Development of Visual Fit Assessment Tool for Apparel Firms
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Apparel sizing is a complex process that has been accomplished in the past by apparel companies with limited data, shrinking resources, and growing expectations on the part of the consumer. The provision of well-fitting clothing for the population as a whole is a difficult task given the variations in body sizes, proportions, and postures of consumers, particularly in countries such as the U.S. where great ethnic diversity contributes to this variation. The demands for well-fitting ready-to-wear clothing have increased in the last few decades, as consumers expect to find clothing that fits with no alterations. When consumers expected to alter clothing it could be sized generously and tailored to fit; in today’s high speed, instant gratification market clothing must literally fit off-the-rack. At the same time apparel companies competing with low cost imports have less time and fewer resources to assess their sizing.

To provide good fit apparel companies identify a target market for their products that comprises a segment of the population based on age, income, lifestyle, shopping preferences and also to some extent body size and type. The company then chooses a fit model, a person whose body shape and proportions are consistent with their target market, for fittings of prototype garments in a single base size. A set of additional sizes are created using grade rules developed by the firm to create the full range of sizes for their sizing system. However, the full range of the sizes in the system is seldom tested. Most firms do not know how their sizing actually fits their target market, and data about fit is difficult to collect. Feedback from consumers on their problems with fit is limited. Retailers and data about fit is difficult to collect. Feedback from consumers on their problems with fit is limited. Retailers and

The rotating visual image from a 3D scan provides another type of data that can contribute to providing better fit. Both the numeric and visual data from scanning are useful for our research and also for a variety of industry initiatives to improve apparel fit using body scan data.

Current work
A pilot test has been conducted with scans from a study of custom-fitted princess style jackets for women. Eleven women wearing miss-fitted jackets were scanned, and the jackets were then adjusted to fit. The alterations made in the fitting session were recorded in notes and by taking close-up photographs of each alteration. In addition, nine women wearing well-fitted custom jackets were scanned for comparison of scan data of miss-fitted jackets. The jackets were fitted using the standards set by Erwin (1979) that include five basic requirements of fit categorized as ease, line, grain, balance, and set.

Participants were scanned twice, first in minimal clothing and the second time in the miss-fitted or the custom-fitted jackets using the VITUS/smart 3D Body Scanner. The scans were then viewed in Polyworks IMView, a software that creates a high quality 3D image from the data that can be easily examined. The effect is much like manipulating a 3D statuette of the subject on the screen. Four expert judges from academia and three judges from the apparel industry assessed the fit of the jackets from the body scans. Stress folds and their directions, seam placement, and hem balance provide clues to identify the misfit. The judges rotated and

| Image 461x472 to 572x634 | Figure 1. Use of body scan data to improve apparel fit |

Improved Apparel Fit
3D Body Scan Data

Applications
Product Development
Fit Analysis
Communication

Size Prediction
Virtual Try-on
Custom Fit
Cad Design

Figure 1. Use of body scan data to improve apparel fit
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zoomed the scans to identify the origin of stress folds and to estimate the location and scale of the corrections needed. In a comparison of the fit analyses from the records of the alterations made to the misfitted jackets and the photographs to the fit judge assessments from the 3D scans, similar results were observed in many areas. The judges were generally able to identify areas of miss-fit and proposed the appropriate alteration from the 3D scans for all areas except the underarm and shoulder seam, areas where there is missing data from the scans. Many of the line and ease issues in the jackets could be identified and evaluated from the scans. Waist ease was the most difficult to assess as the garment style did not fit tightly to the waist. Balance issues were not generally identified by the judges even though the scans can be easily tested for the balance using tools that show the evenness of the hem. Judges had difficulty estimating the amount of change needed in an alteration to correct the misfit when there was no measurement reference in 3D scan images.

Aids to analysis of the scan data were introduced including the addition of a grid for assistance in calculating ease amounts, and the introduction of the body scan to layer with the clothed scan for direct comparison. Further aids to analysis are planned including the incorporation of automatically generated graphs and horizontal slice data to facilitate more reliable estimates of appropriate alteration amounts from 3D scans.

Next Steps

- Technical designers will be observed and interviewed to compile a database of the types of information needed to assess fit, the tools that they currently use and their needs.
- Several sets of visual and numerical data will be collected in different formats and tested by the technical designers to assess which formats and resolutions are most effective.
- The first prototype software for capturing, formatting, and displaying scans and for capturing fit data will be developed.
- The first test of the system on a large scale will be conducted by setting up a scanner in or near a firm’s retail store, using current customers as subjects and testing current styles from the firm’s line. Technical designers from the firm will assess the fit from the scans and develop new sizing or grading strategies from the data. Data on the effectiveness of the software interface will be collected.
- Desired changes to the system will be noted for further development in a new iteration of the visualization software.

Future work will consist of technology transfer of this concept, the development of a further iteration of the software, and further testing and validation. A cost benefit assessment of the tool in terms of the cost of collecting the target market information (the images) and the time spent on analysis by the apparel professionals versus the value returned in improved understanding and deployment of the sizing system will ultimately be conducted to validate this tool.

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*go to http://www.tx.ncsu.edu/itam to see articles in Journal of Textiles and Apparel, Management and Technology
Susan P. Ashdown, Helen G. Canoyer Professor in the Department of Fiber Science & Apparel Design at Cornell, joined the faculty in 1991. Susan earned a Ph.D. in Apparel from the University of Minnesota in 1991, an M.A. in Textiles: Apparel Design from Cornell in 1989, and a B.A. in Theater Arts from Grinnell in 1971. Her research interests include anthropometrics; apparel sizing, fit and the perception of fit, functional apparel design, changes in body measurements and clothing fit in active positions, and 3D body scanning.

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