SYNERGIES IN THE EVOLUTION OF ARTIFICIAL INTELLIGENCE AND FASHION

A PROSPECTIVE ANALYSIS

ARRIGO BERTACCHINI
University of Campania “Luigi Vanvitelli”
Arbertacchini@gmail.com

PIETRO SALVATORE PANTANO
University of Calabria
pietro.pantano@unical.it

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.
Competing Interests: The Author(s) declare(s) no conflict of interest
DOI: https://doi.org/10.36253/fh-2503

Abstract

This study provides an in-depth analysis of the intersection between artificial intelligence (AI) and fashion, focusing on the potentials and ethical challenges related to the intensive use of large datasets. Using methodologies such as “Envisioning” and the “Scenario Planning Model”, the aim is to develop clear and structured approaches to the deployment of AI in the fashion industry, exploring how this technology can transform and enrich the creative process, extending human capabilities. Among the main ethical challenges are training on culturally connoted data, which risks introducing formative bias, and the need to explain AI processes and decisions in understandable terms (explainability). The possible formalization of AI methods to make their processes and results formal is also discussed. The potential capabilities of these technologies to overcome the limits of human intellect are also considered. The conclusions highlight the importance of a balance between technological innovation and ethical considerations to promote ongoing dialogue among diverse stakeholders, ensuring that AI in the fashion industry evolves inclusively, ethically, and responsibly, fostering a future where technology and human creativity coexist harmoniously.

Keywords: *Artificial Intelligence (AI), Fashion and Technology, Envisioning and Scenario Planning Models, Creative Innovation, Human-AI Harmony*

Foreward

The evolution of Artificial Intelligence (AI) is radically transforming various sectors, including the field of fashion, traditionally guided by human creativity and sensitivity. This article explores how AI is influencing fashion, not only in terms of design and production but also in trend analysis and marketing strategies. Authors such as Hennigs et al. (2015) have examined the impact of AI on consumer behavior, while Tuarob and Tucker (2019) have discussed the potential of AI in design innovation. A crucial aspect of this transformation is the use of large datasets. Analyzing vast volumes of data - from consumer preferences to sales trends - allows AI to offer valuable and personalized insights, as emphasized by Smith and Linden (2017). To understand and predict the future implications of AI in fashion, this study employs two main methodologies: Envisioning and Scenario Planning Model. Envisioning, as described by Dunne and Raby (2013), enables imagining possible futures and exploring how current technological trends may evolve. This approach is particularly useful for considering how AI can influence not only the technical aspect of fashion but also its cultural and social perception. On the other hand, the Scenario Planning Model, illustrated in the works of Schwartz (1996), provides a framework for developing and analyzing various future scenarios. This methodology is effective in evaluating the different trajectories AI could take in the fashion industry and planning strategies that are resilient to various possible

developments. To explore the intersection between Artificial Intelligence (AI) and fashion, this article utilizes two advanced methodologies: Envisioning and Scenario Planning. These approaches provide a framework for analyzing and predicting the potentials and challenges that AI brings to the world of fashion. Through Envisioning, we imagine future scenarios and potential developments of AI in fashion. This method allows us to explore how new technologies can influence not only production and design processes but also consumer trends and the cultural perception of fashion. Envisioning serves as a tool to anticipate technological advancements and understand their impact on society and the fashion industry. Scenario Planning, on the other hand, allows us to examine a variety of possible futures in which AI could evolve in the context of fashion. By creating different scenarios, from optimistic to more cautious ones, we can assess how fashion companies and consumers might have to navigate these futures. This approach helps identify flexible and resilient strategies to address uncertainty and rapid technological transformations. After the introduction, we will focus on the potential of AI in fashion, exploring how it can transform the creative process, enhance human capabilities, and drive data-driven design innovations. Subsequently, the issue of originality and intellectual property in the era of AI will be explored, highlighting the challenges posed by machine learning models. The article will conclude with a synthesis of the main points, emphasizing the importance of finding a balance between technological innovation and ethical considerations, and proposing a perspective for constructive dialogue and responsible evolution of AI in the fashion industry.

Research Methodologies: Envisioning and Scenario Planning

To explore the intersection between Artificial Intelligence (AI) and fashion, the use of the Envisioning and Scenario Planning Model methods plays a fundamental role in analyzing and predicting the potential trajectories of this emerging technology. The Envisioning method, rooted in long-term thinking and interdisciplinary creativity, as discussed by Dunne and Raby (2013), allows us to explore how AI can open new horizons in the field of fashion. This approach, integrating various perspectives from engineering to design, will guide us in imagining future scenarios, evaluating both the social and cultural impacts that AI could have on fashion. For example, we will consider the ways in which AI could influence the perception of value and luxury, as highlighted by Hennigs et al. (2015), as well as the implications for consumers and designers. Here is how these methods will be employed.
The processes enabled by Envisioning are as follows:
- *Creative Exploration:* through Envisioning, the article will explore creative visions of how AI can transform the fashion industry. Future scenarios will be imagined, where AI could personalize the shopping experience, influence fashion trends, or even autonomously create designs.
- *Assessment of Future Impacts: we will use this* method to assess the social and cultural impacts that AI could have on fashion. It will be important to examine how AI may influence the perception of value and luxury, as well as the implications for consumers and designers.
- *Identification of Opportunities and Challenges:* Envisioning will help us identify new opportunities for AI in fashion, such as supply chain optimization and sustainable production, as well as challenges, such as ethical and privacy issues

