DIGITAL JEWELRY AND VIRTUAL EXHIBITION: INTERACTION IN THE METAVERSE

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Abstract

The paper describes the experience of the Utopia: Jewelry Beyond the Body workshop held at Politecnico di Milano in the context of higher academic training which had as its object an innovative design methodology for future creatives. It aimed at testing the design process for creating a jewelry collection specifically designed to have an autonomous life in the digital context. In particular, the paper focuses on the virtual exhibition created in Spatial.io to present students' final virtual projects. First of all, the reference context is described. In fact, the field of jewelry and fashion has progressively been digitized and the interactions between objects and customers that once took place in real life are now dematerialized and moved into the virtual environment. For this reason, the need to experiment with the digital uses of digital products and test digital co-creation spaces is highlighted. Secondly, the methodology used in the workshop will be presented, with a particular focus on the realization of the virtual exhibition. Finally, the experience will be described in detail, presenting quantitative and qualitative results and offering a critical understanding for future research.

Keywords: Jewelry design, Design methodology, Digital technologies, Virtual exhibition.

1 INTRODUCTION

Digital technology has become ubiquitous in the fashion industry, affecting everything from product design to retail [1][2]. In the product, whether it is clothing or an accessory, with the help of digital tools, designers can create detailed sketches and models of their designs, allowing for greater precision and flexibility. These models today not only can be printed thanks to the 3D printing technology that enables designers to create prototypes quickly and efficiently, but they can also have a role in digital platforms [3][4]. Not only are the products digitised, but also the places where they are used lose their materiality, marking a digital shift of consumers in the use and experience of the fashion product [5]. Social media platforms like Instagram, Facebook, and TikTok have become essential marketing tools for fashion brands. Brands can showcase their products, connect with consumers, and gather insights into their preferences and behaviors. Additionally, influencer marketing has become a popular way for brands to reach their target audience through social media. In these spaces, digital influencers, together with products can move from tangible to intangible. From the digital transposition of a physical identity, the fashion system has recently witnessed the adoption of virtual influencers, computer-generated influencers (CGI), or artificial intelligence influencers (AII) with a social media presence [6]. Noonoouri is a well-known virtual influencer who creates content related to anime, video games, and cosplay. She has amassed a large following on social media platforms like Instagram and TikTok by sharing her creative and imaginative cosplay designs. Noonoouri often collaborates with brands to promote their products to her followers, leveraging her influence to drive sales and engagement. Noonoouri is not real, she is just an avatar. Among other virtual influencers, Lil Miquela has achieved great acceptance among fashion brands, boasting collaborations with Prada and Calvin Klein with estimated earnings per post (EEP) from $6,056 to $10,093, indicating her enormous success and popularity [6][7]. There are also many platforms and digital gaming environments (e.g., Fortnite, Decentraland, Elden Rings, Roblox) where digital products play a significant role. Roblox, an online gaming platform that allows users to create and play games using a simple game development tool, has become increasingly popular among young people, and digital products play a significant role in the platform's ecosystem. Roblox offers a virtual marketplace where users can buy and sell digital items such as clothing, accessories, and game assets. These items can be purchased using the platform's virtual currency, Robux. The digital products on Roblox are created by developers who use the platform's tools to create custom items and experiences for users. Some of the most popular items on Roblox include avatar clothing and accessories, game passes, and virtual pets. Digital products are an essential part of the platform's monetization strategy, as developers earn a percentage of the revenue generated from their products [8]. In this dematerialized [9] context, online shopping has become increasingly popular, and fashion brands have responded by investing in e-commerce platforms. With the help of digital technology,

