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Exploring design and technological aspects of digital fashion: a systematic review of recent innovations

Olga Yezhova ^a, Simiao Wu ^b, Kalina Pashkevych ^c, Maryna Kolosnichenko ^d, Nataliia Ostapenko ^d and Tetiana Struminska ^d

^aDepartment of Graphic Design, Kyiv National University of Technologies and Design, Kyiv, Ukraine; ^bDepartment of Digital Media Art, Beijing Technology and Business University, Beijing, People's Republic of China; ^cFaculty of Design, Kyiv National University of Technologies and Design, Kyiv, Ukraine; ^dDepartment of Fashion and Style, Kyiv National University of Technologies and Design, Kyiv, Ukraine

ABSTRACT

This study examines the state of research in the field of digital fashion, specifically focusing on design and production. The authors propose a definition for digital fashion as the 'virtual creation, production, and depiction of an individual's identity, in particular in the field of clothing and footwear, through computer-aided design'. Using PRISMA 2020 guidelines, 386 publications from the Web of Science database have been selected for the systematic review. A keyword map was created based on bibliographic data, and a cluster analysis of the publications revealed five main clusters. The analysis of articles shows that the most frequently mentioned topics are design, fashion, social media, and technology. Sustainability, digital fashion, and performance are also frequently discussed.

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Digital fashion; design; technology; textile; computer-aided design

1. Introduction

Digital fashion design has become an essential tool for fashion professionals to streamline the design process, reduce waste, and improve the overall efficiency of the fashion industry. This technology not only simplifies the design process but also provides designers with more creative and stylistic opportunities. The use of digital fashion design has grown significantly in the past decade with rapid advances in technology providing new opportunities for the fashion industry. In this review article, we aim to explore the emerging trends in digital fashion design. We will analyse various technologies used in digital fashion design and their impact on the fashion industry. This article aims to provide insights into the emerging field of digital fashion design and its implications for the fashion industry. The knowledge gained from this review will help researchers and industry professionals to better understand the main trends of digital fashion design researches and how it can be implemented in the industry.

2. Literature review

The fashion industry has been one of the most significant contributors to global economic growth, with digital technologies driving innovative developments in the

industry. Digital fashion, the integration of cutting-edge digital technologies into the design, production, and marketing of clothing, has been gaining momentum in recent years. As the Prokopenko, Kudrina, and Omelyanenko (2018) note, as part of the formation of Industry 4.0, the digitalisation of all spheres of human life is taking place. The use of artificial intelligence, 3D printing (Gong & Kang, 2021; Mahmood, Akram, Chen, & Chen, 2022; Robinson, Lagnau, & Boon, 2019), wearable electronics, and virtual and augmented reality technologies (Baek et al., 2022) have revolutionised the way fashion designers conceive and produce their creations. This review article aims to explore the design and technological aspects of digital fashion, highlighting the opportunities and challenges presented by the use of emerging digital technologies in fashion design and production.

The definition of digital fashion, as posited by in their review article, pertains to the creation, production and depiction of an individual's persona in virtual settings via computer-generated design. The review article by Baek et al. (2022) of the field of digital fashion, the authors identified six themes related to digital fashion, including design, consumer, virtual, body, printing, and supply. Based on these themes, the authors define digital fashion as 'the virtual creation, production, and representation of one's identity via computer-generated design.'

This article by Noris, Nobile, Kalbaska, and Cantoni (2020) presents a systematic literature review of the research in the area of digital fashion, which is the intersection between fashion and information and communication technologies (ICTs). The review identified three main categories of research papers: Communication and Marketing, Design and Production, and Culture and Society, focusing on the Communication and Marketing related research. Of interest is a further review by Nobile, Noris, Kalbaska, and Cantoni (2021), which systematises research in the categories Design and Production (D&P) and Culture and Society (C&S). Wang and Juhlin (2020) discuss the emergence of digital fashion and wearable technology, which can offer new products that differ from traditional clothing fashion as they can change their visual expression. Recent years have witnessed the development of various fashion design models based on big data and digitisation, which enable fashion designers to identify fashion trends, create designs accordingly, and offer consumers a virtual fitting experience (Zhao, Liu, & Zhao, 2021). Faria, Cunha, and Providencia (2019) focus on the experience of fashion industry professionals and identify strategies to elicit emotions and attain knowledge in digital product and experience design. The article by Yezhova, Pashkevich, and Gryn (2019) underscores the importance of developing ICT and computer-aided design competences in technology and vocational education students, which is essential for advancing innovative and efficient practices in the fashion industry. Casciani, Chkanikova, and Pal (2022) provide an overview of the digital transformation of the fashion industry and describe the opportunities and influences on supply chains, business models, and sustainability-oriented innovations.

Dal Forno, Bataglini, Steffens, and Ulson de Souza (2023) developed an Industry 4.0 maturity model tool to diagnose the textile and clothing industry's status.

To meet the needs of customers and stay up-to-date with the latest trends and fashion, CAD and digital techniques have been widely used. The approaches to designing virtual garments may be categorised as '2D to 3D' and '3D to 2D.' The work by Pandey, Ranjan, Malviya, Pipleya, and Dixit (2021) highlights the importance of CAD and the virtual platform for the final customised apparel designing. Ji et al. (2019) proposed a deep learning-based reconstruction of 3D human body shapes from 2D orthographic silhouette images, which can be used for digital avatars, 3D games and virtual reality. Zhang et al. (2021) proposed the multi-view systems for high-fidelity human body shape reconstruction. Paganelli (2021) aimed to find new

solutions for greater inclusion of non-standard body types in the apparel industry, using 3D body scanning, virtual design tools, and computerised 3D knitting to facilitate the mass production of inclusive apparel for persons with disabilities. Yezhova and Pashkevich (2021) presented a new methodology for creating virtual mannequins for customer's figures, as well as outlined the sphere of use for virtual mannequins with the purpose of clothes design. Lin's (2022) article presents an introduction to the body-oriented parametric design for 3D-printed fashion and textiles, emphasising the importance of parametric design for creating 3D-printed fashion and textiles.

