춘계학술대회 : 한국학술정보 7,000,000원
　　　　　　　　　한국섬유산업연합회 2,000,000원
　　　　　　　　　다이텍연구원 2,000,000원
　　　　　　　　　중앙대 예술문화연구원 300,000원
　　　　　　　　　경춘사, 교문사 각 300,000원
　- 추계학술대회 : 씨에잇플래닛 1,000,000원, 지모우션 1,000,000원
　　　　　　　　　경춘사, 교문사, 교학연구사 각 300,000원

　- 산학연포럼 : 호원실업 3,000,000원, 다산투자자문 2,000,000원

4) 제14회 패션상품기획콘테스트 후원
　협찬금, 브랜드 상품 제공 :
　㈜돌실나이, 신성통상㈜, ㈜영원아웃도어, ㈜이영주컬렉션, ㈜인동FN

5) 한국의류학회지 인세(한국학술정보): 10,000,000원

5. 산·학·연 협동사업

1) 2023년도 산학연포럼
　- 일 시 : 2023년 2월 22일(수) 오후 1시 30분 ~ 5시 20분
　- 장 소 : 섬유센터 17층 대회의실
　- 주 제 : 2023 한국 패션, 새로운 도약을 위한 도전
　- 주 최 : (사)한국의류학회, 한국섬유산업연합회
　- 후 원 : 한국패션산업협회, 호전실업(주), ㈜다산투자자문
　- 참석인원 : 76명

〈프로그램〉

·주제강연1: 글로벌 의류 유통 변화에 대한 대응책

　　　　　강연자: 박용철, 호전실업(주) 회장

·주제강연2: MZ세대 정의, 특징, 소비성향

　　　　　강연자: 김기환, 어바웃블랭크앤코 대표

·주제강연3: Hilight Brands

　　　　　강연자: 이준권, 하이라이트브랜즈 대표

·패널토론: K패션의 가능성

　- 이재원, 호원실업 상무

　- 김기환, 어바웃블랭크앤코 대표

　- 이준권, 하이라이트브랜즈 대표

　- 유은진, 스타트업 쉘코퍼레이션 대표

　- 김용주, 한성대학교 교수

2) 한국여성과학기술단체총연합회 단체사업

　- 사 업 명 : 디지털 콘텐츠 활용을 통한 의류전문 여성과학기술인 임파워먼트 사업

　- 사업기간 : 2023년 4월 1일 ~ 2023년 11월 10일

　- 사업금액 : 6,000,000원

　- 책 임 자 : 이정임 교수 (배재대)

3) 한국학술단체총연합회 학술용어정비사업

　- 사 업 명 : 학술용어정비사업 (분야 : 복식)

　- 사업기간 : 2023년 7월 ~ 2023년 12월

　- 사업금액 : 17,750,000원

　- 책 임 자 : 이윤정 교수 (고려대)

4) 제14회 패션상품기획콘테스트 개최 및 시상

 - 일 시 : 2023년 10월 21일(토) 12시 30분 ~ 14시

 - 장 소 : 서울대학교 글로벌공학교육센터(38동)

 - 참가인원 : 국내 대학 215팀이 참가신청

 - 수 상 : 브랜드상 : 9팀, 우수상: 2팀, 장려상 : 35팀, 입선 : 49팀

　　　　(한국의류학회 심사위원회 심사 후, 각 브랜드의 최종심사)

- 브랜드상 수상자

브 랜 드	브랜드상 수상자
꼬마크	최승현, 김태연, 서하얀, 조예나 (서울여대)
노스페이스	강지현, 김지수, 심예린, 홍서현, 손민정 (수원대) 김율희, 이유미, 김유정, 전소영 (덕성여대)
돌실나이	김채린, 오상은, 이수민 (충남대)
리스트	윤다빈, 고현아, 손연수 (대구가톨릭대)
쉬즈미스	구본혁, 유지인, 구현모, 김준호 (한성대)
시스티나	박지현, 박재경, 오정주, 유민영, 임민하 (이화여대)
이영주컬렉션	임승욱, 서진영, 정윤성 (가천대)
탑텐	김세은, 양현아, 장정문 (고려대)