brands can create immersive online shopping experiences, including virtual try-on and augmented reality tools. Additionally, retailers can use data analytics to better understand their customers and personalize their shopping experience [10]. Digital technology has also played a role in promoting sustainable fashion practices. Brands can use digital platforms to communicate their sustainability efforts and engage with consumers on these issues. Additionally, blockchain technology can be used to trace the supply chain of clothing and ensure ethical and sustainable production practices [11]. The context described above demonstrates how digital technology has had a pervasive influence on the fashion industry, transforming everything from product design to retail. As the industry continues to evolve, we can expect digital technology to play an even greater role in shaping the future of fashion. The literature attests that "More and more, researchers have begun to recognize the value of virtual technology in fashion, and it is becoming more immersive.[...] Moreover, future researchers can examine how the emergence of virtual environments (e.g., metaverse) may contribute to and transform the digital fashion experience." [12]. In particular, the loss of materiality of the fashion object opens space for new immersive digital experiences of products which, in the digital context, are designed with new expressive capacities and visualisations. A new possibility of doing design [13] that introduces the need to rethink the digital product value chain and opens interesting observations on the widening of creative opportunities in the creation of objects that do not have to submit to the same rules and limitations imposed by physical design. The use of the product itself is amplified, where the user can experiment with his own body, dressing his avatars in bolder and more extravagant looks than he would try in real life [12]. This leads to the evolution of the role of the fashion designer, increasingly called to deal with cross-fertilized skills [14] coming not only from the fashion system, but also from visual effects, cinema, animation, engineering and coding, hybridizing traditional design tools with new digital technologies such as mixed realities, 3D technologies or artificial intelligence [15][16][17]. In this regard, there is a growing need to test new digital tools within design education and to propose new methodologies and processes in those areas, such as the fashion system, in which the product is predominantly physical [3].

With this in mind, this paper presents the case study 'Utopia. Jewelry Beyond the Body' carried out within the academic training at the Politecnico di Milano where 38 international learners were involved in a workshop in order to test an innovative methodology to design both intangible jewellery and a digital exhibition to present and enhance them. In particular, for the purposes of this publication, the innovative methodology will be briefly introduced and subsequently the discussion will focus on the results obtained from the experience of the digital exhibition. Part of the present findings on the workshop methodology and conduct were previously published by the authors [18]. This publication offers an extension of the data analysis around a specific theme of the analysed case study, inherent to the fruition of the digital product in a virtual space.

2 METHODOLOGY

As previously stated, the case study was carried out at the Politecnico di Milano, within the Accessory Design Studio course part of the master's degree program in Fashion System Design. The 38 international learners involved came from different disciplines such as fashion design, industrial design, communication design, visual art and art history. The workshop took place over 11 days between November and December 2022, and it was supervised and conducted by 1 professor, and 1 tutor (Ph.D. student supporting the activity). The design outputs for the workshop were twofold: the first tasked participants with creating an individualized jewel that aligned with the provided brief and methodology, while the second tasked groups with realizing a digital exhibition featuring the aforementioned jewels, utilizing the Spatial.io platform. The groups were established midway through the workshop, with formation based on thematic affinity. The workshop's structure was carefully crafted (Fig. 1), with two theoretical lectures about utopia, Metaverse, and digital transformation in the fashion system serving as foundational knowledge, providing learners with necessary insight and inspiration for project realization. Progress was tracked via a detailed calendar, with scheduled reviews occurring at specific intervals. Additionally, the first day of lessons saw the dissemination of links to tutorials, which provided participants with valuable guidance for the creation of 3D models, animations, Instagram filters, and GIFs. To ensure that the workshop ran smoothly, a list of 'Dos and Donts' was provided to attendees at its inception. The innovative methodology suggested for the workshop is divided into four main phases: research, concept development, digital development, physical twin prototyping. More specifics on the different phases of the methodology are published in the Proceedings of INTED2023 Conference held on 6th-8th March 2023 [18]. During the concept development, the teams for the creation of the digital exhibition were identified. The exhibition was developed simultaneously with the physical transposition of the project. In particular, the exhibition was used as a tool for the final presentation of the project