These studies highlight the growing interest and development in the field of digital fashion and its diverse applications.

2.1. Objectives

The purpose of this study is to explore the emerging trends in digital fashion, focusing on issues related to design and technology, and to identify priority directions for further research in the field of digital fashion.

To achieve this goal, the following tasks were set and solved in the work:

- bibliometric analysis of relevant publications in the Web of Science database;
- analytical review of the most relevant publications.

For the purpose of our own article, we grounded on the particular characterisation of digital fashion as posited by Baek et al. (2022) in their review article. We propose the definition of digital fashion, as the 'virtual creation, production, and depiction of an individual's identity, in particular in the field of clothing and footwear, through computer-aided design'.

3. Methodology

The selection of articles for the systematic review was carried out according to the PRISMA 2020 recommendations described in the article by Page et al. (2021). Scientific articles, the subject of which includes digital fashion design, were selected for review.

3.1. Information sources

The search was carried out in the Web of Science database in April 2023.

In the search conditions, the topic 'digital fashion design' is specified.

Publications for 2019–2023 were selected to identify the most relevant areas of scientific research, as a result, 386 publications were selected for review.

3.2. Cluster analysis based on bibliographic data

At the next stage, in order to identify the most significant directions of scientific research in the field of digital fashion design, a cluster analysis was conducted on selected 386 sources by keywords. For this, the software tool for constructing and visualising bibliometric networks Vosviewer (2023) was used. The keywords map based on bibliographic data on digital fashion design has been created. For this, keywords for selected publications were used.

The following resource settings are used Minimum number of occurrences of a keyword: 5. Min. cluster size: 6.

For cluster analysis, the list of keywords excludes words that do not outline the subject of the research, but refer to general scientific categories (impact, knowledge, systems, optimisation, strategy), direction of scientific research (future, innovation, perspective, strategy), conditions of conducting the research (covid-19). The results of cluster analysis are presented in the table in section 4, and interpreted in section 5.

3.3. An analytical overview of the most relevant sources

For further analytical review, publications were selected that addressed issues related to digital fashion design,

namely the artistic and technological aspects of digital fashion creation, production and distribution. Publications are selected from a pre-received list of 386 publications by Citation Topics Meso filters. As a result, 75 publications were identified, which were included in the textual analytical review. The results of the review of generalising publications are presented in the introduction of this article, the rest of the publications are analysed in section 4.

4. Results

4.1. Search results in the Web of Science database

According to the search results, 1115 results were obtained. Refinements were made to remove search results that were not relevant to this study. Publications related to non-relevant Research Areas are excluded, namely: Medicine, Veterinary, Pharmacology, Food Science Technology, Geography, and Zoology. As a result of this exclusion, 952 results remained. They are distributed by year since 1991, as shown in Figure 1. As seen in Figure 1, the distribution of digital fashion design publications by year shows a general increasing trend. The peak of publications occurred in 2021 with 98 publications. The majority of the publications were from the years 2018 to 2021, with a total of 353 publications in those four years alone. The years with the lowest publications were 1991, 1994, and 1996, each

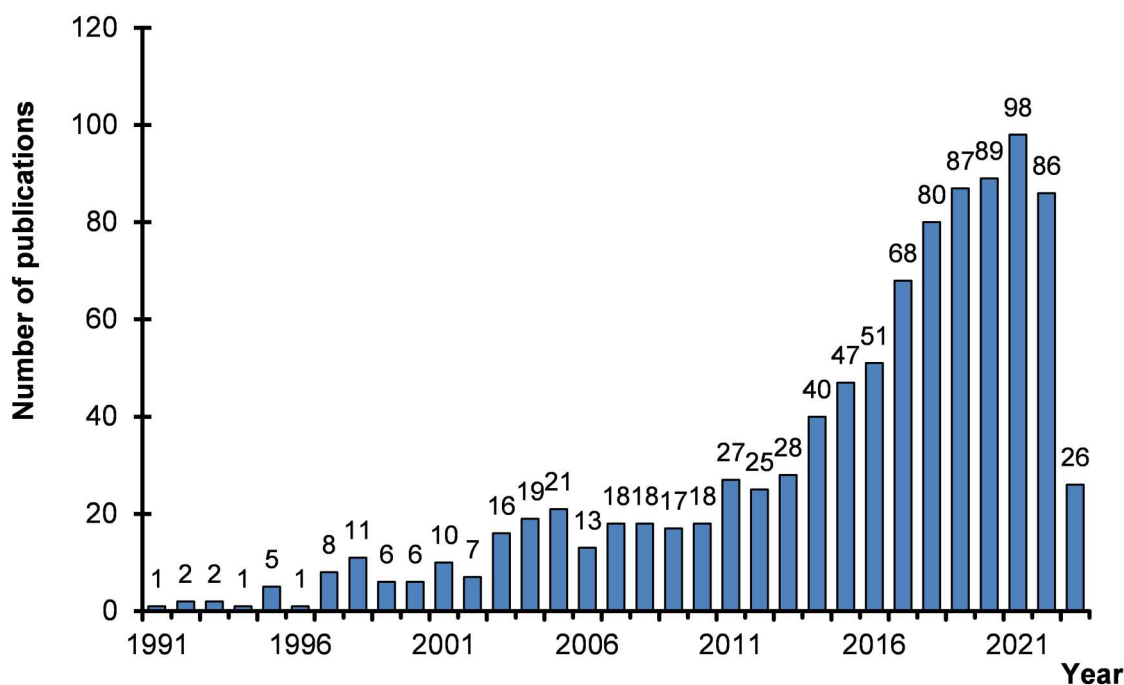


Figure 1. Distribution of digital fashion design publications by year (Web of Science, $N = 952$).

