Hanfu Rising: The Simulation and Evaluation of Chinese Cultural Garments: A Multi-Dimensional Comparison Study

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Keywords: Multi-layered, Chinese cultural garments, sustainability, virtual

Introduction: The process of apparel sampling produces a large amount of waste. In the U.S., the clothes that end up in the landfill increased almost 40% between 1999 and 2009, is expected to reach 25.4 billion pounds by 2019 (Council for Textile Recycling, 2017). One study shows that nearly 10% to 20% of textiles are wasted during the manufacture process (Domask, 2007). **Virtual prototyping technology** is essential to the design process within a sustainable contemporary product development model. The 3D technology of virtual prototyping is a method of product prototyping that uses computer-generated virtual reality in combination with a manufacturer's engineering data (Cobb et al., 2017). Commercial 3D systems that support simulation of 2D pattern pieces on virtual mannequin started to appear on the market in 2001 (Goldstein et al., 2009). While virtual prototyping is seen as beneficial in reducing impact of manufacturing waste, few studies have verified the fit, appearance and fabrication characteristics of virtually simulated multi-layered garments. Multi-layered garments such as Qipao and Hanfu are being promoted in popularity among Chinese fashion markets, with the rising of "Hanfu movement" (Ji, 2016). It would be beneficial for the Chinese cultural garments' market to adopt 3D virtual garment simulation in the design process of Hanfu and Qipao since the design process of Modern Hanfu and Qipao are sophisticated. The current literature into virtual prototyping typically focuses only on western garments (Morfin, 2017). Therefore, the researcher would like to choose Qipao and Hanfu as our research samples. The researchers determined that simulation and evaluation of cultural non-western garments would build on and contribute to existing research in this area. **Purpose:** This study was designed to analyze the similarity of fit and appearance between physically constructed multi-layered cultural garments and those virtually constructed. Prototypes were developed in various fabrics. Simulation technologies were researched and Optitex EFI technology was utilized to virtually simulate garment. **The research goal** is to expand the use of virtual technology to include non-western cultural garments and to demonstrate comparisons of complex garments, physically and virtually. The procedure of research involved measuring the physical parameters of the fabric, customizing a Optitex EFI Fabric library. Develop 2D and 3D patterns via Optitex EFI pattern drafting software. Researchers hypothesized that 3D simulation of non-western garments would be beneficial for emerging market. **Processes and Results:** The representative standard size 8 for American women was used to produce Qipao and Hanfu physically and virtually. The researcher worked to investigate potentials of virtual prototyping by customizing a virtual fabric library based on measurements of textile mechanical property data from cotton, silk, and hemp fabrics. The researcher adopted methods such as KES-f, obtaining objective fabric measurements that could be applied to fabric parameters (weight, thickness, breaking strength, and extension), for virtual

garment simulation, by customizing a virtual fabric library. Example of virtual and physical historical multi-layered garments are in Figure 1.

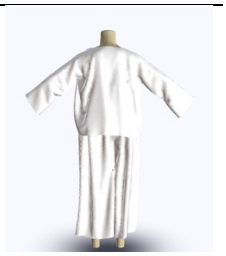
Front View		Side View		Back View	
					
Physical	Virtual	Physical	Virtual	Physical	Virtual

Figure 1. Example of the physical and virtual garment.

The researcher investigated the potential of virtual prototyping by customizing a virtual fabric library based on measurements of textile mechanical property data from cotton, silk, and hemp fabrics. The results of this paper include textile mechanical property report, virtual apparel prototypes produced by Optitex (CAD) software, and physical apparel product prototypes. **Conclusion and Future Study:** This study was designed to analyze the similarity of fit and appearance between physically constructed multi-layered cultural garments and those virtually constructed. The researcher created two Chinese historical garments and explored the relationship between the similarity of the appearance of physical and virtual models, taking into account the physical fabric mechanical properties, and the fabric objective measuring data such as weight, thickness, breaking strength, and elongation. The researcher found that the virtual and physical multi-layered garments in Figure 1 are similar. Based on these results it can be concluded that virtual presentation has great potential as a tool to evaluate the appearance of a garment in a relatively simple and quick way. Also, the study indicated the potential opportunity of virtual presentation will be widely used in the future. By carrying out the mass production through the virtual presentation, multi-layered garments such as Qipao and Hanfu can be put into the Chinese fashion market. Future studies include comparing virtual and physical garments by an on-campus survey. Also, the researcher should consider comparing several programs using different garments and more fabric combinations for complete testing of 3D virtual garment simulation fidelity and accuracy.

Reference:

Cobb, K., Cao, H., Davelaar, E., Tortorice, C., Li, B., Sharek, A. S., Dubriel, M., & Scarry, M. (2017). Physical to virtual: Optimizng the Apparel Product development process to reduce solid waste in apparel. In Poster session at the meeting of the International Textile and Apparel Association, St. Petersburg, FL.

Council for Textile Recycling. (n.d.). Retrieved December 12, 2017, from http://www.weardonaterecycle.org/

Domask, J. J. (2007). Achieving goals in higher education: An experiential approach to sustainability studies. *International Journal of Sustainability in Higher Education*, *8*(1), 53-68.

Goldstein, Y., Robinet, P., Kartsounis, G. A., Kartsouni, F. F., Lentziou, Z., Georgiou, H., & Rupp, M. (2009). Virtual prototyping: from concept to 3D design and prototyping in hours. In *Transforming clothing production into a demand-driven, knowledge-based, high-tech industry* (pp. 95-139). Springer London.

Ji, Z. (2016). Research on the structure characteristic of "modern Hanfu" and digital implementation (Master dissertation). Retrieved from Donghua University.

Morfin, M. (2017). 9 extraordinary fashion designers reinventing traditional dress. Retrieved November 21, 2017, from https://theculturetrip.com/asia/india/articles/9extraordinary-fashion-designers-reinventing-traditional-dress