outputs. The goal was to evaluate the application of Spatial.io as a tool for student presentation and digital product experience.
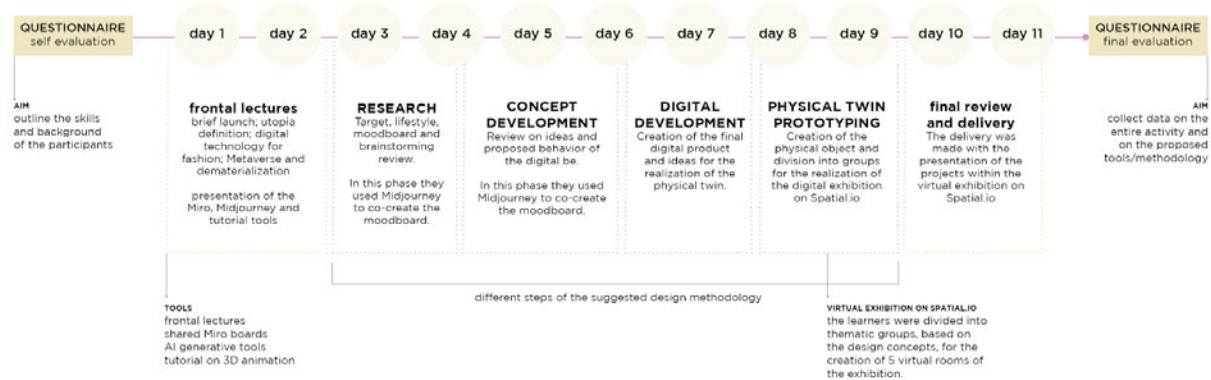

Figure 1. Structure of the workshop.

Digital environments were not only the places to showcase digital products, but they were also the space in which students shared their ideas. Indeed, a diagram was created on the Miro platform to support the methodology and guide learners in project implementation. The diagram explored all the phases outlined in the methodology and provided structured guidelines to ensure correct execution of the workshop. Fig. 2 illustrates the diagram's structure. The aim was to provide learners with graphical support to help them navigate the different phases of the project. Each learner had access to a personalized diagram in a shared space on Miro. The workspace was kept open to allow learners to observe and discuss their colleagues' work. To foster a collaborative and open creative exchange, all necessary tools were provided to learners well in advance, with supplemental advice, links, and input offered to stimulate inquiry. The workshop's success was evaluated via two questionnaires, with the first being completed by participants prior to the workshop's commencement, and the second being administered upon the workshop's conclusion, aimed at measuring the overall experience and efficacy of the methodology employed. Ultimately, the questionnaires served as an important tool for monitoring learning and assessing the success of the workshop's approach.
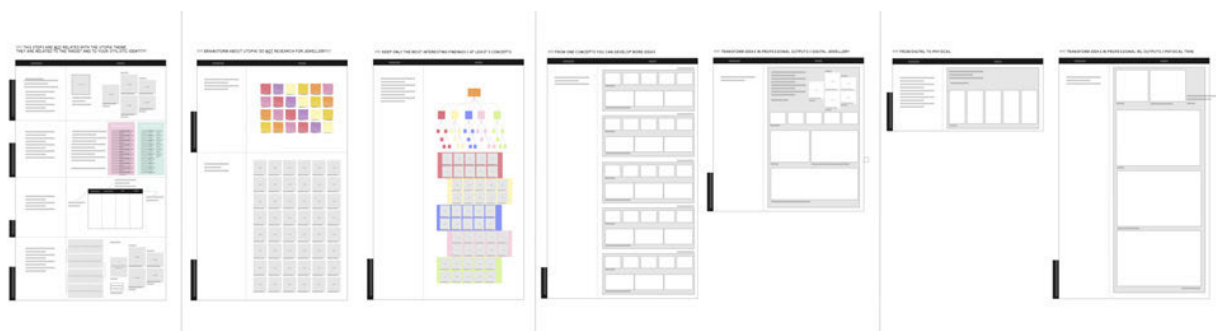

Figure 2. Scheme on Miro shared platform.