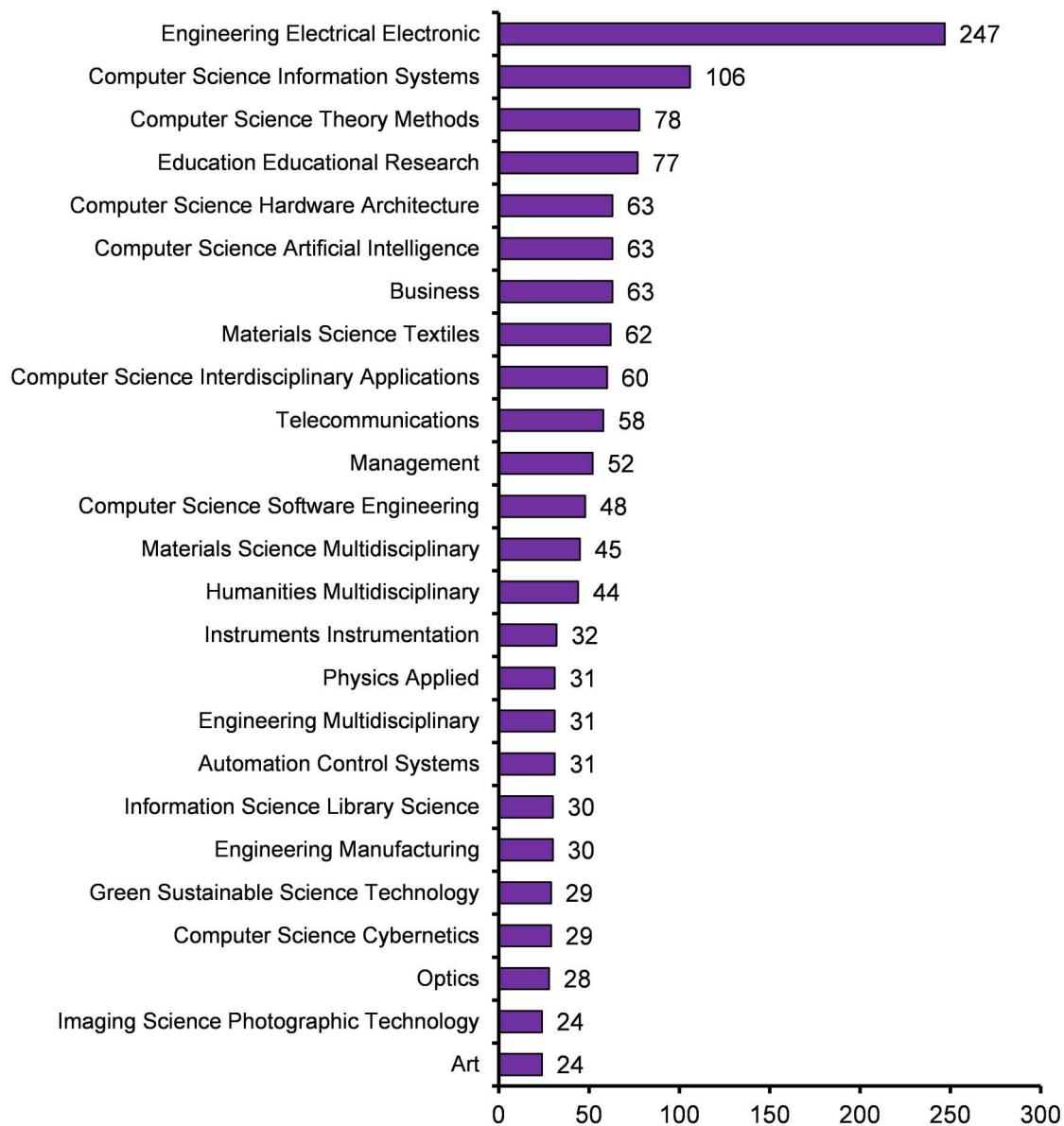


Figure 2. Distribution of search results for digital fashion design by WoS categories (Web of Science, $N = 952$, only the top 25 categories are included).

with only 1 publication. Overall, the data indicates a growing interest in digital fashion design with a steady increase in publications over time.

The distribution of search results for digital fashion design by Web of Science categories (presented in Figure 2) shows that the research is most prominent in the fields of engineering (specifically electrical and electronic engineering), computer science (particularly information systems, theory and methods, and artificial intelligence), education, business, and materials science (specifically textiles). Other fields with a significant number of publications include telecommunications, management, software engineering, and interdisciplinary applications of computer science. The research is

less common in fields such as economics, law, and cultural studies. Overall, these results suggest that digital fashion design is an interdisciplinary field, with publications appearing across a diverse range of categories.

The distribution of search results for digital fashion design by countries presented in Figure 3. The United States dominates the distribution with 234 publications, followed by China with 110 and England with 93. Germany, Italy, and South Korea also have a significant presence with 58, 57, and 47 publications respectively. Canada, India, and Spain also have notable numbers of publications with 43, 41, and 34 respectively.

