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There is no recognized sizing system that is used from one company to the next. However, consumers still have difficulty finding garments that fit. Apparel returns are at an all-time high due to consumer dissatisfaction with fit (Dockterman, 2016). Research has shown that there are significant shape differences among females (Simmons, Istook, & Devarajan, 2004) that complicates the industry's ability to consistently fit all women across all styles. In addition, the growing concern about sustainability makes it important that manufacturers create products that will meet the needs of consumers, rather than remain in stock and ultimately discarded when they don't sell. In a response the problem of overstocked product, with underserved consumers, some apparel companies have implemented mass customization processes into their product design and development to achieve better fit for their target consumers using CAD technologies (Istook, 2002). The fit issue is more than a measurement issue because consumers' preferences for fit play an important role in their satisfaction with garments. Ashdown and Dunne's (2006) results showed that participants' body shapes and fit preferences had influences on successful custom garment development. The purpose of this study was to evaluate the customization process and the impact of fit preference on a successful outcome.

Methodology

A simple princess line shift dress was developed for a class project of Fashion Product Analysis. A fit model, who represents target consumers aged 18-25 and an hourglass shape, was selected for the mass custom pattern development. Since body scanning measurement extraction was faster and more reliable than self-measurement (Ashdown & Dunne, 2006), the fit model was scanned using a 3D whole body scanner to obtain her measurements. The fit model's body measurements were set as the basic (sample) size to draft a basic torso block with bust and waist darts, using industry pattern making software. A muslin prototype of the block was assembled and evaluated for fit on the model. After several fit adjustments and a redevelopment to a princess line shift to remove the darts, a final garment pattern was achieved. The final pattern was graded using standard grading rules. Alteration rules were created to enable the pattern to be adjusted for custom measurements and a sizing table was created to categorize body measurements into specific sizes. Therefore, measurements were aligned with the alteration rules, grade rules and size code table values.

Twenty-one participants were body scanned and measurements for the bust, waist, hip, back-waist length, waist to knee length and waist to hip length were extracted for each. Customized garments were created for each of the participants using an industry Made-to-Measure (MTM) process that integrated participants' measurements, size code tables, grading, and alteration rules.

To investigate participants' perceptions of their body shapes and fit preferences, three surveys were conducted. The first survey was related to the body scanning process and

customized fit. This questionnaire was completed after the participants were body scanned. The second survey consisted of one question that asked the participants to define their fit preference from an image that attempted to provide visualization of a tight, regular, or loose fitting shift dress. The final survey was used to determine the participants' satisfaction with the custom fitted garment. Questions were associated to the fit of the dress and factors (such as fabric, pattern errors or assembly techniques) that might have had an impact on fit. The overall fit evaluation from the researchers was compared to the fit evaluation of the participants.

Findings and Conclusion

Generally, the customization effort was successful; however, there were some issues that became apparent during the process. The first patterns automatically generated for some of the participants were obviously misshaped due to a rather large reduction in back-waist length. Once a "petite" dress pattern had been created, the alteration issue appeared to have been repaired. More than 50% of the participants needed a petite model garment. In addition, incorrect measures were obtained from the scans for several of the participants, primarily at the bust location.

The participants were comfortable being body scanned and were generally satisfied with their body image on the screen and with the measurements that were extracted, even though a few thought the image looked bigger than their real body. Most also thought that being able to try-on clothing online using their avatar would be a benefit. All of the participants had a custom fit garment created for their measurements, although some needed more adjustment than others.

The majority (57%) of the class preferred a regular fit garment (selected from images) which included generally accepted ease standards at the bust, waist, and hip locations. Only 4 out of 21 participants wanted a tight fitting garment, which was a surprise considering that the majority of the participants were between the ages of 18 to 22. During the final fit evaluation, the majority of the participants found the fit of the dress to be acceptable, except for the length of the garment. The researchers created a moderately short garment (about 17" from waist to hem) and attempted to maintain the same proportion in the customized garments. Participant preference for skirt length was not included in the study. Overall satisfaction could have been increased had the length of the garment been well documented on the original fit model. This outcome reinforced the idea that garment fit needs to be communicated as precisely as possible in a visual form on a human model so that consumers are able to make informed choices regarding the suitability of a garment to fit as they might prefer.

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