Supporting Technical Designers' Decision-Making in the Era of Artificial Intelligence

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Introduction: Artificial intelligence (AI), which was first known in 1955, can be defined as "the attempt to make computers simulate human intelligence by using techniques such as reasoning, learning, natural language processing, and decision making" (Benetti, 2016, p.9). Technological developments have been making human lives more complex by exposing them to a great amount of information. Therefore, AI emerged to help people better comprehend big data and provide them with a strategic advantage to achieve success. The most recent AI example, ChatGPT, is capable of addressing a variety range of tasks from simple to the most advanced text-based requests (Lund & Wang, 2023). Its application in academia can significantly improve research and scholarship through literature review assistance and so forth (Lund & Wang, 2023), but it also raises questions about the future of education and challenges current practices. The same challenges may permeate other domains. Therefore, it is time to start discussing its entry points into the field of apparel and textiles.

In the apparel industry, AI covers a variety of decision-making problems in apparel design, manufacturing, and retailing. At the apparel design stage, AI has been studied to create designs (i.e., AI-based fashion designer) (Yan et al., 2022), provide style solutions (Lin, 2007), improve garment drapability in 3D CAD systems (Fan et al., 2001), predict missing body measurements for improving 3D body scan dataset and as a result improving size charts (Wu et al., 2022), develop an interactive CAD system for pattern design that facilitate the collaboration of designers and experts to enhance design (Fang & Ding, 2008), and predict ease allowance based on sensory evaluation of wearers (Chen et al., 2006). However, these studies are just the beginning application of AI in this field and can be considered as a basis advance research since the prediction performance was only tested only on a few garment styles and the prediction accuracy generated by those algorithms needs to be improved further so that the system can be applied in practice (Jung et al., 2003).

Conceptual approach: The emergence of simulation technologies provided technical designers with learning opportunities to improve garments' fit by going back and forth between 2D and 3D environments, which would benefit the retention of information (Motejlek & Alpay, 2022).
So far, AI studies in digital apparel product development investigated predicting factors that influence wearing comfort (Liu, Wang, & Hong, 2017), predicting the relationship between digital clothing pressures and garment fit level (fit and unfit) using 3D (Liu et al., 2018), garment fit prediction (tight, fit, loose) by using digital clothing pressure (Liu et al., 2022), predicting pattern making-related body dimensions from key body dimensions in 3D virtual setting (Liu et al., 2017). However, neither of these studies considered technical designers' points of view to better implement fit requirements (Scott et al., 2019). Based on the need identified from the literature review, we propose the term, "*AI-based technical designer"* to describe how AI could be integrated into product development to support technical design teams. Our conceptual model

(Figure 1) follows the steps described by Robinette and Veitch (2016) to achieve a good fit in a fewer number of sizes. out conceptual approach suggests that fit sessions should be documented based on four components: a) collecting anthropometric data, b) measuring fit based on the company's fit criteria, c) mapping fit scores to anthropometry, and d) determining how to improve fit overall. Therefore, it is crucial to re-envision how AI can support fitting efforts and help technical designers with decision-making.

In addition, Actor-Network Theory (ANT) suggests that technology and social interactions are intertwined and mutually constitutive (Latour, 2007). In the apparel industry, AI-based technical designers can act as agents to influence social interactions and behavior. Different aspects of ANT can be applied to AI-based technical designers in the apparel industry. For example, AI-based technical designers can (a) enroll people into new social networks and change the way they interact with apparel (enrollment), (b) facilitate communication and collaboration across different groups (translation), and (c) become so familiar and ubiquitous that people no longer think about them or notice their impact on behavior (black boxing). For example, AI-based technical designers can "*automate* routine tasks in the apparel design process.

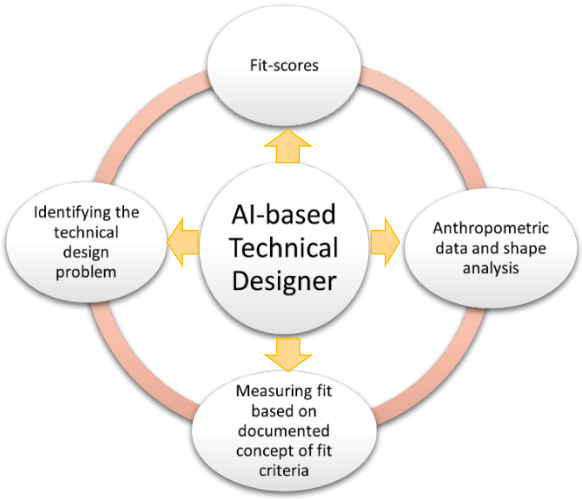

Figure 1. Conceptual areas to infuse AI in the apparel technical design process.

Discussions and implications: AI will play a very important role in the future of work. It would lead to a digitally connected supply chain and improve our field's sustainability efforts. It would also help apparel manufacturers shorten the lead time and costs associated with product development. For this reason, it is important to detail how this integration can happen in apparel product development and how the technology can be expected to revolutionize technical designers' work. The present study provided a conceptual framework based on Robinette & Veich (2016)'s seminal work that helped identify the areas to be focused on for integrating AI in apparel product development. Moreover, this framework can lead future researchers to develop further ideas in the new era of AI and propel our field. Moreover, we introduced the term, "*AI-based technical designer* "and broadly described its transformational capabilities based on ANT. However, AI would also bring some concerns such as job displacement due to automation, bias and discrimination, privacy and security, lack of transparency, unintended consequences, and ethical considerations highlighting the need for the responsible and ethical development of AI systems. It is important to consider the potential impacts of AI on individuals and society as a whole and to develop policies and regulations that ensure that AI is used in a way that is fair, transparent, and beneficial for all.

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