The distribution of the search results for digital fashion design by WoS categories (presented in Figure

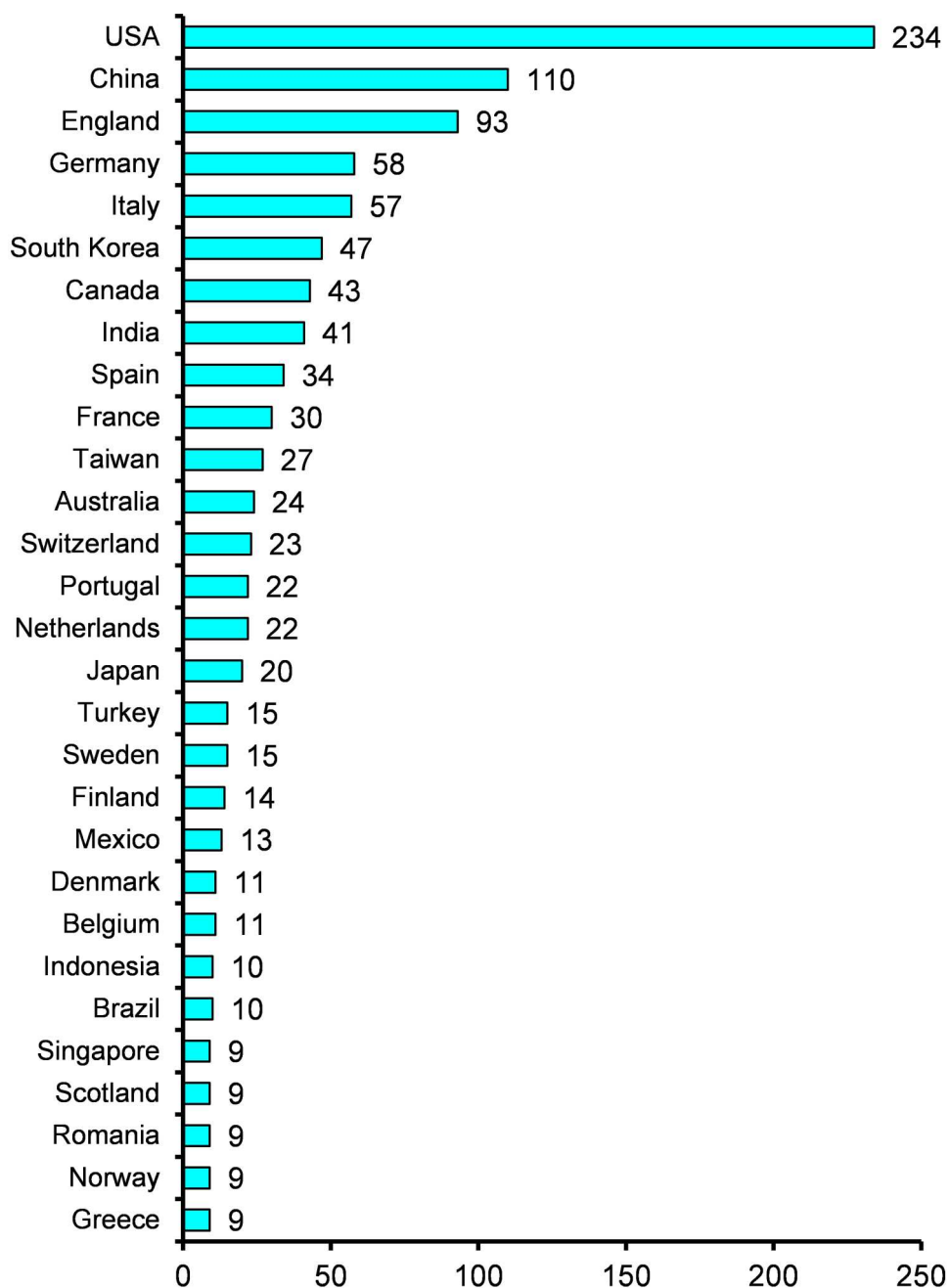


Figure 3. Distribution of search results for digital fashion design by countries (Web of Science, $N = 952$, only the top 24 countries are included).

4) shows that Engineering Electrical Electronic and Business are the two categories with the highest number of publications, with 69 and 48 publications respectively. Computer Science Information Systems, Management, and Education Educational Research are also among the categories with a relatively high number of publications, with 33, 32, and 27 publications respectively.

Additionally, the data shows that publications related to digital fashion design can be found across a broad range of categories, including Humanities Multidisciplinary, Materials Science Textiles, Computer

Science Artificial Intelligence, and Green Sustainable Science Technology.

4.2. Results of analysis of publications by keywords

The analysis of articles about digital fashion design by keywords using Vosviewer shows that the most frequently mentioned topics are design, fashion, social media, and technology (Table 1). Sustainability, digital fashion, and performance are also frequently discussed.

