CRITICAL APPLICATION OF INNOVATIVE DIGITAL TECHNOLOGIES TO ANALYSE PRACTICAL AND VIRTUAL FASHION PROVISION BEYOND IMAGE DEVELOPMENT INTO INTROSPECTION

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ABSTRACT

The magnitude of what fashion has to offer lies in the dynamics of its provision. Globally, fashion providers seek creative approaches to deliver products that meet consumer demands and needs. Currently, there are virtual reality (VR) and augmented reality (AR) technologies that may be used to enhance opportunities in fashion development, realisation and conscious consumption.

Whiles dominance of social media and visual images in fashion promotion continue to drive appetites for personalised ideals with body image, digital transformations through VR and generative artificial intelligence (AI) endeavour to connect consumers to their preferred projections in the world of fashion. It has been argued that engaging fashion consumers through virtual consumptions enable them to thrive in virtual environments, satisfy visual desires of their preferred body cathexis and images which stand to induce emotional stability. There are however knowledge gaps relating to correlations and practical creation of balance between virtual reality and reality; as well as emotional and psychological implications towards post-humanism where fashion is concerned. These ought to be better understood.

The study applies a triangulated and mixed method approach in primary data collection and qualitative analysis. It employs cutting-edge 3D virtual fashion technologies and AI, to simulate and analyse creative fashion garments and fit. These are tested by the Avatars that it generates using participants anthropometric data from 3D body-scanning technology. The AI generates unique visual output based on specific prompts; whiles the 3D virtual technology is engaged in constructing garment patterns, prototyping outfits, visualising finished virtual fashion garments and testing fit on the Avatars.

This study captures and examines practical development processes for fashion outputs through experimentation with digital technologies. The work collects and evaluates emotive responses from participants regarding what constitutes ideal garment fit, body image and preferred projections relating to fantasied bodies in a post-human environment. In providing insights into balances between practical and virtual fashion, aspirations for conscious and sensitive fashion consumption are realised. The practicality of applications for fashion brands and consumer prognosis featured in this work contribute further insights into corporation towards a positive future society.

INTRODUCTION

As an industry, fashion has experienced changes induced by economic, ecological, technological and social trends. Subsequently, these have resulted in image-driven, personalised consumer demands that require effective application of technologies in today's digital and data-driven world, particularly post-pandemic.

In outlining key sustainable initiatives towards a positive social and economic future, McKinsey & Company (2023) purport that today's consumers seek and invest in products that best denote their interest. Creative and virtual fashion promotions during lock-down were intensified by abundant body image ideals online, to which consumers were exposed. Subsequently, the demand for non-generic, creative provision has become a very attractive proposition. This has direct impact on application processes geared towards fashion provision and sustainability; hence, research in this area is warranted. This study has sought to acknowledge consumer size, shape and image profiles; and using innovative digital technologies including generative artificial intelligence (AI), it tests virtual and practical outcomes for fashion development.

VIRTUAL FASHION AND DIGITAL TECHNOLOGIES

Today's fashion environment grants opportunities for individuals and professionals to be able to experiment with AI (Bain, 2023) and virtual image representations such as Avatars. Self-presentation through a range of avatars in virtual worlds and social media have gained attention (Freeman & Maloney, 2021) mostly amongst young adults (Starkey et al., 2021). At present, fashion generators and providers seek innovative approaches to deliver creative and fashionable work using sustainable means including cutting-edge and smart technologies. Currently, there are virtual reality and augmented reality technologies that may be used to enhance opportunities in fashion development and conscious consumption.

Interaction between virtual and physical fashion is becoming more pronounced especially post-pandemic (Silvestri, 2022). Consumers currently have the ability to create their own digital identities, either similar to or distinct from who they really are; and now present themselves in the digital world without being constrained by physical limitations such as structure, looks, or location. Fashion and identity are intrinsically linked, so digital fashion plays a significant role in how customers create and view virtual selves (Baek, et al., 2022).

Whiles dominance of social media and visual images in fashion promotion continue to drive appetites for personalised ideals with body image, digital transformations through VR and AI endeavour to connect consumers to their preferred projections in the world of fashion. It has been argued that engaging fashion consumers through virtual consumptions enable them to thrive in virtual environments, satisfy visual desires of their preferred body cathexis and images which stand to induce emotional stability. AI image generation creates inspiration and foundation for creative designs (Muret, 2023) and has potential for fashion customisation.