- 기획위원:

　회　장 : 이윤정 (고려대)

　위　원 : 하지수 (서울대), 최수아 (단국대)

- 운영 및 심사위원:

　위 원 장 : 최미영 (덕성여대)

　심사위원 : 김승현 (국민대), 노주현 (충남대), 박민정 (이화여대),
　　　　　　　양희순 (상명대), 최미영 (덕성여대), 최수아 (단국대)
　　　　　　　후원 브랜드 임원 및 부서장

6. 특별사업

1) 제20회 이흥수저술상 수상자

- 수상자: 유혜경 교수 (인천대)

- 저　서: '실무를 위한 패션산업 이해' (수학사, 개정판-2017년)

2) 제13회 영원신진학자학술상 수상자

- 사회계열: 최영현 (한국과학기술대)

- 자연계열: 윤창상 (이화여대), 한현정 (충북대)

- 제13회 공고 및 신청서 접수 : 2023년　11월 7일 공고
　　　　　　　　　　　　　　　　 2023년　1월 31일 신청서 접수 마감
　　　　　　　　　　　　　　　　 2023년　4월 15일 시상

3) 한국과학기술단체총연합회 "제34회 과학기술우수논문상" 수상자

- 의류소재시스템분과: 이선희 교수 (동아대)

4) 한국의류학회지 우수논문상, 우수심사위원상 수상자
 (1) 우수논문상
· 패션마케팅분과1: 장세윤·김하연 (서울대/군산대)
  패션마케팅분과2: 추호정·장주연 (서울대/HongKong Polytech University)
 ; 1. 딥러닝을 통한 하이엔드 패션 브랜드 감성 학습
  2. 베트남 MZ세대의 다차원적 소비가치에 대한 연구
-소비가치 요인과 인구통계학적 특성 및 글로벌 소비성향의 관련성을 중심으로-
· 의류소재시스템분과: 노정심 (상명대)
 ; 스마트 웨어러블 회로 구성을 위한 고신축성 이선 전송선형 전자섬유 밴드
· 의류설계생산분과: Xiang Liu·서추연 (XianYang Normal University/동아대)
 ; Development of Rushan (襦衫) and Qun (裙) Patterns for Traditional Chinese
   Wedding Dresses Using a Virtual Fitting Program
· 패션디자인분과: 김가현·하지수 (서울대)
 ; 포스트하위문화 관점의 한국 타투문화
· 한국·아시아복식: 김순영 (전북대)
 ; 개항기 일본으로부터 수입된 직물 상품의 종류와 무역 특성
   -면직물, 견직물, 모직물을 중심으로-

 (2) 우수심사위원상
  - 패션마케팅   : 이하경 (충남대)
  - 의류소재시스템: 이아람 (경북대)
  - 의류설계생산 : 이은경 (부산대)
  - 패션디자인   : 채영주 (충북대)

5) Fashion and Textiles Best Paper Award, Best Reviewer Award 수상자:
 (1) 2023 Best Paper Award
  - Textile Science & Technology / Clothing Science and Technology :
    논문제목: Numerical investigation of heat transfer in a garment convective
              cooling system (2022.01)
    저자: Yijie Zhang, Juhong Jia & Ziyi Guo
  - Economics of Clothing and Textiles / Fashion Business :
    논문제목: Coronavirus versus the textile industry: cluster lessons for
              future challenges (2022.03)
    저자: Francisco Puig, Santiago Cantarero & Francesco Verdone

- Fashion Design and Cultural Study on Fashion :

  논문제목: 3D dynamic fashion design development using digital technology and
  its potential in online platforms (2022.03)

  저자: Kyung-Hee Choi

(2) 2023 Best Reviewer Award
- Textile Science & Technology : Yoon Jeong Baek, Seoul National University
- Clothing Science & Technology : Do-hee Kim, Seoul National University
- Economics of Clothing and Textiles/Fashion Business :
  Ha Kyung Lee, Chungnam National University
- Fashion Design and Cultural Study on Fashion :
  Hyosun An, Ewha Womans University

7. 뉴스레터 제작:
- 2023년 2월 8일, 2023년 8월 1일에 발간 (총 2회)

2023년도 결산보고

(2023.1.1 ~ 2023.12.31.)