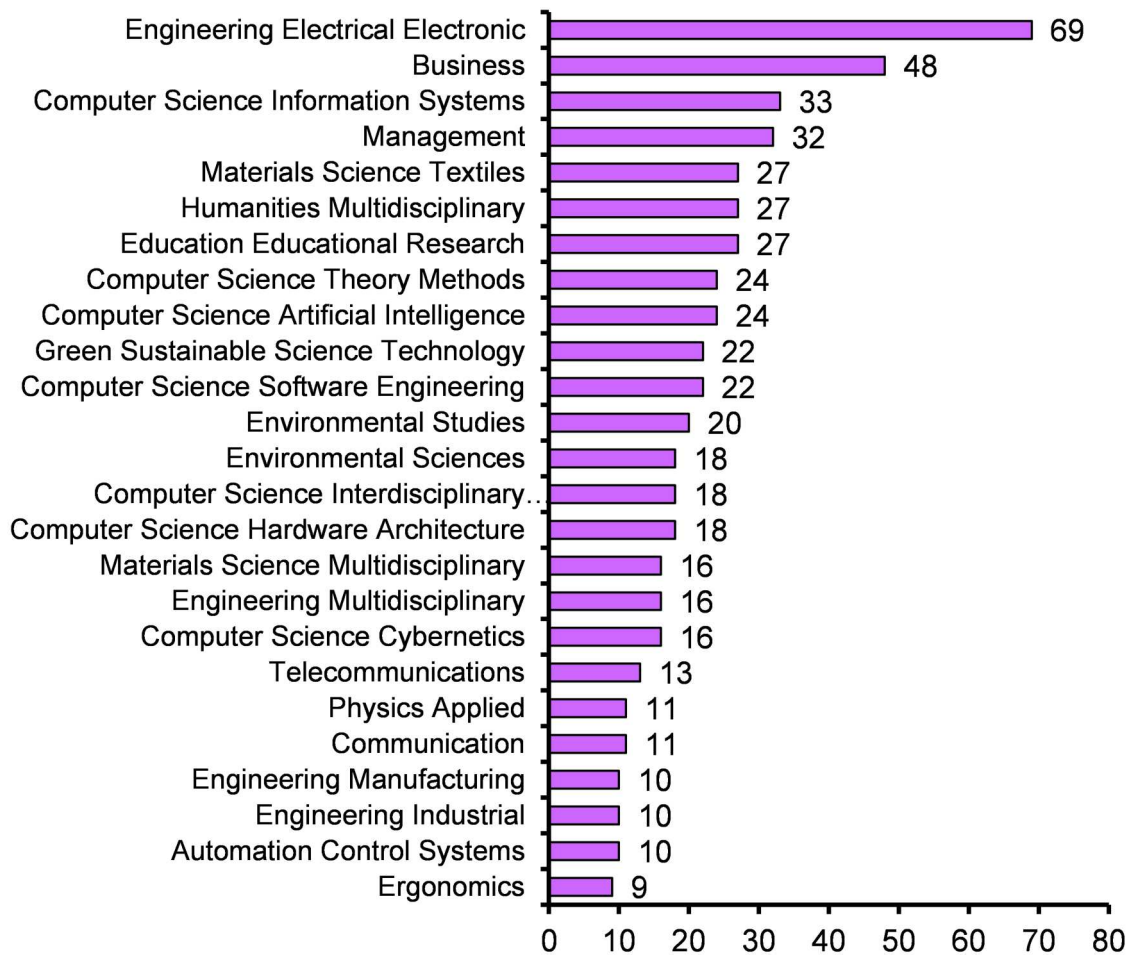


Figure 4. Distribution of search results for digital fashion design by WoS categories (Web of Science, 2018–2023 years, $N = 386$, only top 25 categories are included).

The impact of digital transformation on the fashion industry, the role of consumers, and the use of augmented reality and big data analytics are also noteworthy themes.

The use of 3D printing, virtual and augmented reality, and wearable technology is seen as potentially transformative. The circular economy, sustainability, and ethical considerations are also emerging as important factors.

Overall, the analysis shows that digital fashion design is a complex and dynamic field with multiple perspectives and stakeholders, including designers, consumers, educators, and industry professionals. The impact of COVID-19 is also noted as a significant factor affecting the industry.

After the exclusion from this list of words that do not characterise the subject of research (see more details in section 3), 57 items were obtained, which form 5 clusters. The map of keywords built as a result of statistical analysis by the Vosviewer tool is shown in Figure 5.

To clarify the links of the keyword ‘digital fashion’, the visualisation of the links of the keyword ‘digital fashion’

with other keywords is performed. As seen in Figure 6, the main relationships of the keyword ‘digital fashion’ in the articles are: technology, design, fashion design, media, industry, wearable technology, sustainability, digital transformation, internet, education, behaviour, virtual reality, augmented reality, 3D, machine learning, performance, culture, customisation, and identification. The links between keywords ‘digital fashion’ and ‘technology’, ‘design’, and ‘fashion design’ are the strongest.

The cluster analysis of articles about digital fashion design by keywords performed in Vosviewer resulted in five clusters with a minimum cluster size of 6. The results of the cluster analysis of publications by keywords are presented in Table 2.

4.3. Results of a review of publications on the design and technology aspects of digital fashion

Digital fashion design has become increasingly important in the textile and fashion industry due to the fast-changing environment of clothing. One of the essential

Table 1. Occurrence and total link strength for keywords (Web of Science, 2019–2023 years, $N=386$, only keyword with occurrences of at least 5 are included).

Keyword	Occurrences	Total link strength
Design	46	85
Fashion	40	70
Social media	24	66
Technology	24	54
Consumption	13	44
Management	12	44
Digital transformation	8	37
Sustainability	17	35
Internet	10	34
Digital fashion	14	33
Performance	14	32
Impact	11	31
Model	13	31
Information	8	30
Augmented reality	8	28
Engagement	9	28
Future	9	28
Industry	7	28
Media	8	28
Fashion industry	8	27
Consumers	8	26
Innovation	9	26
Perspective	6	24
Instagram	10	23
Big data analytics	5	22
Things	5	22
Communication	6	21
Consumer	5	20
Fashion design	16	20
Big data	6	19
Insights	5	19
Additive manufacturing	5	18
Adoption	5	18
Culture	5	18
3d printing	6	17
Knowledge	6	17
Systems	8	17
Women	5	17
Behavior	6	16
Education	9	16
Framework	8	16
Challenges	6	15
Covid-19	8	15
Digital technology	5	15
Online	6	15
Optimization	6	15
Strategy	5	15
3d	7	14
Machine learning	10	14
Gender	6	13
Networks	7	13
Circular economy	7	12
Creation	5	12
Perceptions	5	12
Internet of things	5	11
Customization	5	10
Virtual reality	5	10
Wearable technology	6	10
Identification	5	9
Sensors	6	9
Architecture	6	8
ICT	5	8
Blended learning	6	7
Parametric design	5	7
Textiles	5	7
Digital printing	5	6
Deep learning	5	1