DATA COLLECTION METHODS

Digital technologies have been targeted for automated fit and its visualisation, pattern development, customisation and virtual fit assessment. Nonetheless, virtual fit technology is still being validated for wider implementation across supply chains.

With a triangulated mixed method approach of data collection and qualitative analysis, this study conducted and analysed responses from participants, which contributed to AI prompts for experimental visualisation. The study also captured and examined practical development processes for fashion outputs using a range of cutting-edge digital technologies. The phases of data-capture and analysis as well as instrumentation used were:

1) Focus group session comprising avid fashion consumers interested in virtual fashion and social media and body

image.

2) 3D body scanning procedure to capture anthropometric data.

3) Midjouney generative AI visual tool for generating fashion images.

4) Clo3D software for developing fit trial Avatars, customising patterns, prototyping and visualising finished virtual fashion garments.

PRESENTATION, DISCUSSION OF KEY FINDINGS AND PROTOTYPING

Phase (1) - Participants' Input:

Purposive sampling methods resulted in the selection of five 19-24 year old female fashion consumers from the cosmopolitan city of Manchester. Table 1 provides a profile of participants of the focus group discussion; whiles Figures 1 and 2 summarise critical responses.

F/G ID	Current visual attributes of body and identity	Garment size	Body shape	Personal Interests
AA	Slender & sporty Caucasian female	10	Slender	Sports, dance, fashion, shopping, yoga, social media
BB	Slender, petite Asian female	8	Slender	Social media, fashion, accessories, travelling
CC	Slender, curvy, athletic mixed-race female	12	Slender-curvaceous	Holidays, cycling, fashion, social media, shopping
DD	Full form Caucasian female	14	Full-figured	Fashion, social media, singing, films
EE	Voluptuous, black female	14	Full-curvaceous	Social media, fashion, socialising, cooking, shopping

Table 1: Profile of focus group participants

Personal experiences, garment fit and social media

(AA) *I like garments to fit me just right. I don't have many bad experiences with fit, but I sometimes struggle to get want I want that matches my personality. I like to be able to move in my garments and feel comfortable. I buy a lot of clothes to support my social media content.*

(BB) *Because I am quite small, I like garments that make me look taller. For me it fits if it makes my waist look smaller and I got like a small waist, long legs. Even if it is a bad fit but makes me look taller in pictures then it fits.*

(CC) I mostly go for *tightly fitted clothes and show off my figure. It makes me feel great. Not all clothes fit the way I want them to and sometimes adjustments are needed – which is not great. I am active and work on figure so when clothes fit me just right, I feel wonderful. I wish there was a way that custom fitted clothing could be normalised on the high street. During the pandemic my social media following grew so much and followers like how my clothes fit on screen.*

(DD) *I sometimes struggle to find what I want and spend too much time shopping for the right fit or size. It is frustrating and I am not sure why technology has not helped to address issues with fit because this is a long-standing problem. I follow people on social media but not yet ready to start any image-based content yet. Still finding my fit.*

(EE) *I think fit has to go along with body shape. There should be special sizing for curvy females. Having garment ease going all way from top to bottom distorts shape and fit. I mean why should garments just be tight across the bust and hip and start to gather around the waist? it needs to be the right amount of tolerance and tightness the whole way. I speak for curvy ladies and having grown more followers during and after lockdown may mean that I'm representing out there. I tend to alter clothes to fit my silhouette and pictures look great. It's all in the visual screen image.*

Figure 1: Key summaries on participants' fashion experiences, garment fit and social media.

Body image aspirations, fashion fantasies and an ideal future with media, Avatars and AI

(AA) *I think my image represents a real Mancunian. Not extreme and I am able to fit in well. I like to change my looks and image from time to time and do that through my media Avatar. Sometimes I like flamboyance and other times just subtle generic looks. I guess I'm all for innovation and creativity. I would pay for clothes that reflect my image occasionally and welcome AI assistance.*

(BB) *I like to look petit but much taller. My social media Avatars are always much taller because that is how I like myself to be. When garments make me look small or my correct size, they don't make me feel inconspicuous and unimportant. My fantasied body is a bit futuristic and has a sense of belonging. If I find clothes that give me that look, I buy them.*
I will use AI for help all the time if it really works.