1. 수입지부 (단위: 원)

항 목	2023년 예산	2023년 결산	% (예산대비)	비 고(2023년도 결산내용)
A.전년도이월금	156,470,101	156,470,101	100	
	EUR4,064.82	EUR4,064.82	100	
1. 적립이입금	1,200,000	4,758,614	397	평생회비 이자수입
2. 특별회계 전입금	0	129,467,547		고정자산에서 차용(학회 발전기금통장 해지)
3. 회비	21,300,000	37,760,002	177	
1)정회원	18,000,000	26,510,002	147	(30,000원*320명)+(50,000원*338명)
2)단체회원,특별회원,준회원	700,000	850,000	121	10,000*85명
3)평생회원	1,800,000	2,400,000	133	600,000원*4명
4)평의원	800,000	8,000,000	1,000	100,000원*80명
4. 학회지 논문게재료	50,000,000	42,563,706	85	
	EUR60,000	EUR62,958.71	104	
1)한국의류학회지	50,000,000	42,563,706	85	논문투고료 및 게재료(6회 발간)
2)Fashion & Textiles	EUR60,000	EUR62,958.71	104	스프링거 환급금(유로)
5. 학회참가비	16,000,000	19,917,000	124	
1)춘계학술대회	8,000,000	9,594,000	120	(40,000원*145명)+(20,000원*64명)+(10,000원*115명)+포스터비용
2)추계학술대회	8,000,000	10,323,000	129	(50,000원*104명)+(30,000원*67명)+(10,000원*135명)+포스터비용
3)ICCT (국제학술대회)	0	0		
6. 학회사업	25,000,000	51,824,600	207	
1)산학연포럼	4,000,000	2,280,000	57	2023년도 산학연포럼 참가비
2)패션상품기획콘테스트	18,000,000	18,600,000	103	
*상금후원금	12,000,000	13,300,000	111	브랜드후원금
*참가비	6,000,000	5,300,000	88	참가신청금(2만원*265명)
3)ITAA-KSCT Joint Symposium	0	16,194,600		참가비(교수: 880,200*9명, 학생 참가비: 517,050원*16명)
4)연구용역 및 특별사업	3,000,000	14,750,000	492	여과총단체사업비(600만원), 섬산연사업(875만원)
7. 학술상 상금	15,000,000	14,877,177	99	
1)이흥수저술상	5,000,000	4,962,047	99	이흥수저술상 상금
2)영원신진학자학술상	10,000,000	9,915,130	99	영원신진학자학술상 상금
8. 보조금	50,000,000	27,660,000	55	과기총(2,566만원), 섬산연(200만원) 지원
9. 찬조금	60,000,000	57,050,000	95	광고협찬(영원무역2,000만원(22년,23년도광고비), 글로벌세아1,000만원, 한국섬유수출입협회광고비6,250,000원) 학술대회찬조금(한국학술정보700만원, 중앙대예술문화연구원30만원, 다이텍연구원200만원, 씨에잇플래닛100만원, 지모우션100만원, 경춘사30만원, 교문사60만원, 교학연구사60만원) 산학연포럼찬조(호원실업300만원, 다산투자자문200만원) 한국의류학회지찬조(우양신소재300만원)
10.기타	11,100,000	13,235,026	119	
1)이자수입	100,000	173,996	174	예금이자
2)잡수입	11,000,000	13,061,030	119	한국학술정보인세(1,000만원), 법인세환급금(526,030원), 여과총 오버비 (60만원), 학총사업 오버비(87만원), 섬산연사업 오버비(875,000원) 외
11.임대수입	0	39,780,721		보증(2,000만원), 임대료(132만원/10개월), 상생후원 이자(6,580,721원)
B.금년도실수입합계	249,600,000	438,894,393	176	
	EUR60,000	EUR62,958.71	104	
총 계(A+B)	**406,070,101**	**595,364,494**	**147**	**전년도이월금 포함**
	EUR64,064.82	**EUR67,023.53**	**104**	