tools used nowadays is digital prototypes, which enable fast and custom design of costumes for the customers. An and Park (2020) apply text mining and semantic network analysis to identify sportive fashion trends and offer a consumer-driven design approach. Yang and Lee (2022) explored user perceptions of design personalisation of fashion products using computational design methods and found that consumers mainly focused on hedonic values and satisfaction as a destination triggered by inspiring and fun design experiences. The articles (Hauser, Guenther, Flath, & Thiesse, 2019; Jo, Lee, Lee, Lee, & Lim, 2020) describe the development of an intelligent fashion technique based on deep learning for efficient fashion product searches and recommendations. The system includes a sketch-product fashion retrieval model and a vector-based user preference fashion recommendation model to enhance consumers' satisfaction in searching for fashion products. Conlon (2020) conducted a literature review of the latest academic research on product lifecycle management (PLM) in the textile and apparel industries. In (Wang, Xu, Zhang, Bao, & Zhong, 2020) paper, a collaborative architecture for an industrial Internet platform (IIP) was proposed to manage the interaction between physical and cyber components in manufacturing systems. Meng (2022) discusses how digital technology can improve clothing production efficiency and diversify clothing design under the mass customisation mode. The article by Huang, Kettlely, Lycouris, and Yao (2023) explores the use of autobiographical design for emotional durability in digital transformable fashion and textiles. The article by Wang et al. (2023) proposes a novel design approach for customised garments using machine learning techniques, which include artificial neural networks, genetic algorithms, and support vector regression. The approach aims to promote sustainability in fashion design while enhancing the interactions among the digital garment demonstration, the designer's professional knowledge, and the user's perception.

Virtual try-on is the latest approach to fitting and fashion, and various 3D capture software and scanning techniques have simplified the procedure and led to the development and fast procurement of custom-fit apparel design. Zhang, Luo, Cui, Bian, and Shan (2020) presented a virtual fitting based on CLO3D technology and evaluation system in a virtual reality environment for the fashion industry. The articles (Avadanei et al., 2022; Greder, Pei, & Shin, 2020) present a digital-integrated solution for a customised 3D design process of garments, highlighting the role of information and communication technologies (ICTs) in the fashion industry.

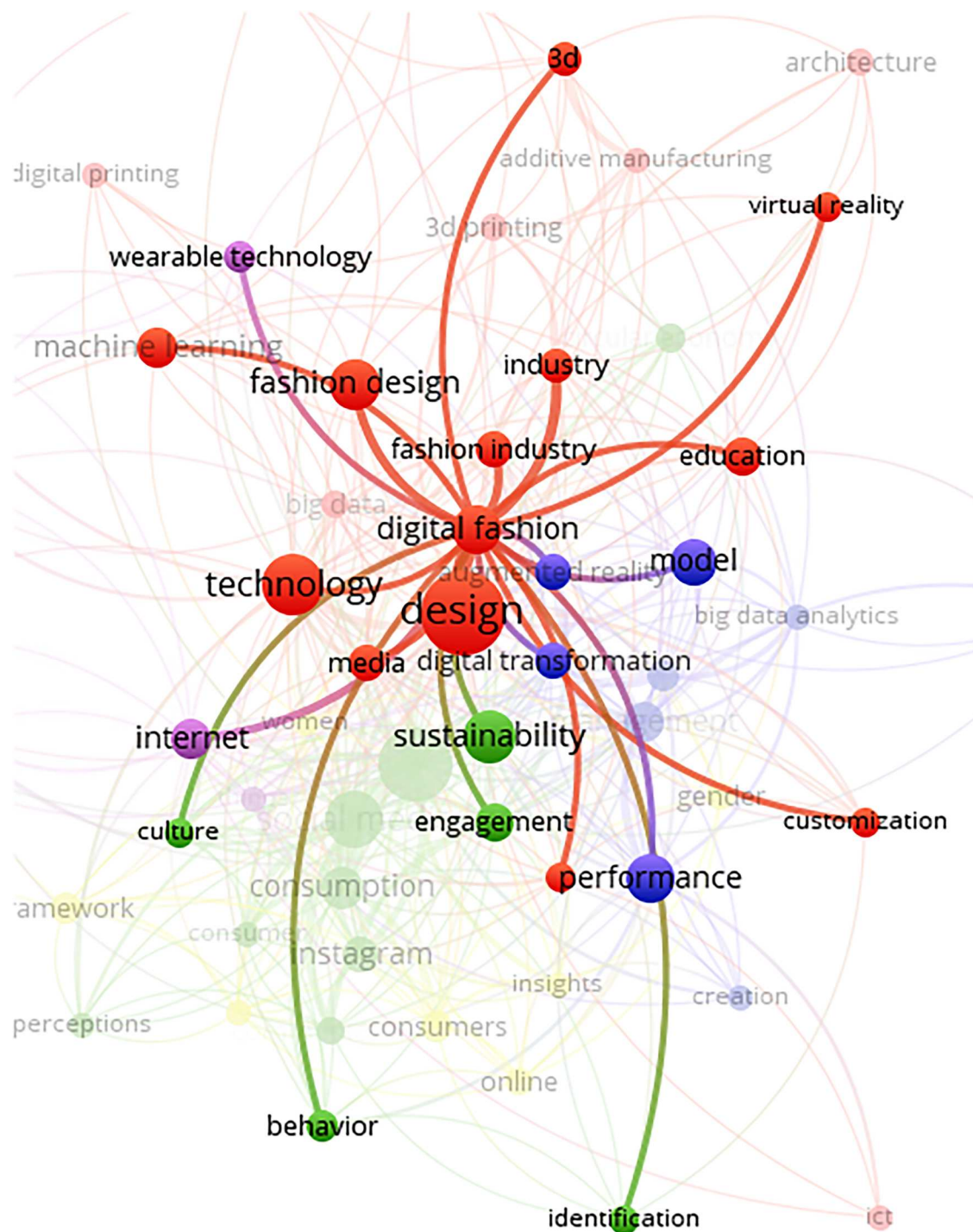


Figure 6. Primary relationships for the keyword 'digital fashion' on bibliographic data (2019–2023, Web of Science).

design context, highlighting three issues: the gamut issue, the intuitive issue, and the engagement issue. The research of Duje, Ales, Alenka, and Vanja (2022) has been conducted to identify key preferences for colour in the digital age, with the goal of showcasing new trends. Han, Kim, and Ahn (2022) used machine learning to analyse colour trends in fashion collections and found a significant gap between the Pantone colour

palette and the colours used in fashion shows, indicating the potential of machine learning to guide production. Yum's (2023) article focuses on the digital colour analysis of artwork to extract fashion colour semantics, providing fashion designers with colour guidance for product design. Using Monet's paintings as an example, the study reveals the underlying colour semiotics representative of digital images.