2.1   The exhibition on Spatial.io

Spatial.io is a cloud-based platform that provides developers with tools to build real-time multiplayer games and applications. It is a spatial computing platform that allows developers to create immersive experiences using real-world data and spatial computing technology. Spatial.io provides a set of APIs and tools that enable developers to build location-based applications, games, and other interactive experiences. One of the main strengths of Spatial.io is its focus on spatial computing, which is becoming an increasingly important area of technology. With the rise of virtual reality, augmented reality, and other immersive technologies, there is a growing demand for platforms that can help developers build spatially-aware applications. Another strength of Spatial.io is its scalability. The platform is designed to handle large-scale applications with many users, making it ideal for multiplayer games and other real-time applications. In terms of opportunities, Spatial.io is well-positioned to take advantage of the growing demand for spatial computing platforms. As more developers start building location-based applications and other spatially aware experiences, there is likely to be a growing market for platforms [19] like Spatial.io. In the case study, the platform was used as a tool for the creation of the digital exhibition

proposed in the project brief. The learners were informed at the beginning of the workshop of the intention to use the platform but the process of learning how to use it took place through an autonomous learning-by-doing approach. The objective was to evaluate whether the previous skills of the learners were sufficient for using the platform. In particular, each working group was asked to create a virtual room for the exhibition, personalizing the environment. In this way, the learners acted as digital curators of the exhibition. The platform was also used as a tool for the final presentation of the project outputs. This moment of final observation of the works produced by the students was also used as a method of evaluating the digital exhibition. In the previously described workshop structure, a review day was dedicated to monitoring the digital exhibition creation activity.

3 RESULTS

The workshop produced 38 innovative concepts of digital jewelry, along with their physical twins. Five general themes emerged and were the basis for the virtual exhibitions: Metamorphosis, Illusion, Identity and Culture, Bodies, and Two. As regards the digital exhibition, the subject of this publication, the spaces created have been coherently interpreted according to the assigned theme. Each exhibition began with the title and presentation of the members of the group and with a short introductory text explaining the thematic path followed for the exhibition. The jewels were exhibited with a title, a brief description, still life and on-the-body images of the physical jewel, the gif or animation with the behavior of the digital object, and the 3D render or animation of the digital object. The choice between visualizing the digital jewel through a gif, therefore a two-dimensional image, or by inserting the 3D object directly into the platform depended on factors linked on the one hand to the technical rendering and animation skills of the individual student, on the other to difficult management of the platform itself which has specific technical limits to properly insert the rendered 3D object. The curatorship criteria of the physical exhibition where the exhibited works are often accompanied by a textual reference, have been transferred to digital. However, the degree of personalization of the space differed according to the workgroup. The first group worked on the theme of Metamorphosis and opted for a chromatic order based on the degree of changeability in the display of the jewels, leaving the space of the platform almost unchanged. In fact, the template used was only modified in terms of color, choosing a white background and walls so as not to alter the aesthetics of the digital jewels. The metamorphosis of the jewel itself was the focal point of the exhibition: from the more static and realistic jewel to the one that changes with a chromatic explosion (Fig 3).

Figure 3. Overview of the digital exhibition of the Metamorphosis group and detail of one of the jewels on display.

The theme of Illusion has been digitally treated by modulating the exhibition space with dark reflective surfaces to give an atmosphere of mystery even on the jewels themselves. In fact, as with the lighting in physical exhibitions, the digital jewel has in this case changed in aesthetics according to the environment created. The further possibility of digital exposure has been identified in the external environment, set at twilight, to increase the illusory perception of the internal space (Fig 4). For the jewels in this example, the use of gifs and images was privileged, with less explanatory text.
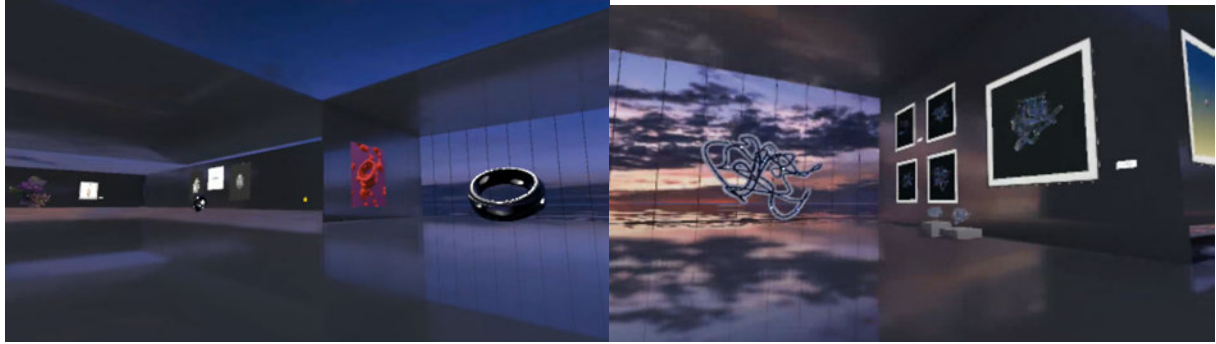
Figure 4. Overview of the digital exhibition of the Illusion group and detail of one of the jewels on display.