The Envisioning method is a technique used for design and futuristic analysis, especially in the context of technological innovation and design. This method is based on some fundamental assumptions:
- *Long-Term Thinking*: Envisioning requires a perspective that extends beyond the immediate, considering how technologies, society, and the environment may evolve in the long term.
- *Exploration of Different Scenarios*: It involves exploring a variety of future scenarios, including those that may seem unlikely at the current moment, to better understand potential developments and their implications.
- *Interdisciplinarity:* It combines knowledge and approaches from different disciplines, such as technology, sociology, economics, and design, to achieve a holistic and integrated view of the future.
- *Creativity and Innovation*: Envisioning encourages creativity and innovative thinking, allowing for the imagining of new possibilities and solutions that are not constrained by current limitations or conventions.
- *Human Focus:* It centers attention on the human experience and the social implications of emerging technologies, placing the user and society at the

core of the envisioning process.
- *Impact Assessment*: It includes the assessment of the potential impacts of new technologies, both positive and negative, on people, societies, and the environment.
- *Agility and Adaptability*: It recognizes that the future is inherently uncertain and that plans and visions must be flexible and capable of adapting to new information and circumstances.
Stakeholder Involvement: It often involves a variety of stakeholders in the envisioning process to ensure that different perspectives and interests are considered.

The use of the Scenario Planning Model in analyzing the potential of Artificial Intelligence (AI) in the fashion industry proves to be a strategic methodological approach to anticipate and prepare for future technological developments. This model, as outlined by Schwartz (1996), is particularly valuable in the context of AI in fashion, an industry undergoing rapid evolution and characterized by significant uncertainty and complexity.

1. Development of Multiple Scenarios: Using Scenario Planning, the article is dedicated to developing various future scenarios based on current trends in AI in the fashion industry. Following the example of Ringland (1998), who emphasizes the importance of considering a broad spectrum of possibilities, these scenarios will range from optimistic ones, where AI seamlessly integrates into the industry, to pessimistic ones that anticipate significant challenges and potential negative impacts. Realistic scenarios, offering a balanced and probable view of the use of AI in the fashion sector, will also be considered.

2. Analysis of Strategic Implications: In each proposed scenario, the strategic implications for various stakeholders in the fashion industry will be analyzed, following the approach suggested by Van der Heijden (2005). This includes examining the impact on fashion brands, designers, retailers, and consumers. Special attention will be given to adaptability to emerging technologies and resilience in the face of rapid market changes. Reflections on how companies can anticipate and respond to these developments will be provided, following Chermack's (2004) analysis of the importance of strategic preparedness.

3. Planning and Preparation: Finally, based on the developed scenarios, the article will formulate strategies for stakeholders to prepare for and adapt to possible future developments of AI in fashion. This segment will focus on recommendations in terms of innovation, training, and regulatory policies. The goal is to provide stakeholders in the fashion industry with tools to navigate a continuously changing landscape, as suggested by Bradfield et al. (2005) in their research on strategic planning and change management.

The combined use of Envisioning and the Scenario Planning Model will be crucial to guide an informed and in-depth discussion on the evolution of AI in the fashion industry, navigating through a territory that is both promising and complex. Both methods will be essential for steering an informed and in-depth discussion on the evolution of AI in the fashion sector, assisting in navigating a landscape that is both promising and complex.

Potential of AI in Fashion

In this section dedicated to the potential of Artificial Intelligence (AI) in the fashion industry, we will examine how AI is transforming the creative process, expanding human capabilities, and driving data-driven design innovations.

Transformation of the Creative Process: AI is revolutionizing how fashion designers conceive and create their products. The integration of AI into design offers new possibilities for customization and innovation. As emphasized by Tuarob and Tucker (2019), AI can analyze real-time consumer trends and preferences, providing designers with valuable insights that can inspire new creations. Furthermore, AI can automate parts of the design process, such as fabric selection and modeling, allowing designers to focus on the more creative and innovative aspects of their work.

Extension of Human Capabilities: AI represents an extension of human capabilities in the fashion industry. Through machine learning and data analysis, AI can offer a deeper understanding of consumer needs and preferences, as illustrated by Smith and Linden (2017). This enables fashion brands to create products more in line with customer expectations, improving the shopping experience and increasing consumer satisfaction.

