An Exploratory Study of the Accuracy of Parametric Avatars in Browzwear VStitcher

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Introduction

The implementation of three-dimensional (3D) virtual try-on/fitting, as an innovative marketing approach, has led to an increase in online apparel sales and a decline in garment return rates (Hwangbo et al., 2020). The integration of 3D simulation technology in apparel product development has shortened lead times and enhanced cost efficiency. Most sourcing agents/contractors have confirmed that 3D virtual fitting can effectively guarantee garment fit and sizes and facilitate smoother communications with overseas apparel companies (Hwang-Shin & Lee, 2020). These benefits also significantly contribute to fashion sustainability. Major apparel companies and retailers, such as VF Corporation, Walmart, and Target, have embraced 3D apparel simulation in their product development processes to minimize costs and streamline prototyping and production (browzwear.com). However, compared to the real garments, the virtual garments simulated in OptiTex and VStitcher 3D packages showed discrepancies at some locations because the avatar's body shape differed from the real model's (Lim & Istook, 2010). Therefore, it is essential to ensure the accuracy of an avatar to achieve a successful simulation result.

Importing 3D body scanning OBJ files into the software is the most precise method for avatar creation and apparel simulation (Balach et al., 2020; Gu et al., 2018; Lim & Istook, 2011). However, it could be inconvenient or troublesome for many users to obtain body scanning data, as they might not have a body scanner available. It would be easier for them to adopt parametric avatars, defined as virtual models that can be customized for specific measurements, proportions, body sizes, shapes, and postures in Browzwear VStitcher, and to adjust the measurements in the software (Browzwear, 2023). As a result, in comparison to the real model, the parametric avatar may not be accurate and could impact the simulation outcomes. Therefore, in this research, the parametric avatars created by entering the models' measurements were compared with the body scanning avatars generated by importing the models' body scanning OBJ files. The purpose of this study is to examine the accuracy of the parametric avatar. The research findings would be valuable for users, such as sourcing companies and technical designers, to better utilize 3D apparel simulation and could also provide some useful managerial suggestions for those CAD developers to improve the technology.

Methodology

Four models aged 18-25 were selected to investigate the parametric avatar's precision in Browzwear VStitcher. All models were body scanned using a $[TC]^2$ 3D body scanner. They represented the four typical body shapes: Model 1 (Spoon shape), Model 2 (Rectangle shape), Model 3 (Hourglass shape), and Model 4 (Bottom Hourglass shape) according to Simmons et al.'s (2004) body shape categorization. Only Model 2 was identified as Size 16, and the other three models were categorized as Size 8 based on a size table created by Guo and Istook (2023). The four models' body scanning OBJ files were imported into VStitcher to generate virtual models following the system's directions for setting up a body scanning avatar. The body

scanning avatars were rendered for the images of the models' front, side, and back views. Then, the measurements extracted from the four models' body scanning were entered into VStitcher to create the parametric avatars for comparison.

The default parametric avatar, Olivia, is the newest version of the virtual model for altering the measurements (Browzwear, 2023). Olivia was adopted for the parametric avatar creation for Model 1, Model 3, and Model 4. Olivia had two versions: the original version developed in 2021 and the newer version in VStitcher 2023.3. The three models' measurements were tried in these two versions of Olivia as well. The plus-sized avatar, Sofia, that was close to Model 2's measurements, was used for her avatar creation. In addition, since Olivia has a size set of seven sizes from EU-32/US-0 to EU-44/US-12 available, each of the four models' measurements was also entered into one of Olivia's sizes that is close to the model's body measurements. During the process, the measurements were adjusted to match the four models' body characteristics, such as sizes, shapes, and postures. Then, the created parametric avatars were compared with the models' body scanning images.