Table 2. Keyword clusters of digital fashion design publications (Web of Science, 2019–2023 years, $N = 386$, only keyword with occurrences of at least 5 are included).

Cluster 1–21 items	Cluster 2–13 items	Cluster 3–9 items	Cluster 4–7 items	Cluster 5–7 items
3d	Behavior	Augmented reality	Adoption	Challenges
3d printing	Circular economy	Big data analytics	Consumers	Internet
Additive manufacturing	Communication	Blended learning	Gender	Internet of things
Architecture	Consumer	Creation	Framework	Networks
Big data	Consumption	Digital transformation	Insights	Sensors
Customization	Culture	Information	Online	Things
Design	Engagement	Management	Women	Wearable technology
Digital fashion	Fashion	Model		
Digital printing	Identification	Performance		
Digital technology	Instagram			
Education	Perceptions			
Fashion design	Social media			
Fashion industry	Sustainability			
ict				
Industry				
Machine learning				
Media				
Parametric design				
Technology				
Textiles				
Virtual reality				

Green et al. (2021) propose evaluation criteria for peer review of fashion exhibitions, with the aim of elevating the scholarly status of modestly funded institutions' exhibitions. They found that the methodology adopted can provide new ideas for costume archaeology, a reference for modern fashion design, and materials for the VR Museum of Ancient Costumes. In their article on fashion curation, Du Puis and Yamakawa (2022) explore the use of symbolism as an organisational device for the digital exhibition *Flights of Fancy: Fashion and Function in Circus Performance*. Through multiple theoretical lenses, the authors illustrate how digital fashion exhibitions may be developed as educational resources and curated through theory. Smith-Glaviana (2023) discusses the effectiveness of digital tours of physical fashion exhibitions, which offer an online object-based learning experience.

The reviewed articles discuss various aspects of fashion design and marketing, including the use of digital technology and social media influencers. McMillan (2019) suggests that virtual adornments using haute couture practices can be a promising path to follow in the context of designing wearables for the Internet of Things. Pedro et al. (2019) proposed a product analysis methodology for the fashion industry, based on the sensing, smart and sustainable S-3 model, for evaluating how useful internet videos influence the customer's emotional response and the tendency for using certain products. A critical analysis of Instagram's influencer economy by Hund and McGuigan (2019) found that social media users navigate the imperative to produce an authentic but branded and monetisable self, with

stakeholders mediating and profiting from these productions. Skjulstad's (2020) article relates the design collective *Vetements* to contemporary scholarship on digital connective mediational practices and internet culture, with a focus on internet memes. The paper by Choi (2020) explores aspects of fashion blogging as a new genre of fashion communication. Stoicescu (2020) discusses the social impact of digital dating platforms, with a case study focused on Tinder. The article by Gerrie (2020) analyses Virgil Abloh's borderless fashion practice in the contemporary global fashion system, proposing the concept of metamodernism. The qualitative study by Le and Aydin (2022) explores the impact of the pandemic on social media influencer marketing in the fashion industry through interviews with influencers and industry professionals. Young and Roberts (2021) explore the gender transformational capacity of the dating app, Bumble, through focus groups with women who have used the app, showcasing how technological design challenges existing gender patterns and internalised gendered behaviours, whilst creating tensions. Casais and Gomes (2022) investigate the discourse of fashion bloggers on brands under corporate crisis situations and their role in crisis management. Brachten-dorf (2022) examines how virtual influencers, like Lil Miquela, are fashioned and how their bodies reflect normative ideals of beauty and youth.

Rees-Roberts (2020) questions the relevance of traditional definitions of 'fashion film' in digital media and explores the intersection of fashion branding and celebrity influence. In the realm of virtual reality, in the paper of Hou, Wang, Liang, and Ning (2021) digital fashion has been used to design an appropriate dress for

virtual characters based on the scenario analysis where they appear. The article by Yang, Lee, and Lee (2023) investigates the cognitive patterns involved in the process of collaborative exploration in fashion design using virtual reality environments (VREs) as a new collaborative design tool. Of interest is the article (Liu, Zhou, Zhu, & Lu, 2022) about the virtual presentation of the Yue Opera costumes.

The use of digital tools in fashion design education is a growing topic of interest. Postlethwaite (2022) emphasise the need for a new generation of designers with an interdisciplinary skill-set and introduce holistic platforms for teaching materials in fashion design. The article by Pashkevich, Yezhova, and Gerasymenko (2020) highlights the role of information and communication technologies in facilitating self-education for fashion designers, thereby enhancing their ability to access, utilize, and contribute to digital fashion resources and communities. Kolosnichenko, Yezhova, Pashkevich, Kolosnichenko, and Ostapenko (2021) argue that the use of modern digital technologies, particularly computer-aided design, in the design and technology vocational education and training of fashion designers and technologists contributes to their readiness to use specialised software in their professional activities. The paper by Taverna, Bertola, and Mortati (2019) discusses the interdisciplinary approach to designing MOOCs and educational modules to support digital entrepreneurship upskilling in cultural and creative industries, with a focus on the fashion sector. Tenuta, Cappellieri, Testa, and Rossato (2022) present an innovative teaching and learning model in jewelry-tech design, focused on integrating diverse skills to train new professional figures successfully. Lara (2021) investigated the use of an educational tool, a historical clothing image bank, in a course on Fashion Design. Furthermore, Mohamed and Sicklinger (2022) examine the incorporation of virtual and augmented reality technologies in multiple design disciplines, providing a careful examination of case studies in literature and a curriculum that demystifies these new technologies from the design process to product marketing. The article by Conlon (2022) reports on an educational research project that used Product Lifecycle Management (PLM) software as a context for practice-based learning and as a mechanism to update the learning experience and stimulate the development of future practice.