The third group, Identity and Culture, narrowed the exhibition space by digitally mounting a mirror to divide the Spatial.io template space. Except for this detail, the space and jewelry display was very similar to group 1, albeit more compact. Interesting is the choice of the group to be present in the space with each one their own avatar, exploiting the possibilities given by the interaction of the Metaverse. Indeed, they treated the exhibition as a physical field of work, interacting not only physically but also digitally with their digital body (Fig 5).
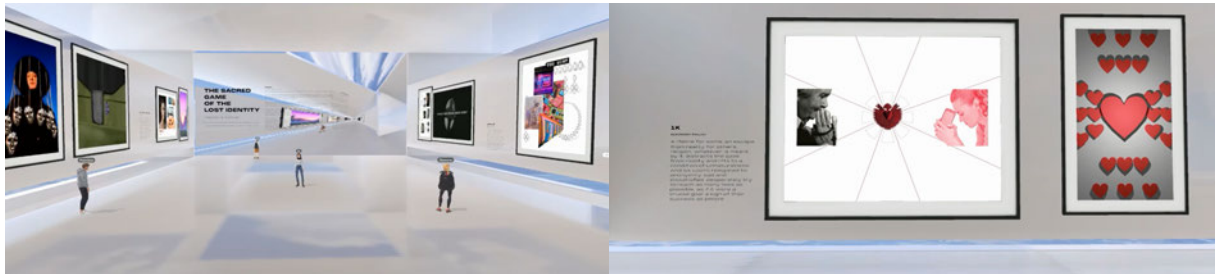

Figure 5. Overview of the digital exhibition of the Identity and Culture group and detail of one of the jewels on display.

The theme of the body was interpreted in the digital exhibition with installations and furnishing objects that populated the space, informing and enriching the exhibition. In particular, at the entrance to the exhibition, a robotic body welcomes you together with an introductory text explaining the proposed concept. The personalization of the avatar which was carried out autonomously by one of the learners belonging to this group was a very strong identity tool (Fig 6).
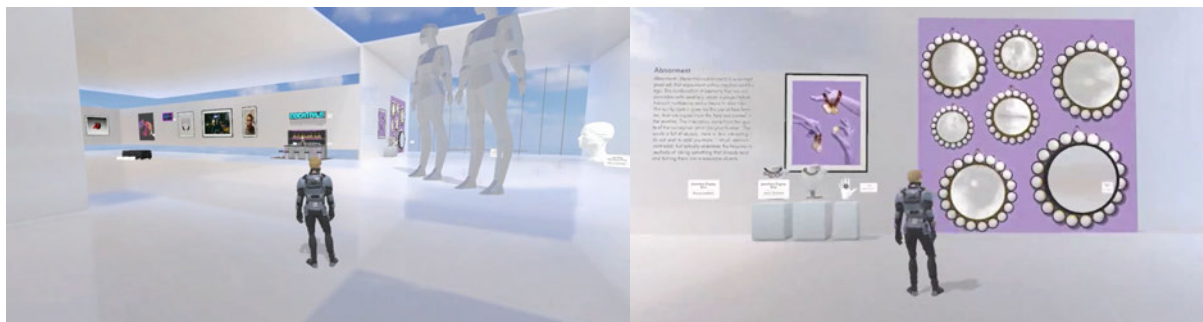

Figure 6. Overview of the digital exhibition of the Body group and detail of one of the jewels on display.