2. 지출지부

<div align="right">(단위: 원)</div>

항 목	2023년 예산	2023년 결산	% (예산대비)	비 고(2023년도 결산내용)
1. 운영비	88,120,000	73,853,408	84	
1)인건비	69,500,000	63,299,295	91	
*사무국장,한국의류학회지 편집간사 월급여	53,500,000	46,351,535	87	인건비
*Fashion & Textiles 보조간사, 학술대회 보조간사 수고비	16,000,000	16,947,760	106	FTEX 편급간사 급여 외, 춘계학술대회 인건비(100만원)
2)사무비	3,320,000	2,570,000	77	사무용품 ;
*소모품비	1,000,000	411,720	41	*문구, 복사지, 기타 소모품
*회계지급수수료	1,320,000	1,320,000	100	*회계수수료
*카드수수료	1,000,000	838,280	84	*이니시스+카드기
3)통신비	1,800,000	1,592,430	88	통신전화비 ;
*우편 및 발송용역비	300,000	135,880	45	*발송용역비 및 우편
*통신,전화	1,500,000	1,456,550	97	*통신, 전화요금 외
4)홈페이지 관리비	3,500,000	0	0	관리비, 홈페이지 시스템비 외
5)홍보비	3,000,000	2,480,000	83	관련기관 연회비(과총, 여과총 연회비), 뉴스레터 제작
6)기본관리비	3,500,000	1,023,710	29	관리비+가스비 (구사무실 22년12월~23년 2월 13일)
7)잡비	2,000,000	2,329,113	116	법인등기(1,062,320원), 섭외비 및 업무비용, 화환 외
8)기기구입 및 기기관리비	1,000,000	0	0	기기 구입 및 수리
9)수수료 외	500,000	558,860	112	주민세(62,500원), 임대부가세(496,300원)
2. 학술지 사업비	42,000,000	38,789,210	92	
	EUR35,000	EUR29,025	82	
1)한국의류학회지	41,000,000	38,756,210	95	총6회 발간
*편집비	10,000,000	15,190,710	152	*투고논문 사독비, 영문에디팅, 참고문헌 편집
*출판비	31,000,000	23,565,500	76	*출판비+XML구축(187만원)
*발송용역비/우편비	0	0		*학회지 발송비/우편비
2)Fashion & Textiles	1,000,000	33,000	3	44편 발행
	EUR35,000	EUR29,025	82	
*차년도 발행비	0	0		
	EUR35,000	EUR29,025	82	발행비
*에디팅비	500,000	0	0	논문검수 및 자문료
*기타	500,000	33,000	7	기타(수수료)
3.학술대회 개최비	40,000,000	31,107,069	78	
1)춘계학술대회	20,000,000	12,330,320	62	*정기총회 및 춘계학술대회
2)추계학술대회	20,000,000	18,225,360	91	*추계학술대회
3)ICCT(국제학술대회)	0	551,389		*도메인등록(361,389원)+홍보물제작(19만원)
4.학회 사업비	28,000,000	53,734,212	192	
1)산학연 포럼	5,000,000	2,157,100	43	2023년도 산학연포럼 개최비
2)패션상품기획콘테스트	12,000,000	14,924,400	124	패션상품기획콘테스트 행사비 및 상금
3)ITAA-KSCT Joint Symposium	0	15,890,112		25인 참가비 및 행사지원(배너 및 출력물)
4)연구용역 및 특별사업	3,000,000	13,715,000	457	여과총 단체사업비(600만원)/ 섬산연사업비(7,715,000원)
5)분과/지부 활동비 지원	4,000,000	3,820,000	96	각 4분과(200만원), 5지부(182만원) 지원비
6)기타	4,000,000	3,227,600	81	후원사 및 고문님 명절 인사
5. 학술상	15,000,000	15,000,000	100	
1)이흥수저술상	5,000,000	5,000,000	100	상금
2)영원신진학자학술상	10,000,000	10,000,000	100	상금 및 상패, 심사료
6. 회의비	8,600,000	5,004,560	58	
1)회장단회의	1,000,000	0	0	회장단회의비
2)이사회의	3,000,000	4,079,980	136	신년인사회/이사회의
3)편집회의	1,500,000	647,900	43	편집회의
*한국의류학회지	1,000,000	647,900	65	연 1회
*Fashion & Textiles	500,000	0	0	

