A Wildland Firefighting Uniform Company's Perceptions of Use of 3D Apparel Visualization Software – A Pilot Investigation

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Background

3D apparel visualization software is emerging as a disruptive technology that has the potential to streamline the traditional product development process of the fashion and apparel industry (McDowell, 2021; Weinswig, 2017). In line with the rise of digital design practices, academic researchers have revealed the potential opportunities for adopting 3D apparel visualization software to develop functional clothing (Bogović et al., 2019; Cieśla et al., 2020; Haixia & Yongrong, 2020; Hong et al., 2017; Hudson & Hwang, 2020; Liu et al., 2016; Mert et al., 2018; Rudolf et al., 2017). Nonetheless, little is known about how 3D apparel visualization software can be used to develop functional clothing from the manufacturer's perspective, especially in the wildland firefighting gear sector. This study aimed to explore a wildland firefighting uniform company's views on the application of 3D apparel visualization software for the product development process. This study was a pilot investigation of a more extensive study, and the findings were used to lay the groundwork for an action research study by identifying company needs relating to 3D apparel visualization.

Action Research

Action research is based on cooperation between researchers and subjects to interrogate current practices, identify gaps, and create plans for improvement or change (Sadler & Barry, 1968). Action research consists of a spiral cycle of diagnosing, action planning, action taking, evaluation, and reflective learning stages (Susman & Evered, 1978). Our study is built around the five stages of action research, of which this pilot study is the first, diagnosing stage.

Pilot Study Methodology

An expert sampling approach was used to recruit industry professionals working in the field of wildland firefighting protective clothing. The participating company (Company A) was a wildland firefighting protective clothing company located within the United States. The two representatives of Company A were participants of the study. An online interview was conducted for about two hours via Zoom. The preliminary interview was transcribed, and open coding was used to identify phrases related to the company's current practice, their perceptions of 3D apparel visualization software and needs or problems in the current practice.

Diagnosing. The company's existing problems were identified, and the results were utilized to specify the plans for learning 3D apparel visualization software to improve the problem situations. Subjects reported current challenges including limited style, design and fit standards defined by NFPA; limited available certified manufacturers, and limited use of CAD technology in their sector. Areas of potential improvement defined by the subjects included streamlining workflow and improving timing in the preproduction stage, and better communicating sizing and fit issues with manufacturers. Their current awareness and observations on 3D CAD presented areas for further exploration and improvement as shown in Table 1.

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Table 1

Company A's Current Practice and Perceptions of 3D Apparel Visualization Software

Categories	Notes
Perceptions of 3D Apparel Visualization Software	• Design attributes can be decided based on virtual garment images but fit and grading integration should be validated further • Customized avatar in multiple postures can facilitate checking the mobility of the fabric • Garment fit maps can be potentially used to verbally communicate fit and sizing issues with manufacturers
Expected Challenges in Software Adoption	• Interoperability of 3D virtual garment data • Readiness of manufacturers • Training and hiring workforces having 3D design skills • Financial and technical capability for acquiring, installing, implementing and maintaining the software

Action Planning. Findings from the diagnosing stage were used to develop plans for future interviews with our subjects. Subjects helped to define goals for understanding the software capabilities as outlined below. Throughout the action taking stage of action research, the principal investigator will enter an interview setting as an instructor to facilitate the subjects' learning of 3D apparel visualization software so they can envision how the software could be integrated for their business to address any needs or make improvements in the precedent practices of the company. A series of interactive interviews, including software demonstrations, are planned around each of these topics (Table 2).

Table 2

Current Practice and Counteracting Features of 3D Apparel Visualization Software

Current Practice	Features of Software
Reiterate two to three physical samples	• Fitting virtual garments on avatar before producing physical samples
Pattern alterations by hand	• Correct and modify 2D patterns and visualize them in 3D
Several fit session with models of different sizes	• Virtual fitting on personal avatars of different sizes in multiple postures by referring to garment fit maps
Communicate sizing and fit issues through explanation with tech pack and pattern block	• Pinpoint alterations by sharing images of 1) 2D patterns, 2) 3D garments, and 3) the result of garment fit maps showing tension and pressure distribution
Hand grading	• Creating multiple sizes for based patterns by adding size groups; Automated grading function

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Next Steps/Implications

Data from our next round of interactive interviews will be used to develop a visual framework for the 3D product design and development process. Insights from our study will be useful to small specialty clothing companies who are considering adoption of 3D apparel visualization software.

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