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**Innovative technology for apparel design studio:
Integrating 3D virtual avatars in idea generation stage of design process**

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Keywords: Design process, Idea generation stage, Illustration, 3D avatar

Introduction. Innovative technology tools such as 3D virtual avatar modules (e.g., Optitex, Lectra, Gerber, and Marvelous Designer) provide new opportunities to enhance the apparel design process. Specifically, the modules allow students to creatively explore and customize body sizes and shapes that reflect their own target consumers. Apparel design is a system for creating garment silhouettes, concepts, styles, and collections (Keiser & Garner, 2008). There is no one set design process. The design process may proceed in a linear fashion, continually repeated in a circular fashion or return at any stage to refine prior steps (Watkins & Dunne, 2015). Thus, unlike many other disciplines, it is important for students to understand consumers or user requirements and the interdisciplinary nature of apparel design and product development.

Purpose and significance. The purpose of this study is to introduce a teaching method for apparel design studios to integrate 3D virtual avatars into the design process (see Figure 1). Traditionally in design studios, students draw design sketches based on a template figure provided by the instructor or textbook. Unfortunately, these methods have drawbacks since mostly; they are slim 9 head figures with hourglass body shapes, making it difficult to visualize the garments on diverse range of body shapes during the idea generation stage. Thus, this paper focuses on creating a virtual avatar, of a target consumer, and transferring 3D avatars to 2D figures allowing students to effectively ideate and sketch designs with varying body shapes and sizes. Integrating 3D avatars into design processes provides students with a means to customize figures for their own target consumers and understand these consumer needs. Using 3D avatar module is useful communication tool that represent students thought process.

Apparel design process and theoretical underpinnings.

In general, a design process include: (a) idea generation, (b) design, (c) prototypes, (d) evaluation & design refinements, and (e) production planning.

Specifically, the idea generation stage consists of problem identification, preliminary ideas (Lamb & Kallal) or opportunity identification and selection and concept generation (Crawford & Benedetto, 2003).



Figure 1. 2D design sketches (left) and 3D avatars (right)

During the preliminary idea stage, identifying functional, expressive, and aesthetic consumer needs (Lamb & Kallal, 1992) is crucial since it influences the design and its process. Different girth and vertical body measurements would lead to different bust, waist, and hip (BWH) ratio and result in different body shapes such as apple, pear, hourglass or inverted triangle. Thus, varying body shapes and sizes require design attributes to suit their needs.

Proposed strategies and methods. Figure 2 shows a model for integrating 3D virtual avatar module into the idea generation stage. The idea generation stage consists of market research where students identify problems and analyze current trends. Next, a profile for the target market is generated and students can morph a 3D parametric avatar to fit their own target market needs. The customized 3D virtual avatars can be easily exported to 2D digital files, then opened in drawing apps such as Procreate other software for virtual sketching. The exported 2D files can be also printed on papers and students can use the figures as a template to draw designs.

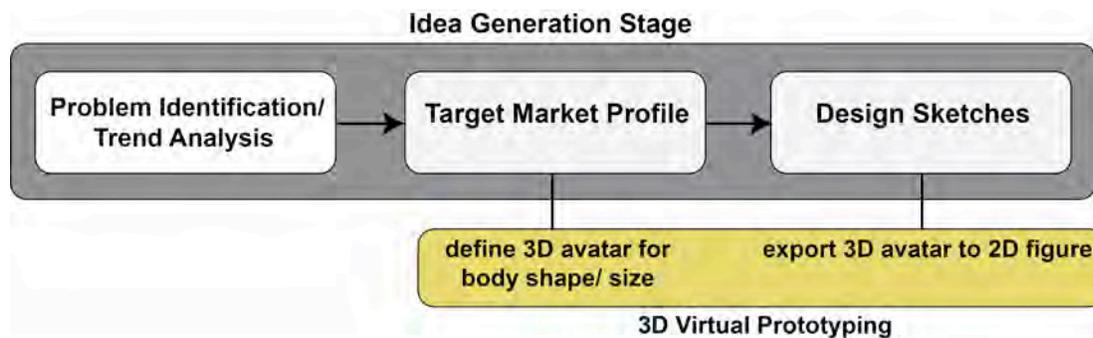


Figure 2. A model of idea generation stage with integration of 3D virtual prototyping

The presentation includes in-depth explanation on how to integrate 3D virtual avatar module to idea generation stage that have been traditional taught in apparel design studio. The significance of using this technology to customize figures in apparel design studio provides instructors and students with exciting tools to communicate and enhance design outcomes.

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