(CC) *My ideal body image is a bold and confident silhouette. I like garments that fit me according to what my figure looks like to show a bit of my feminine side. Sometimes I create a mor pinched in waist when I dress up or get clothes that are very tight at the waist and get a lot of attention – that is my ideal. I imagine my Avatar has a perfect body and I feel I have to maintain my shape to reflect that. I know what I want and like to appear creative and exclusive.*
If AI understands what I want, then I want that.

(DD) *I am currently not my most ideal size or shape. I struggle with weight and sometimes wish real clothes were worn only on screen so that I can possess my perfect body image, which will be tall, a bit curvy and sexy. My avatars on screen are not a true representation of my present self ...more like my fantasised self. I wish we could live in a post-human world where our appearances are exactly what we want them to be all the time. If there were clothes that would make me look my ideal I will consider them. If AI helps, then it will be my go-to.*

(EE) *Most times I feel that I reflect my ideal body image and get compliments, so I suppose that is my ideal and fantasied look. That said, there are also very rare times when I just wanted to look slimmer and more "regular" to enjoy a bit of privacy. If I had my own way, I would always wear outfits that reflect self-determination and a strong feminine person. That is who I am. Sometimes I pay for custom-made garments, and I will continue to pay for garments that are fashionable and reflect my image. AI should be designed to help me.*

Figure 2: Critical summaries on participants' body image aspirations, fashion fantasies and ideal futures with media, Avatars and AI.

Phase (2) - 3D Body Scanning:

An ethical protocol for 3D body scanning was followed and anthropometric data was obtained for the study's experimental work. Precise measurement data was captured using a non-contact 3D body scanner, capable of generating body size and point-cloud shape data (see Figure 3).

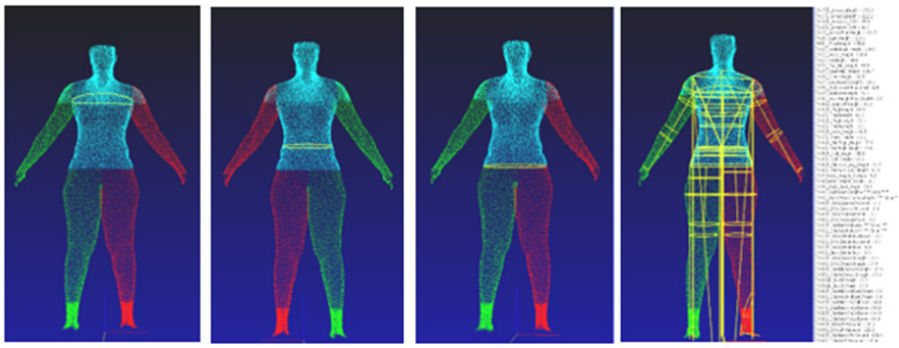

Figure 3: Data output from body scanner.

Phase (3) - AI Visualisations with Midjourney:

Midjourney was utilised through prompts (natural language descriptors). Commands tested connection of design features to predetermined concepts underpinning this study together with some key words associated with responses from the study's sample participants. The study sought to produce images focusing on the themes of 'innovation', 'post-humanism' and 'self-determination'. These would test how realistic the images will be, in terms of wearability and suitability to diverse consumers.

The first prompt was "a photorealistic fashion model wearing innovative outfits inspired by post-humanism; perceived self- future of fashion; sustainability and Manchester" (Figure 4).

Figure 4: Original images generated by AI.

All images generated followed a similar style and could easily be perceived as one collection. Outputs were depicted through 3-dimensional forms and in translucent material. The AI tool produced outfits on a slender Caucasian female model by default.

The second prompt was “to modify original images and generate alternative designs for one of the outputs”. Results feature in Figure 5.

Figure 5: Modified images generated by AI.

It is visible from the result that the second prompt offered very subtle modifications. The model remained unchanged, and overall style and garment silhouette were preserved, with subtle changes in details of the overgarment and underlayer design. This depicts AI’s recognition of very nuanced design changes.

A “Self-determined outfit” and “a photorealistic fashion model wearing ideal self-outfit” prompts resulted in images in Figure 6. Outfits were more conservative and mainly displayed diverse variations of the classic shirt on a Caucasian model. This may represent generic output from AI where not enough data was provided by the prompt.

Figure 6: AI images generated to the prompt of “ideal self-outfit”.