The last theme explored was Two, which represented the duality inherent in the students' project. In particular, the exhibition has been called 'Inter Connection' to underline the theme of the double as a common thread between the physical and the digital, between the body and the object, between different cultures. The exhibition space was created from scratch by the learners, inserting curved walls in which the project was displayed (Fig 7).

Figure 7. Overview of the digital exhibition of the Two group and detail of one of the jewels on display.

3.1 Limits and opportunities from the questionnaires

The observation of the digital exhibitions together with the data analysis of the questionnaire submitted to students at the end of the workshop (to which 32 out of 38 learners responded) offered insights into the limits and opportunities of using the Spatial.io platform. First of all, the main problems that emerged in the management of the platform were of a technical nature. In fact, although most of the learners (68.7%) declared that the preliminary information provided had been detailed enough to complete the project, only 15.6% found it very easy to use the platform. Furthermore, around 41% told us that it was rather difficult to create a digital environment consistent with the project: from the observation made in the previous section, it can in fact be seen that the display output remains very faithful and linked to the template offered by the platform. The learners stated that often the technical limitations imposed by their personal computer, such as the RAM capacity or the graphics card not sufficient to support the platform, made it difficult to use. Furthermore, limits were also found in the free version of the platform and in the management of animated 3D objects which, due to characteristics incongruous with those of the platform, lost the applied materials when loaded or did not display the platform. Some of the participants underlined comments such as "Can not feel it physically" or "Can't touch" or "too unreal" underlining how physical and real perception was for them an important prerequisite for the experience of the project. Despite this, only 3 out of 32 comments underlined this aspect. Among the opportunities identified by the learners, on the contrary, the characteristic of having no physical limits and being able to explore one's creativity was appreciated. In particular, the learners expressed positive comments in not having "geographical restrictions" or "Putting our works on a platform for everyone to see" or again, among the main comments, a participant stated "I think the main opportunities for the digital are the fact that you basically can create whatever you want. Freedom of creativity". In numerous comments, the possibility of showing the projects together and sharing the work of the group was appreciated, giving a further aesthetic value to the output and one learner stated that he appreciated the opportunity to use the platform as a link to show all within your portfolio.

4 CONCLUSIONS

The paper proposed an analysis of the digitization of the fashion system, focusing on the intangible places where digital products are experienced. The transformations that occur in the contemporary world led researchers to reflect on teaching methodologies and on the new professional figures that emerge from this context. Fashion designers are no longer isolated creatives with purely material and embodied knowledge, but rather their skills are enriched by the dematerialisation of the fashion system, both for the digital tools introduced in their design practice and for the digital contexts for which they are called to design. The case study 'Utopia: Jewelry Beyond the Body' proposes an innovative methodology that places the creation of the digital object at the center of the design practice, which should have equal dignity and priority over its physical twin. In particular, the experience of the digital exhibition created on Spatial.io was analysed, from the results of which interesting themes emerged to stimulate future discussion on the digitization of the spaces for the use of fashion products. Digital interaction spaces such as the Metaverses, offer the possibility to explore the "digital self" [20] and their interaction with digital objects. The compression between what is real and virtual [21] increases and increases the contexts and bodies for which one designs. Digital becomes a means but also the ultimate goal of design, subverting the dynamics of the traditional production of fashion objects and making the discourse of the relationship between the fashion object itself and the body fertile. In this multiplicity of bodies and spaces [22] the languages and skills of the fashion designer change, hybridizing contexts that allow for the creation of a greater digital experience connected to the designed object.

REFERENCES

[1] V.M. Iannilli, and A. Spagnoli, "Phygital Retailing in Fashion. Experiences, Opportunities, and Innovation Trajectories" . *ZoneModa Journal*, Volume 11, no.1, pp 43–69, 2021.