4)감사회의	200,000	12,000	6	연1회
5)평의원회의	1,000,000	0	0	
6)이흥수저술상 회의	200,000	0	0	연1회
7)영원신진학자학술상 회의	200,000	0	0	연1회
8)선거관리위원회 회의	500,000	264,680	53	
9)연구윤리위원회 회의	500,000	0	0	수시
10)기타	500,000	0	0	
7. 예비비	5,000,000	0	0	
8. 특별회계적립금	1,800,000	202,400,000	11,244	평생회비 240만원 적립+과총 상생후원사업 적립금(2억원)
9. 사무실임대	0	39,314,670		과총회관 보증금(9,804,000원) 및 임대 및 관리비 (1,964,000원/월) 이사 비용 및 가구 외 8,575,570원
금년도 지출 총액	**228,520,000**	**459,203,129**	**201**	
	EUR35,000	**EUR29,025**	**82**	
차기년도 예산유보분	177,550,101	136,161,365	77	
	EUR29,064.82	EUR37,998.53	130	
총 계	**406,070,101**	**595,364,494**	**147**	
	EUR29,064.82	**EUR37,998.53**	**130**	

감 사 보 고 서

사단법인 한국의류학회의 2023년 1월 1일부터 12월 31일
까지 사업실적과 고정자산내역 및 종료된 회계년도의 수지
계산서를 포함한 2023년도 결산서를 감사한 결과 그 내용이
적정함을 확인함.

2024년   2월

감 사   고 애 란 (인)

감사보고서

  사단법인 한국의류학회의 2023년 1월 1일부터 12월 31일
까지 사업실적과 고정자산내역 및 종료된 회계년도의 수지
계산서를 포함한 2023년도 결산서를 감사한 결과 그 내용이
적정함을 확인함.

2024년   2월

감 사   오 경 화

확 인 서

2023년도 (사)한국의류학회 결산자료를
검토한 결과 이상이 없음을 확인합니다.

2024년   2월

공인회계사   최 정 준 (인)

2024년도 사업계획안

사 업 명	단위사업	예 정 일
1. 학술지발간	1) 한국의류학회지 발간 　·국·영문 혼용(연 6회 발간) 2) Fashion & Textiles 발간 　·영문(연 40편 발간)	제48권 (2024년) 1호 : 2월말 2호 : 4월말 3호 : 6월말 4호 : 8월말 5호 : 10월말 6호 : 12월말 매달 3~4편 발행
2. 학술활동	1) 2024 ICCT 국제학술대회 2) 추계학술대회 3) 분과·지부의 분야별 워크샵 개최	2024. 5. 10(금)~11(토) 예정 2024. 10. 19(토)예정 수시
3. 산·학·연 협동사업	1) 산학연 포럼 개최 2) 정부·지방자치단체와의 협력사업 　: 한국섬유산업연합회, 　　한국여성과학기술단체총연합회 외 3) 패션업체와의 협력사업 　·패션상품기획콘테스트	2024. 상반기 예정 수시 2024.03 공지 2024.10 시상
4. 특별사업	1) 학술상 　·이흥수저술상 　·영원신진학자학술상 2) 포상 　·우수논문상- 한국의류학회지 　　　　Fashion and Textiles 　·우수심사위원상- 한국의류학회지 　　　　Fashion and Textiles 3) 한국과학기술단체총연합회 우수논문상 4) 국제학술교류	2024. 상반기 춘계, 추계학술대회에서 시상 수시
5. 조직강화	1) 정회원, 단체회원, 특별회원 증가 2) 분과 및 지부 활동 강화 3) 유관업체 및 유관학회와의 유대강화	수시
6. 재정강화	1) 회비수입의 증대 2) 보조금 증대 3) 찬조금 증대(학회지 광고수입 확대)	수시

2024년도 예산안

(2024.1.1 ~ 2024.12.31.)