The next prompt tested the visual interpretation of “post-humanism”. Figure 7 showcases result from the prompt “a photorealistic fashion model wearing outfits inspired by post-humanism”.

Figure 7: AI images generated to the prompt of “post-humanism”.

There was some consistency in the style of the garment and leather/lycra -based fabrics. Garment shapes were also slightly complicated from previous, which may reflect components linked to “post-humanism” features contextualised by AI. Creativity in garment construction and silhouettes of the generated outfits were also observed.

The final prompts tested were “innovation” and “future of fashion” (Figure 8).

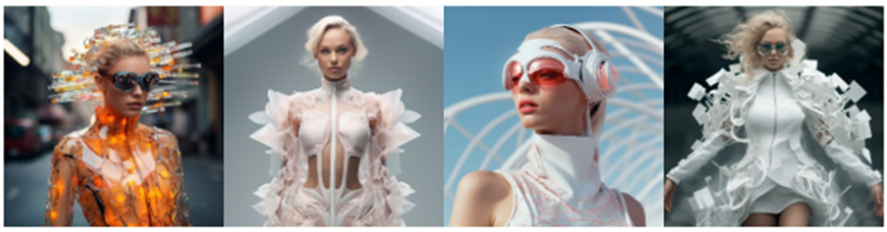

Figure 8 - AI images generated to the prompt of “innovation” and “future of fashion”.

This prompt produced much more futuristic and extravagant results. Links to wearable technology were observed. The concept, design and look resembled the original prompt, which may suggest that the key design features were based mainly on the prompts of “innovation” and “future of fashion”. With all outputs, models were either blond or red-headed, slim and Caucasian by default.

Phase (4) - Prototyping and Fit Trials with Clo3D:

The next stage of the study tested practicality of developing Midjourney AI’s generated outfits into virtual prototypes using Clo3D’s virtual prototyping software. The 3D visualization and technical property features in Clo3D grants opportunities to apply and test innovative fabrics, finishes and trims. These had to be discerned from the onset with any AI generated images for successful development, as they were not known.

Prototyping was preceded by the following key questions:

1) How practical are AI generated images for fashion and what steps may be involved to recreate patterns and garment specifications for them?

2) Will visual appearance of the look change drastically when realistic physical properties are applied to developed patterns and garments?

3) How easy it is to grade a prototype sample garment; and will its appearance get modified when visualised on a range of body forms?

4) How practical is this process and its wider implication for future professional garment development?

One of the outfits generated by the AI prompt was then selected based on visual appeal, uniqueness and its com-

plexity as well as likelihood to generate a potential challenge for the experimental virtual prototyping work ahead (Figure 10).

Figure 10: AI outfit selected for experimental prototyping.

To address the first question, there was an initial analysis of anticipated fit and silhouette of the garment and development of required shapes from basic patterns. It was practical to create a generic fit for UK Size 12 female model. The under layer featured a dropped-shoulder top, belt and an unidentifiable bottom, which was assumed to be a plain skirt. Although the precise characteristics of the dropped shoulder sleeve was unclear from the image, after careful consideration and experimentation it was surmised that reproduction of the outfit was possible with some advanced modifications of a raglan sleeve. Following further challenges regarding the finishing to the bottom layer and hem, the volume and structure of the garment could be achieved by applying suitable construction techniques.

There were further tweaks involving shaping and cutting of pattern pieces as well as improvising with draping (of the plastic-looking fabric) and the creation of several seam lines, as they were not discernible from the AI-generated garment image.

Further challenges were presented with the virtual garment construction, in particular with what appeared to be heat-bonded seams featured at the edges, which appeared to be merging into some cutting lines. There was also no clarity on how the garment was meant to be donned, or whether there was an opening or closure to this effect. The neckline also appeared to be too tight for the outfit to be donned in the absence of any fastening. These subtle inconsistencies revealed the state of imperfection or lack of clarity by the AI for product development. It may stand to reason that visualisation capabilities have achieved dramatic advances, however, implementation on practical levels are still not fully considered. Subsequent patterns recreated from the AI images feature in Figure 11.