Xepoleas and Hayflick (2022) reflect on the colonial gaze in university dress collections and suggest digital curation as a means of decentring biases and promoting inclusivity.

Fashion has been explored from different angles, including its connection to technology and

sustainability. The article by Wolff and Sorkine-Hornung (2019) presented an algorithm for automatically aligning textile patterns along garment seams, a process which is typically performed manually by experienced tailors. With the aim of improving sustainability in the value chain of the apparel industry, a collaborative business model empowered with social manufacturing has been proposed by Mohajeri et al. (2020) for shifting from conventional screen-printing to more environmentally sustainable digital textile printing. Wu and Devendorf (2020) explored techniques and practices for reclaiming and reusing smart textile materials through the design inquiry titled 'Unfabricate.' Their research probes the values of time and labour in crafting garments and how electronic and textile components may be given new life in novel uses. Tunakova, Tunak, Tesinova, Seidlova, and Prochazka (2020) investigated the use of digital printing on woven fabric made with stainless steel fibres to provide electromagnetic radiation protection, while also examining the fabric's colour fastness and functionality. Bertola (2021) suggests a new systemic approach to data analytics can empower the design process within the fashion industry to promote a radical sustainable transformation. Ramkalaon and Sayem (2021) develop a strategic framework for implementing the zero-waste pattern-cutting technique in mass production and use digital pattern-cutting and marker-making techniques to design and cut pattern pieces. The article by Sterman and Almog (2022) investigates the seamless digital knitting design. The study by Lei and Li (2022) proposes a new approach to 3D pattern-making for the apparel industry using graphic coding-based localisation.

5. Discussion

The conducted systematic review of scientific publications demonstrates the promising potential of digital technologies in fashion design.

The results of the cluster analysis of publications showed that all studies can be conditionally grouped into 5 clusters.

Cluster 1, with the largest number of items (21), includes keywords related to digital technology and its impact on fashion design and industry, such as 3D printing, digital printing, and parametric design. It also covers related areas like education, media, and virtual reality.

Cluster 2, with 13 items, mainly covers social and cultural aspects of fashion, such as consumer behaviour, sustainability, and perception of fashion and consumption in the era of the circular economy. Social media

platforms, particularly Instagram, also feature in this cluster.

Cluster 3, with 9 items, is dominated by keywords related to performance, including augmented reality, digital transformation, blended learning, and big data analytics.

Cluster 4, with 7 items, is focused on the adoption and consumption of digital fashion by women and gender considerations, as well as frameworks and insights for analysing the online behaviour of consumers.

Cluster 5, also with 7 items, mainly covers the technical aspects of digital fashion design, including challenges posed by the Internet of Things, wearables, and sensors in the industry.

The results of the study confirmed the main conclusions contained in the review articles (Baek et al., 2022; Nobile et al., 2021; Noris et al., 2020; Wang & Juhlin, 2020). Thus, clusters 3 and 4 identified in our study can be attributed to the Communication and Marketing category, clusters 1 and 5 to the Design and Production category, and cluster 2 to the Culture and Society category.

The limitations of this study are related to the use of publication information only from the Web of Science database. Obviously, for a more complete presentation of the range of scientific research on the problem of design and technology in digital fashion, it is necessary to review publications in other databases, in particular Scopus.

6. Conclusions

This review article has examined the emerging trends in digital fashion design, exploring the various technologies used and their impact on the fashion industry. It showed the growing interest and development in the field, by the use of emerging digital technologies in fashion design and production.

The review identified five clusters of scientific research, covering a broad range of categories, including Humanities Multidisciplinary, Materials Science Textiles, Computer Science Artificial Intelligence, Green Sustainable Science Technology, and Social and Cultural Aspects of Fashion. The review has identified various technologies used in digital fashion design, including artificial intelligence, 3D printing, wearable electronics, and virtual and augmented reality. Our systematic review of recent innovations in digital fashion design has revealed emerging trends across various technologies used in this field, including virtual try-on, additive manufacturing, colour management, and virtual reality.

Our proposed definition of digital fashion as the ‘virtual creation, production, and depiction of an individual’s identity, in particular in the field of clothing and footwear, through computer-aided design’ can serve as a foundation for further exploration in the field. The knowledge gained from this review can help researchers and industry professionals better understand the main trends of digital fashion design researches and how it can be implemented in the industry. Digital fashion design will continue to revolutionise the fashion industry, pushing the boundaries of creativity and sustainability while increasing the efficiency of the design process.

Future research should focus on addressing the challenges of integrating digital technology into the industry, including issues of sustainability, data privacy, and the need for interdisciplinary skill sets among fashion professionals to adapt to the evolving landscape of digital fashion design.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Olga Yezhova  <http://orcid.org/0000-0002-5920-1611>

Simiao Wu  <http://orcid.org/0009-0004-8820-9171>

Kalina Pashkevych  <http://orcid.org/0000-0001-6760-3728>

Maryna Kolosnichenko  <http://orcid.org/0000-0003-0020-3214>

Nataliia Ostapenko  <http://orcid.org/0000-0002-3836-7073>

Tetiana Struminska  <http://orcid.org/0000-0003-0449-4768>

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