1. 수입지부 (단위: 원)

항 목	2023년 결산	2024년 예산	% (결산대비)	비 고(2024년도 예산내용)
A.전년도이월금	156,470,101	136,161,365	87	
	EUR4,064.82	EUR37,998.53	934	
1. 적립이입금	4,758,614	4,000,000	84	평생회비 이자수입
2. 특별회계 전입금	129,467,547	0		
3. 회비	37,760,002	35,800,000	95	
1)정회원	26,510,002	25,000,000	94	(30,000원*310명)+(50,000원*310명)
2)단체회원,특별회원,준회원	850,000	1,000,000	118	10,000*100명
3)평생회원	2,400,000	1,800,000	75	600,000원*3명
4)평의원	8,000,000	8,000,000	100	100,000원*80명
4. 학회지 논문게재료	42,563,706	40,000,000	94	
	EUR62,958.71	EUR29,000	46	
1)한국의류학회지	42,563,706	40,000,000	94	논문투고료 및 게재료(6회 발간)
2)Fashion & Textiles	EUR62,958.71	EUR29,000	46	스프링거 환급금(유로)
5. 학회참가비	19,917,000	29,000,000	146	
1)춘계학술대회	9,594,000	0	0	
2)추계학술대회	10,323,000	10,000,000	97	(50,000원*100명)+(30,000원*100명)+(10,000원*100명)+포스터비용
3)ICCT (국제학술대회)	0	19,000,000		(130,000원*100명)+(50,000원*100명)+포스터비용
6. 학회사업	51,824,600	36,500,000	70	
1)산학연포럼	2,280,000	2,500,000	110	참가비(3만원*83명)
2)패션상품기획콘테스트	18,600,000	19,000,000	102	
*상금후원금	13,300,000	14,000,000	105	브랜드후원금
*참가비	5,300,000	5,000,000	94	참가신청금(2만원*250명)
3)ITAA-KSCT Joint Symposium	16,194,600	0	0	
4)연구용역 및 특별사업	14,750,000	15,000,000	102	여과총단체사업비, 섬산연사업
7. 학술상 상금	14,877,177	15,000,000	101	
1)이흥수저술상	4,962,047	5,000,000	101	이흥수저술상 상금
2)영원신진학자학술상	9,915,130	10,000,000	101	영원신진학자학술상 상금
8. 보조금	27,660,000	30,000,000	108	과기총, 섬산연 지원
9. 찬조금	57,050,000	80,000,000	140	광고협찬, 학술대회찬조금, 산학연포럼찬조
10.기타	13,235,026	11,100,000	84	
1)이자수입	173,996	100,000	57	예금이자
2)잡수입	13,061,030	11,000,000	84	한국학술정보인세, 법인세환급금, 사업오버비 외
11.임대수입	39,780,721	20,000,000	50	임대료, 상생후원 이자
B.금년도실수입합계	438,894,393	301,400,000	69	
	EUR62,958.71	EUR29,000	46	
총 계(A+B)	**595,364,494**	**437,561,365**	**73**	**전년도이월금 포함**
	EUR67,023.53	**EUR66,998.53**	**104**	