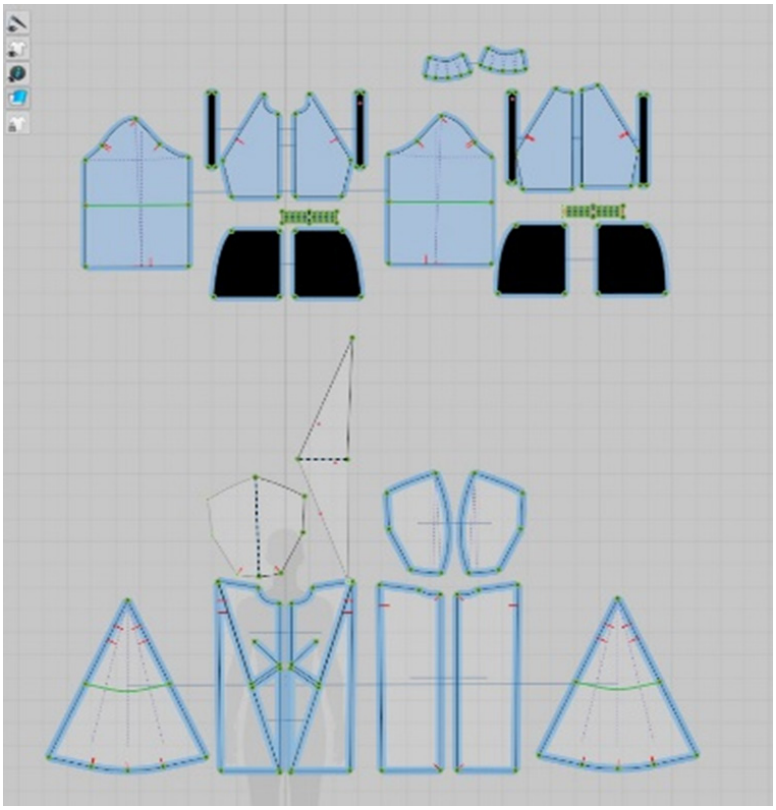

Figure 11: Patterns created using 3D visualization software.

To address the second and third questions, the developed patterns were then prepared, assigned fabric properties identical to the perceived original image, virtually stitched and mounted onto the trial Avatar (Figure 12).

Figure 12: Virtual stitching and mounting of outfit using 3D visualisation.

To support the prototype procedural testing, the selected Avatar was built into the sizes and shapes of the study's sample participants. Visual results are presented in Figure 13.

Figure 13: Prototype generation and individualised fit trials

It was feasible to grade and mount the prototype outfit onto the diverse range of the sample participants' body forms with minimal design alterations. Standard grading rules were applied to the outfits. Fit trials were conducted to ensure consistent achievement across the different sizes and shapes (Figure 14). It was possible to scrutinise fit with a colour-coded thermal indicator for tightness. This revealed issues with tight necklines (x3 cases) and bust tightness (x1 case). Slight adjustments were conducted fix these.

Figure 14: Scrutiny of prototype fit with coded indicator for tightness.

In response to the fourth question, the experimental procedure and fit trials found that beyond its initial glitches, with slight modifications and technical alterations it was possible to achieve innovative garment development to through the processes established by this study.

CONCLUSION

This study has experimented with the application of AI prompts to support creation of fashion consumers' aspired body image identity, as well as tested the practical steps of converting AI-generated images of these aspirations into production-ready garments of custom sizes. It finds and concludes that it is possible to generate diverse, unique and highly detailed fashion looks from just short text prompts using generative AI tools, then develop these into virtual prototyping samples for fashion practice, albeit with tweaks along the way.

Presentations of body forms and visualisations of self-image are crucial to the way fashion is exploited. Whiles it may be estimated that digital technologies, image ideals and evolving lifestyle trends contribute to the fashion industry in general, the direction to sustenance beyond growth and secular humanism must point towards efforts in aligning today's image-conscious fashion consumer's preferences with product provision. Such will enable promotion of a more sustainable future. Aspirations for conscious and sensitive fashion consumption have been realised by this research. Although this study was limited to a small, homogenous sample of young female adult participants, findings from this experimental work could inform futuristic realisation of profile-based, customised apparel development and its prototyping procedures. These have implications for fashion practitioners and academics. Further developments from this study proposes a larger sample across a wider age group and broader scale prototyping to gauge and verify viability towards wider future applications.

The practicality of applications for fashion brands and consumer prognosis featured and further planned for this work stives to contribute insights into corporation towards a positive future society beyond image development into introspection.

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