[2] A. Cappellieri, F. Moreira da Silva, B. Rossato, L. Tenuta, and S. Testa, "Hand-Made Jewelry in the Age of Digital Technology". *AHFE International, Human Dynamics and Design for the Development of Contemporary Societies,* Volume 25, pp 1-8, 2022.

[3] V. Arribas and J.A. Alfaro, "3D technology in fashion: from concept to consumer", *Journal of Fashion Marketing and Management: An International Journal*, Volume 22, Issue 2, pp.240-251. 2018

[4] F.A. Bitonti, "When matter becomes media: how our new tools are reinventing physicality", *Architectural Design*, Volume 86. no. 5, pp 100-107, 2016.

[5] BoF and McKinsey & Company, The State of Fashion Report, 2021.

[6] E. Moustakas, N. Lamba, D. Mahmoud and C. Ranganathan, "Blurring lines between fiction and reality: Perspectives of experts on marketing effectiveness of virtual influencers," *International Conference on Cyber Security and Protection of Digital Services (Cyber Security)*, Dublin, Ireland, pp. 1-6, 2020.

[7] M. Conti, J. Gathani and P. P. Tricomi, "Virtual Influencers in Online Social Media," *IEEE Communications Magazine*, Volume 60, no. 8, pp. 86-91, 2022.

[8] E. Sheridan, M. Ng, L. Czura, A. Steiger, A. Vegliante, K. Campagna, "Americas Technology Framing the Future of Web 3.0 - Metaverse Edition", *Goldman Sachs Equity Research*, pp 14-15, 2021.

[9] J. Thackara, *In the Bubble: Designing in a Complex World*, Cambridge: MIT Press, 2005.

[10] K. Quartier, A. Petermans, T. C. Melewar, "The Value of Design in Retail and Branding", *Emerald Publishing Limited*, 2021.

[11] B. Ayan, E. Güner, S. Son-Turan, "Blockchain Technology and Sustainability in Supply Chains and a Closer Look at Different Industries: A Mixed Method Approach", *Logistics,* 2022.

[12] E. Baek, S. Haines, O.H. Fares, Z. Huang, Y. Hong, and S.H.M. Lee, "Defining digital fashion: Reshaping the field via a systematic review", *Computers in Human Behavior*, volume 137, 2022.

[13] C. Scarpitti, "Per una sperimentazione materica postdigitale. Oltre i bits, i nuovi atomi" in *A Matter of Design: Making Society trough Science and Technology,* (Editors C. Coletta, S. Colombo, P. Manugaudda, A. Mattozzi, L.L. Parolin, and L. Rampino), Proceedings of the 5th STS Italia Conference, p 1005, 2014.

[14] G. M. Conti, *Cross Fertilization: Un approccio al Progetto per la moda*, Milano 2012.

[15] C. Colombi, and L. Tenuta, *Education for fashion-tech. Design and technology for future fashion creatives*. Nielsen Book, 2020.

[16] C. Colombi, and D. Casciani, D, "Fashion-Tech Alliance: Innovating Professional Digital Competences and Skills in the Fashion Industry", *INTED2021 Proceedings*, pp. 7842-7852, 2021.

[17] L.R. Santos, G. Montagna and M.J. Pereira Neto, "The Virtualization of the Fashion Product", *AHFE 2020: Advances in Industrial Design*, 2020.

[18] L. Tenuta, B. Rossato and A. Cappellieri, "From digital to physical twin. An innovative design methodology for future creatives", *Proceedings of INTED2023 Conference*, pp 5301-5307, 2023.

[19] Y. K. Dwivedi, "Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy", *International Journal of Information Management*, volume 66, 2022.

[20] A. Granelli, *Il sé digitale: identità, memoria, relazioni nell'era della rete*, Guerini e Associati, Milano. 2006.

[21] T. Maldonado, *Reale e virtuale*, Feltrinelli, Milano. 1992.

[22] G. Nichilò, G. Pontillo, and B. Rossato, *Designing the Experience Among the Contemporary Phygital Multiplicity of Bodies and Spaces*, in AA.VV., Exploring Maldonado, (Edited by P. Califano), Fondazione Feltrinelli, Milano, 2022.