Data-Driven Design Innovations: The use of data

has become a fundamental pillar in fashion design innovation. AI can process and analyze large datasets to identify emerging trends, predict future demand, and suggest new styles and patterns. This ability to translate complex data into concrete design insights is crucial for remaining competitive in a rapidly changing industry, as highlighted by Zheng et al. (2020).

More than human

In this section dedicated to the potential of Artificial Intelligence (AI) in the fashion industry, we will explore how AI capabilities can surpass those of human intellect and the implications this could have for the fashion sector, particularly regarding the concept of creativity.

Exploration of AI Capabilities Beyond Human Intellect: The progressive evolution of AI has led to the development of systems capable of performing tasks that go well beyond human cognitive abilities. Authors like Brynjolfsson and McAfee (2017) have discussed how AI can process vast amounts of data, identify complex patterns, and even generate creative ideas in ways that surpass human limitations. This capability extends to the fashion industry, where AI can analyze emerging trends and create innovative designs based on extensive databases of styles, fabrics, and patterns.

Implications of AI Capabilities for the Fashion Industry: The rise of 'more than human' creativity in AI in the fashion industry raises significant questions. For example, as emphasized by Bostrom (2016), while AI can generate a wide range of designs and styles, its integration into the creative process must be carefully managed to maintain a balance between technological innovation and the human essence that traditionally characterizes fashion. The question that arises is how to reconcile the potentially infinite creativity of AI with the limitations of human capabilities. An area of particular interest, as explored by Webb et al. (2020), concerns the impact of AI on creativity and design in fashion. While AI can offer new possibilities for design generation, it is crucial to consider how these innovations fit into the broader context of human fashion traditions and practices. Another area concerns the development of computational agents managed by AI. In particular, Nicenboim et al. (2020) focus on how AI agents can be studied and designed from a more human perspective, integrating approaches such as ethnography of things and material speculations. This approach is relevant to fashion as it allows for examining conversational agents and other AI systems not only as technological tools but also as active participants in a broader social and cultural context. In fashion, the more-human approach could help better understand how AI agents, such as voice assistants or automated design systems, interact with human users and influence design and consumption decisions. For example, AI could be used to personalize the shopping experience or generate new designs, taking into account a variety of human and environmental factors.

The article raises important issues regarding ethics and design in AI, such as the need to consider AI agents within their ecological and infrastructural networks, addressing themes like privacy, security, and business interests. Additionally, how AI agents are presented and perceived by users (e.g., the use of female voices in virtual assistants) can have gender and cultural implications that must be considered in the design of more inclusive and conscious systems. Therefore, adopting a more-human approach in the evolution of AI in the fashion industry can lead to a deeper understanding of human-AI interactions. This will enable the development of technologies that not only enhance design and production capabilities but are also sensitive to the social, cultural, and environmental contexts in which they operate. These are the challenges and opportunities that fashion designers currently face, examining how fashion can benefit from the advanced capabilities of AI while maintaining the uniqueness and authenticity that only the human touch can provide.

Two Perspectives in the Evolution of AI: Risks and Opportunities

Two crucial perspectives regarding the evolution of Artificial Intelligence (AI) in the fashion industry involve both the evolutionary aspects of AI and the dangers arising from it without adequate legislation, as well as aspects that would lead us to view these technologies as opportunities for advantageous growth for humanity, moving towards harmonizing humans and the planet with such technologies.

Uncontrolled Growth of AI and its Dangers: Uncontrolled and unregulated growth of AI in the

fashion industry could lead to a series of challenges and dangers. Authors like Bostrom (2016) have highlighted the potential risks of technological advancement surpassing human capacity for control and understanding. In the context of fashion, this could mean the creation of designs that disregard ethical, social, or environmental norms, or the emergence of new forms of monopoly by companies using AI to dominate the market. Additionally, the lack of transparency and explainability in AI decisions could result in a loss of trust from consumers and stakeholders.
Opportunities for Harmony between Human and AI: On the other hand, there are significant opportunities for a harmonious integration between human and artificial intelligence in the fashion industry. Authors like Daugherty and Wilson (2018) have emphasized how AI can amplify human capabilities, enhancing creativity and efficiency. In fashion, this could translate into collaboration between human designers and AI algorithms to create innovative designs that combine human intuition with AI data analysis. Such an approach could also lead to a higher level of customization in fashion products, meeting individual consumer needs in previously unimaginable ways.
Therefore, as we explore the growth of AI in the fashion industry, it is essential to consider both potential risks and opportunities. A balanced approach could lead to synergy between human and AI, where the strengths of both are utilized to promote innovation, sustainability, and inclusivity in the world of fashion.