2. 지출지부

항 목	2023년 결산	2024년 예산	% (결산대비)	비 고(2024년도 예산내용)
1. 운영비	73,853,408	83,920,000	114	
1)인건비	63,299,295	65,000,000	103	
*사무국장, 한국의류학회지 편집간사 월급여	46,351,535	49,000,000	106	인건비
*Fashion & Textiles 보조간사, 학술대회 보조간사 수고비	16,947,760	16,000,000	94	FTEX 편급간사 급여, 학술대회 보조
2)사무비	2,570,000	3,120,000	121	사무용품 ;
*소모품비	411,720	1,000,000	243	*문구, 복사용지, 기타 소모품
*회계지급수수료	1,320,000	1,320,000	100	*회계수수료
*카드수수료	838,280	800,000	95	*이니시스+카드기
3)통신비	1,592,430	2,200,000	138	통신전화비 ;
*우편 및 발송용역비	135,880	200,000	147	*발송용역비 및 우편
*통신,전화	1,456,550	2,000,000	137	*통신, 전화요금 외
4)홈페이지 관리비	0	6,600,000		관리비, 홈페이지 시스템비 외
5)홍보비	2,480,000	3,000,000	121	관련기관 연회비(과총, 여과총 연회비), 뉴스레터 제작
6)기본관리비	1,023,710	0	0	
7)잡비	2,329,113	2,000,000	86	섭외비 및 업무비용, 화환, 줌비용 외
8)기기구입 및 기기관리비	0	1,000,000		기기 구입 및 수리
9)수수료 외	558,860	1,000,000	179	주민세, 임대부가세 외
2. 학술지 사업비	38,789,210	45,350,000	117	
	EUR29,025	EUR35,000	120	
1)한국의류학회지	38,756,210	45,000,000	116	총6회 발간
*편집비	15,190,710	15,000,000	99	*투고논문 사독비, 영문에디팅, 참고문헌 편집
*출판비	23,565,500	30,000,000	127	*출판비+XML구축
*발송용역비/우편비	0	0		*학회지 발송비/우편비
2)Fashion & Textiles	33,000	350,000	1,061	44편 발행
	EUR29,025	EUR35,000	120	
*차년도 발행비	0	0		
	EUR29,025	EUR35,000	120	발행비
*에디팅비	0	0		논문검수 및 자문료
*기타	33,000	350,000	1,061	기타(수수료 외)
3.학술대회 개최비	31,107,069	75,000,000	241	
1)춘계학술대회	12,330,320	0	0	*정기총회 및 춘계학술대회
2)추계학술대회	18,225,360	20,000,000	110	*추계학술대회
3)ICCT(국제학술대회)	551,389	55,000,000	9,975	*국제학술대회
4.학회 사업비	53,734,212	44,000,000	82	
1)산학연 포럼	2,157,100	3,500,000	162	2024년도 산학연포럼 개최비
2)패션상품기획콘테스트	14,924,400	17,000,000	114	패션상품기획콘테스트 행사비 및 상금
3)ITAA-KSCT Joint Symposium	15,890,112	0	0	
4)연구용역 및 특별사업	13,715,000	15,000,000	109	여과총 단체사업/섬산연사업
5)분과/지부 활동비 지원	3,820,000	4,500,000	118	각 분과, 지부 지원비
6)기타	3,227,600	4,000,000	124	후원사 및 고문님 명절 인사

항 목	2023년 결산	2024년 예산	% (결산대비)	비 고(2024년도 예산내용)
5. 학술상	15,000,000	15,000,000	100	
1)이흥수저술상	5,000,000	5,000,000	100	상금
2)영원신진학자학술상	10,000,000	10,000,000	100	상금 및 상패, 심사료
6. 회의비	5,004,560	9,100,000	182	
1)회장단회의	0	500,000		회장단회의비
2)이사회의	4,079,980	4,000,000	98	신년인사회/이사회의
3)편집회의	647,900	1,500,000	232	편집회의
*한국의류학회지	647,900	1,000,000	154	연 1회
*Fashion & Textiles	0	500,000		
4)감사회의	12,000	200,000	1,667	연1회
5)평의원회의	0	1,000,000		
6)이흥수저술상 회의	0	200,000		연1회
7)영원신진학자학술상 회의	0	200,000		연1회
8)선거관리위원회 회의	264,680	500,000	189	
9)연구윤리위원회 회의	0	500,000		수시
10)기타	0	500,000		
7. 예비비	0	5,000,000		
8. 특별회계적립금	202,400,000	1,800,000	1	평생회비 적립
9. 사무실임대	39,314,670	25,000,000	64	과총회관 임대 및 관리비
금년도 지출 총액	459,203,129	304,170,000	66	
	EUR29,025	EUR35,000	120	
차기년도 예산유보분	136,161,365	133,391,365	98	
	EUR37,998.53	EUR31,988.53	84	
총 계	595,364,494	437,561,365	73	
	EUR37,998.53	EUR31,998.53	84	

한국의류학회 자산 내역

(2024년 1월)

