3D Simulation Technology as an Instructional Tool for Promoting Size Inclusive Apparel Design

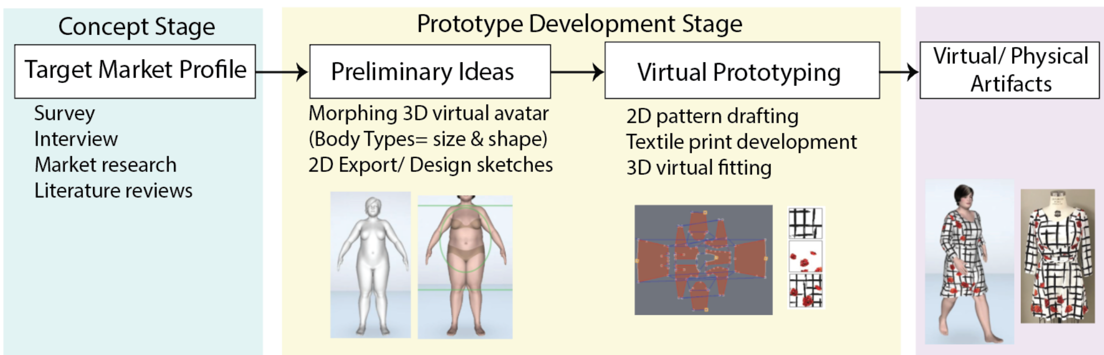
Chanmi Hwang & Keena Hudson
Washington State University

Introduction. Three dimensional (3D) virtual prototyping allows users to customize and develop 3D virtual fit model, presents 360-degree views, and expands reality in the computer (Baytar, 2018). Many universities have adopted 3D simulation software (e.g., Browzwear, Accumark, Modaris, Optitex) and these innovative tools provide useful visual information and competitive advantages for the design process (Chang, Chien, Lin, Chen, & Hsieh, 2016). Researchers have found that virtual prototyping can be used as a great tool to educate students and designers without wasting product and supplies (Park, Kim, & Sohn, 2010). Since design students mostly design garments for women with slim figures, training students to design for other target markets with various body types is important in today's industry. In this regard, integrating 3D simulation technology offers opportunities to promote size inclusive apparel design for a variety body types (e.g., ectomorph, endomorph, mesomorph) and target markets (e.g., plus-size, seniors, transgender).

Purpose and significance. The purpose of this study is to introduce a teaching method for apparel design studios to integrate 3D simulation technology to promote inclusive apparel design processes. The proposed framework (Figure 1) has been further applied to a design process of developing a plus-size womenswear: students can refer to the example as they follow the proposed framework. Some researchers consider traditional physical dress forms limit designers in visualizing morphological characterization of the human body (Sabina, Elena, Emila & Adrina, 2014). Integrating 3D simulation into design processes provides students with a means to customize and examine body figures for their own target consumers and students can flexibly explore size inclusive design processes.

Theoretical underpinning and apparel design process. Experiential learning theory (ELT) is the process where knowledge is created through the transformation of experience and it is built on propositions that learning is best conceived as a process (Kolb & Kolb, 2005). Design education can be considered as being in line with the ELT because in design studio, the knowledge acquired in various courses has to be integrated into the design process in order to find an optimal solution to the design problem (Demirbas & Demirkan, 2007). In general, design process includes: (1) opportunity identification, (2) concept generation/ evaluation and (3) development (Crawford & Benedetto, 2006). Because apparel design is a system for creating garment silhouettes, concepts and styles (Keiser & Garner, 2008), identifying preliminary ideas by examining target body types is important part of the design process.

Method & proposed strategies. Figure 1 provides a means to customize figures for target wearers during concept and prototype development stages. First, various methods including survey, interview, market research, and literature reviews can be conducted when defining a



target market profile. In the *preliminary ideas stage*, a virtual avatar with realistic dimensions and body characteristics can be generated from a parametric model based on a default body form (i.e. women, men, children) or retrieved from 3D scanner data. Students can also morph parametric avatars based on various American Society for Testing and Materials (ASTM) measurements which are the extensive anthropometric surveys of varying populations (i.e. ASTM D5586/D5586M-10- older women sizes, ASTM D6240- men sizes, ASTM D6960- plus women sizes). Students can flexibly classify target body (i.e. size, height, conformation) and the basic morphological indicators (i.e. stature, proportions, balance, and shoulder position) to plan effective and efficient designs. In the *virtual prototyping stage*, garment patterns and any textile prints are drafted and 3D virtual fitting is tested.

Figure 1. A proposed framework: 3D simulation technology for size inclusive apparel design

Based on this framework, a plus-size womenswear has been created as a reference project to promote size-inclusive design process. For the *concept stage,* market analysis of 30 apparel stores, an online survey of 57 plus-size women, and trend analysis using WGSN, a trend forecasting company, were conducted. Next, a plus-size figure was developed based on ASTM D6960 and the 3D figure was exported as 2D for design sketches in the *preliminary ideas stage*. Based on the results from the concept stage, a dress pattern and textile print were drafted in the *virtual prototyping stage*. Finally, both virtual and physical prototypes were developed. The presentation includes in-depth design process of applying the framework on integrating 3D simulation technology to promote size-inclusive apparel design process. It allows students to conceptualize design for different body types and offers instructors with interactive tools to apply experiential learning process into their teaching methods.

References

Baytar, F. (2018). Apparel CAD patternmaking with 3D simulations: impact of recurrent use of virtual prototypes on Students' skill development. *International Journal of Fashion Design, Technology and Education*, *11*(2), 187-195.

Chang, Y. S., Chien, Y. H., Lin, H. C., Chen, M. Y., & Hsieh, H. H. (2016). Effects of 3D CAD applications on the design creativity of students with different representational abilities. *Computers in Human Behavior*, *65*, 107-113.

Crawford, M. & Di Benedetto, A. (2003). *New products management*. New York: McGraw-Hill.

Keiser, S & Garner, M. (2013). Beyond design. New York: Fairchild Publishers.

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of management learning & education*, *4*(2), 193-212.

Sabina, O., Elena, S., Emilia, F., & Adrian, S. (2014). Virtual fitting–innovative technology for customize clothing design. *Procedia Engineering*, *69*(1), 555-564.