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Title: Digital to Physical Garment Development:
Evaluation of Custom Avatar & Bra Development using CLO 3d
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Introduction

The use of digital technology within the apparel design and product development process has altered traditionally analog processes, introducing opportunities for increased efficiency, agility, and creativity. One area that has been significantly impacted by technology is the garment pattern development and fitting process. Digital patternmaking programs are now connected to virtual sewing and fitting tools that eliminate several steps in the physical sampling phase of product development. This reduces cost, accelerates the process, and during the COVID-19 pandemic it has become a solution for reducing face-to-face interactions. In addition, the ability of 3D programs to import or develop a variety of differently sized avatars introduces the opportunity to develop clothes with a fit standard more closely matched to a brand or customer, or even develop custom-fitted garments. In this research, the use of digital 3D CAD technology to develop custom-fitted clothing for real human bodies will be evaluated. Specifically, the program CLO 3d will be used to create a custom close-fitted garment that is digitally sewn and fitted, then cut and sewn in physical form and tested on the actual human body.

Clo 3d, Body-Scanning

Developed out of the gaming industry rather than the apparel industry, CLO 3d offers a user-friendly interface through a cloud-based subscription service. (Our Story, 2019) Within the program is an avatar editing tool that enables the program's avatars to be modified using actual human measurements. The use of human measurements to develop custom avatars supports the development of on-demand product offerings, including customized fit, without the use of body-scanning. Body-scanning has been shown to introduce privacy concerns; additionally, the body-scanning process is more intrusive to the body than traditional tailor's measurements. (Mironcika, Hupfeld, Frens, & Wensveen 2020). Using CLO 3d, these measurements can be transformed into a custom avatar to be used for developing and fitting a custom garment. However, previous research has suggested that 3D avatars are often smoother, firmer and perkier than the actual human body (Balach, Cichocka, Frydrych, & Kinsella 2020).

Bras

One of the more difficult garments to fit is the bra, and many women are not wearing the correct bra size or style for their shape and body type (McGhee and Steele 2010). Most women using a traditional bra-fitting formula end up with a bra that is too large in the band yet too small in the cup, leading to poor band support, loose strap issues for smaller cup-sized women, and uncomfortable wire placement on larger cup-sized women. (Hoffman 2001). Because the need for better-fitted bras exists, the researcher chose to develop a bra for the custom avatar using CLO 3d. Additionally, research has proven a professional fitter can more accurately assess bra size than a formula (White and Scurr 2012); therefore, the researcher's 8+ years of professional industry experience in bra-fitting on a wide variety of shapes and sizes would support evaluation

of the fit. The researcher chose to use themselves as the subject for the research to avoid excessive human to human contact during the COVID-19 pandemic.

Image 1   Image 2   Image 3   Image 4

Method

The development of the custom avatar, basic bra pattern, sewing, and fitting were completed in the digital environment of CLO 3d before the physical garment was made. To create the avatar, the measurements needed for the program were taken directly from the subject. The pattern was developed using the book Bare Essentials (Fairbanks, & Matthews-Fairbanks 2012) with the subject's actual body measurements. Once developed, the fabric

Image 5

properties needed for each component of the garment were imported or created in the program and applied to the appropriate pattern pieces. The garment was then virtually sewn and fitted to the avatar's body using the CLO 3d fit analysis. (Images 1-4) Manipulations were made to address cup fit, strap placement, and wire shape until the program analysis suggested the garment would fit well. The pattern was printed on paper, cut in the appropriate fabric, and sewn to test the fit on the human subject (Image 5).
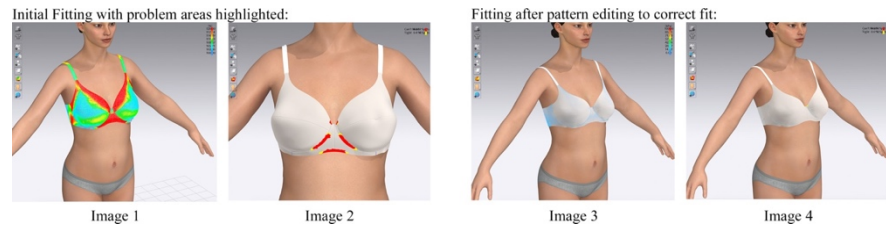
Analysis

Evaluation of the process reveals efficiency, and it is appropriate for the current state of minimal face-to-face interaction and work-from home environments. Conceivably, the subject could be physically distant, yet the designer could develop the entire product using the subject's measurements, and the resulting product could be shipped to the subject. This suggests potential as support for on-demand, custom apparel. However, evaluation of the accuracy of fit on the human subject's body reveals problem areas related to both the garment and the custom avatar. The fit of the bra was self-evaluated using the researcher's industry experience and was found to be too large in the band, too small in the cup, and too shallow in the cup, forcing the wires to sit away from the body at center front and on top of the breast tissue at the sides. The subject's size relates to a D/DD cup, and these fit problems match previous research on poor fit often found in bras for fuller cup sizes using traditional bra fitting formulas. This suggests that the algorithm used to create the avatar is based on traditional average body grading systems used to develop bra-fit formulas shown to be incorrect. Additionally, it confirms the program cannot account for placement and shape of volume of the bust on the body, critical components of correct garment fitting. (Coltman, McGhee, & Steele 2018, Balach, Cichocka, Frydrych, & Kinsella 2020)

Conclusion

For drapey, flowy clothing, the custom avatar would likely lead to the development of a nicely fitted garment. However, for body-conscious support garments such as the bra that need to conform to the placement of shape and volume on the body, the algorithms of the custom avatar need improvement. Future research on the measurements used to create the avatar are needed to identify missing measurements that would indicate body shape and volume placement.

References:

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. https://doi.org/10.2478/aut-2019-0037

Coltman, C. E., Steele, J. R. & McGhee, D. E. (2018) Which bra components contribute to incorrect bra fit in women across a range of breast sizes? Clothing and Textiles Research Journal, 36(2), 78-90.

Fairbanks, J. L., & Matthews-Fairbanks, J. L. (2012). Bare Essentials. Los Angeles Fashion Resource.

Mironcika, S., Hupfeld, A., Frens, J. W., & Wensveen, S. A. G. (Eds.) (2020). I am not an object: Reframing 3D body scanning for co-design. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, Inc. https://doi.org/10.1145/3313831.3376352

Our Story. (2019). Retrieved April 15, 2021, from https://www.clovirtualfashion.com/story.

White, J., & Scurr, J. (2012). Evaluation of professional bra fitting criteria for bra selection and fitting in the UK. Ergonomics, 55(6), 704–711. https://doi.org/10.1080/00140139.2011.647096.