Final Considerations: Balancing Innovation and Ethics

We have explored how AI is transforming the fashion industry, from its potential to renew the creative process and expand human capabilities to the ethical challenges and risks associated with the use of large datasets. We have discussed the need to address issues such as training bias, explainability, and intellectual property in the era of AI. Additionally, we have considered the role of AI in future scenarios, examining both the dangers of uncontrolled growth and the opportunities for harmonious collaboration between human and artificial intelligence.
In conclusion, this study has provided a thorough and multidimensional analysis of the intersection between Artificial Intelligence (AI) and fashion, exploring transformative potentials and ethical challenges arising from the intensive use of large datasets in this dynamic sector. We have seen how AI can revolutionize the creative process in fashion, extending human capabilities and leading to data-driven innovations, while facing significant ethical challenges related to training bias and the explainability of decisions made by AI systems. Through the use of Envisioning and Scenario Planning methodologies, we were able to imagine and assess possible futures for AI in fashion, considering both potential opportunities and risks. This approach allowed us to examine scenarios in which AI not only enhances human creativity and productivity but also raises crucial issues regarding intellectual property, regulation, and the balance between technological innovation and human values.

In particular, the discussion on the risks of uncontrolled AI growth and the opportunities for harmonization between human and AI has revealed the need for a balanced and conscious approach. In this context, regulatory policies play a key role in ensuring that progress in AI occurs responsibly and sustainably, considering social and ethical implications.
Ultimately, the future of AI in fashion depends not only on technological innovations but also on ongoing and constructive dialogue among all stakeholders involved. It is imperative that this dialogue includes ethical, cultural, and social considerations, ensuring that the evolution of AI in the fashion industry develops in a way that is beneficial for society as a whole. Looking ahead, AI has the potential not only to transform the fashion industry but also to do so in a manner that respects and values the uniqueness of human creativity and principles of fairness and sustainability.

References

Bostrom, N. (2016). Superintelligence: Paths, Dangers, Strategies. Oxford University Press.

Bradfield, R., Wright, G., Burt, G., Cairns, G., & Van Der Heijden, K. (2005). The origins and evolution of scenario techniques in long range business planning. Futures, 37(8), 795-812. doi:10.1016/j.futures.2005.01.003

Brynjolfsson, E., & McAfee, A. (2017). Machine, Platform, Crowd: Harnessing Our Digital Future. W.W. Norton & Company.

Chermack, T. J. (2004). Improving decision-making with scenario planning. Futures, 36(3), 295-309. doi:10.1016/S0016-3287(03)00156-0

Daugherty, P. R., & Wilson, H. J. (2018). Human + Machine:

Reimagining Work in the Age of AI. Harvard Business Review Press.

Dunne, A., & Raby, F. (2013). Speculative Everything: Design, Fiction, and Social Dreaming. MIT Press.

Floridi, L., & Cowls, J. (2019). A unified framework of five principles for AI in society. Harvard Data Science Review. doi:10.1162/99608f92.8b7e6e3d

Hennigs, N., Wiedmann, K. P., Klarmann, C., & Behrens, S. (2015). The complexity of value in the luxury industry: From consumers' individual value perception to luxury consumption. International Journal of Retail & Distribution Management, 43(10/11), 922-939. doi:10.1108/IJRDM-04-2015-0052

Nicenboim, I., Giaccardi, E., Søndergaard, M. L. J., Reddy, A. V., Strengers, Y., & Pierce, J. (2020). More-Than-Human Design and AI: In Conversation with Agents. In DIS '20 Companion (pp. 397–398). ACM. https://doi.org/10.1145/3393914.3395912

Ringland, G. (1998). Scenario Planning: Managing for the Future. John Wiley & Sons.

Schwartz, P. (1996). The Art of the Long View: Planning for the Future in an Uncertain World. Currency Doubleday.

Smith, A. N., & Linden, G. (2017). The impact of artificial intelligence on fashion e-commerce. In Proceedings of the 1st Workshop on AI in Commerce (pp. 1-4). ACM.

Tuarob, S., & Tucker, C. S. (2019). A fashion-driven approach for understanding consumer behavior in the context of artificial intelligence design. Journal of Consumer Behaviour, 18(4), 281-292. doi:10.1002/cb.1759

Van der Heijden, K. (2005). Scenarios: The Art of Strategic Conversation. John Wiley & Sons.

Webb, A., Knotts, G., & Bell, L. (2020). The future of fashion: How AI is changing the fashion industry. Journal of Fashion Marketing and Management, 24(4), 575-590. doi:10.1108/JFMM-07-2019-0134

Zheng, X., Martin, B. A. S., Pavur, R. J., & Rainer, R. K. (2020). Ethical data management: A study of IT professionals' code of ethics. Journal of Business Ethics, 162(3), 611-622. doi:10.1007/s10551-018-3981-9