부동산	분 류	주 소	매입가	비 고
	한국의류학회 사무국	서울특별시 영등포구 대림동1122 신대림자이아파트 201동 1305호 *기준시가(2023. 1. 1):3,012,000원/m²	200,000,000	2007년 10월 24일 구입 84m²/ 26평

(단위: 원)

기금	기 금 명 계 좌 번 호	예금 원금	만기시 지급이자	합 계	시작일 / 만기일	비 고
	한국과학기술단체총연합회 '상생하는 후원'	200,000,000	–	200,000,000	23.03.27 /23.12.31	*연말에 시중은행 금리 최고 이율로 연말로 이자 지급 (2023년 이자: 6,580,721원)
	평 생 회 비 Ⅰ 신한 200-837-116242	41,822,765	1,597,812 (연 3.81%)	43,420,577	23.12.29 /24.12.29	* 세금 공제 전
	평 생 회 비 Ⅱ 농협 303-9361-2253-01	76,800,000	3,371,520 (연 4.39%)	80,171,520	23.10.27 24.10.27	* 세금 공제 전
	이흥수저술상 신한 200-722-781615	30,000,000	31,128,082 (연 3.75%)	31,128,082	23.07.04 /24.07.04	* 세금 공제 전
	총 액	348,622,765	-	354,720,179	-	

운영자금	계 좌 번 호	예금	예금이자	합 계	만기일	비 고
	영원신진학자학술상 신한 230-290-700141	0	-	-	-	* 세금 공제 전
	외환통장(유로) 신한 180-008-369444	37,998.53 유로				
	운영자금 Ⅰ 신한 100-014-194016	58,491,516				* 입출금 통장
	운영자금 Ⅱ 농협 079-01-439051	5,791,452				* 평의원회비 통장
	운영자금 Ⅲ 한국의류학회지 신한 100-024-049377	71,878,397				* 입출금 통장
	총 액	136,161,365 37,998.53유로	-		-	

G. Total (기금+운영자금)	484,784,130원 + 37,993.53 유로

2024 섬유패션업계 CEO 포럼

TEXTILE & FASHION
CEO FORUM
BUSAN

일시 2024. 7. 10(수) - 12(금)

장소 아난티 앳 부산 코브

참가신청 | 카카오 채널

프로그램

날짜	시간	프로그램(안)
7.10 수요일	15:00-17:00	참가자 등록 및 칵테일 리셉션
	17:00-17:10	개회사 및 축사
	17:10-18:00	기조강연 350년 동안 망하지 않는 섬유패션기업의 비밀 🎤 서용구 숙명여자대학교 교수
	18:00-	개별 석식
7.11 목요일	08:30-09:20	강연1 세상은 나의 보물섬이다 🎤 김웅기 글로벌세아그룹 회장
	09:30-10:20	강연2 한국경제 전망과 개혁과제 🎤 조동철 KDI(한국개발연구원) 원장
	11:00-18:00	섬산련 회장배 골프대회 및 관광
	19:10-21:30	칵테일 리셉션(스탠딩) 및 네트워킹, 환영 만찬
7.12 금요일	08:00-09:00	합동 조찬
	09:10-10:20	강연3 한국미술의 아이덴티티: 국토박물관 순례 🎤 유홍준 명지대학교 석좌교수
	10:20-10:30	폐회
	11:00-18:00	체크아웃 및 자유일정

Jeju Science Park

The 2nd Jeju Science Park

Jeju Aerospace Museum

Jeju Healthcare Town

Myths & History Theme Park

Global Education City

We enhance the value of Jeju with right-thinking!

To pursue the happiness of people,

We strive to preserve the nature, culture and value of Jeju.

For the youth, we drive the project to create more jobs.

And we support the local communities to revive local economy.

It is time to move on to equal happiness rather than rapid growth!

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JDC 제주국제자유도시개발센터
JEJU FREE INTERNATIONAL CITY DEVELOPMENT CENTER

LG SIGNATURE 세탁건조기

세탁에서 건조까지
하나의 도어 안에서

새로운 세탁건조의 시대

comgen