Results and Conclusion

The parametric avatars in Browzwear VStitcher have their limitations, even though users can modify those parameters, such as the avatar's measurements and postures. Although Olivia has the size set, utilizing these sizes of Olivia often resulted in awkward shapes after inputting the models' measurements. The problems might be because each size of Olivia was not developed based on the real models' anthropometric data in that specific size. In addition, the two versions of Olivia had variations, noticeable at the bust location. The latest version of Olivia in VStitcher 2023.3 offers more parameters for modifications, while this version of Olivia's larger breasts varied more from the real models' and led to greater difficulty in adjusting the bust area. From this aspect, the previous Olivia developed in 2021 was more applicable for the parametric avatar creation.

The measurements adjustments could be made for locations that had variations to correspond with the models' body characteristics. However, the fat distribution of the avatar differed from that of the real model, particularly at the under bust and stomach. Moreover, the posture of the avatar was the most challenging aspect for the measurement alterations to align with that of the exact model. The shoulder slope was not easy either. Since the avatars had these discrepancies from the real models, the fit of virtual garments on the avatars would be somehow different from that of the real garment on the models. The differences might be acceptable for product development of ready-to-wear. However, garment fit is more crucial for those customized clothing tailored to an individual wearer's body size and shape (Ashdown & Dunne, 2006; Guo & Istook, 2022). Therefore, it is recommended to utilize the body scanning OBJ file to generate the avatar for customized garment development.

Importing the body scanning OBJ files into Browzwear VStitcher to set up avatars for 3D garment simulation was convenient and easy to use. In contrast, modifying the parametric avatar to match the model's exact body size, shape, and posture was time-consuming and challenging. These measurement adjustments also rely on the users' expertise and skills. In addition, achieving the same fat distributions was nearly impossible. Therefore, if the garment fit is paramount, it is suggested that users import body scanning OBJ files to create avatars rather than altering a parametric avatar. Moreover, recruiting more subjects with various body shapes for

avatar development is necessary. It is recommended that CAD developers build parametric avatars according to real models' anthropometric data for precision.

References

Ashdown, S. P., & Dunne, L. (2006). A study of automated custom fit: Readiness of the technology for the apparel industry. *Clothing and Textiles Research Journal, 24*(2), 121-136.

Balach, M., Cichocka, A., Frydrych, I., & Kinsella, M. (2020). Initial investigation into real 3D body scanning versus avatars for the virtual fitting of garments. *Autex Research Journal, 20*(2), 128-132.

Browzwear. (February 21, 2023). Get to know the Browzwear Avatars. Retrieved from https://browzwear.com/blog/explore-browzwear-avatars

Gu, L., Istook, C., Ruan, Y., Gert, G., & Liu, X. (2018). Customized 3D digital human model rebuilding by orthographic images-based modelling method through open-source software. *The Journal of The Textile Institute*, *110*(5), 740-755.

Guo, S., & Istook, C. L. (2022). An exploratory study of participants' fit perceptions of customized garments. *Research Journal of Textile and Apparel, 26*(4), 371–389.

Guo, S., & Istook, C. L. (2023). Evaluation of 2D CAD technology for garments customized for body shape. *Fashion Practice, 15*(1), 136–162.

Hwangbo, H., Kim, E. H., Lee, S. H., & Jang, Y. J. (2020). Effects of 3D virtual "try-on" on online sales and customers' purchasing experiences. *IEEE Access*, *8*, 189479-189489.

Hwang-Shin, S. J., & Lee, H. (2020). The use of 3D virtual fitting technology: comparison between sourcing agents contractors and domestic suppliers in the apparel industry. *International Journal of Fashion Design, Technology and Education*, *13*(3), 300-307.

Lim, H. S. (2010). A comparative study on virtual try-on systems using body measurement input. *The International Journal of Costume Culture*, *13*(2), 118-129.

Lim, H. S., & Istook, C. L. (2011). Comparative assessment of virtual garments using direct and manual avatars. *The Research Journal of the Costume Culture*, *19*(6), 1359-1371.

Simmons, K. P., Istook, C. L., & Devarajan, P. (2004). Female figure identification technique (FFIT) for apparel, Part II: Development of shape sorting software. *Journal of Textile and Apparel, Technology and Management, 4*(1), 1-15.