

National Textile Center

FY 2003 (Year 12) Continuing Project Proposal

Project No.

S01-CR01

Competency: **Management Systems**

Use of Body Scan Data to Design Sizing Systems Based on Target Markets

Project Team:

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Objective:

To develop a prototype mathematical process using body scan data to improve sizing systems for specific target market populations of an apparel firm.

Progress Statement:

- 1) Using protocols developed during the pilot study, 203 subjects were scanned at least twice: once in minimal spandex clothing and once wearing test pants. Subjects between sizes were scanned in more than one pant size. Subjects were selected to fit the target market of the industry partner, 34-55 years of age and sizes Misses 4-16 or Women's 14-24. Subjects completed a written questionnaire inquiring about their comfort level with the body scan process, interest in applications of scan data, and demographic information.
- 3) Scan data were cleaned and organized for analysis. This labor intensive process included setting a common coordinate system, patching areas of the body or pants which did not scan due to shadows, and setting planes pertinent to taking measurements.
- 4) An initial visual fit analysis has been conducted to determine ideal placement of the side seam and the key areas to be examined to determine objective fit. A panel of experts is currently evaluating and sorting the pant scans into acceptable, marginal, and unacceptable fit categories.
- 5) Measurement data are being analyzed in three ways:
 - a) In order to assess ease values, the circumference, surface area and volume measurements of sections of the clothed and unclothed bodies will be compared across fit ratings (acceptable, marginal, and unacceptable). The analysis will compare the variation of misfit in the target market within these categories. Figure 1 presents data on ease values from 30 women collected in Pilot I. In this graph the median circumference change between pants and body is shown as a percent of body circumference for each fit category. Differences in waist and hip measures show promise as predictors of misfit.

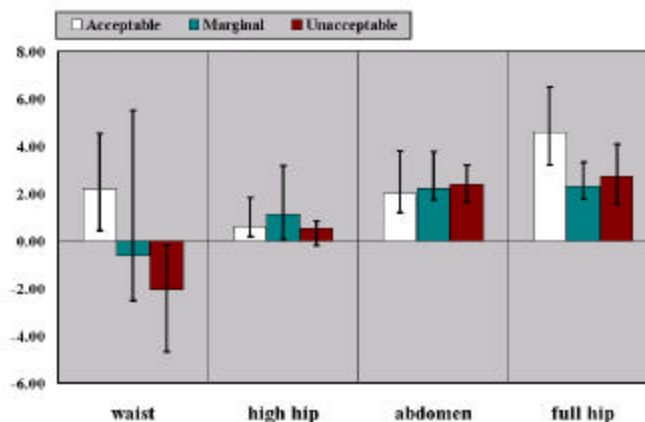


Figure 1. Median circumference change between pants and percent of body circumference (Pilot I, N=30).

b) Waist to hip ratios for body and pant scans will be compared to the waist to hip ratios of the fit models to determine whether differences in body proportion are a predictor of misfit. Recommendations for fit model dimensions and modifications to pattern specifications will be made from these results. Figure 2 displays a preliminary graph of body ratio data from the 203 primary study subjects. The data plotted include information about whether the subject was scanned in the Misses style pants, Women’s style pants, or both. Note the many subjects whose ratios are very different from the fit model’s body ratios used in the development of these two styles of pants.

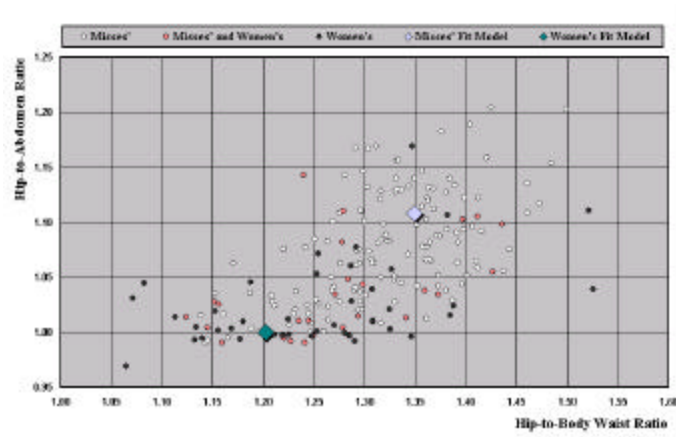


Figure 2. Body types by circumference ratios (Primary Study, N=203).

c) To analyze variations in ease requirements needed for different body positions, eight subjects were scanned in standing and sitting positions while wearing Lycra scan suits in Pilot II. The results in Figure 3 illustrate the percent change in waist, hip, and thigh circumference measures. Note the large changes in the hip measures between the sitting and standing positions.

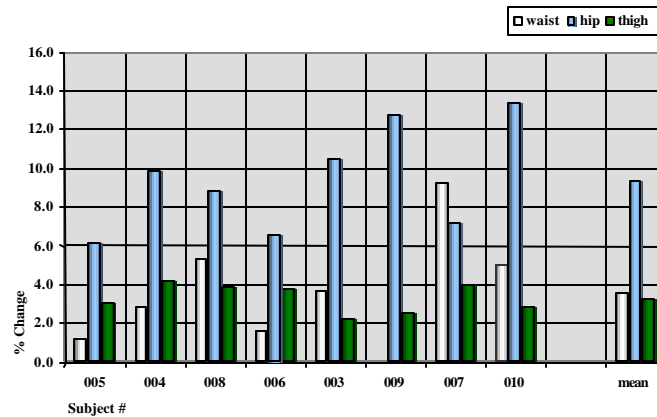


Figure 3. Percent change in waist, hip, and thigh circumference in seated and standing positions (Pilot II, N=8)

Based on the results of these three measurements analyses of the target market scan data as well as a) appropriate definition of size groups, b) appropriate ease specifications by size group, and c) ideal fit model for the target market, a mathematical model will be proposed to predict appropriate adjustments to the size specifications and grading rules to better fit the target market.

Two presentations from the research were presented at the annual meeting of the International Textile and Apparel Association (ITAA) in August in New York City. Three manuscripts are being developed for publication. “Development of Protocols for Objective Fit Analysis using Body Scan Data” describes the protocols developed for

collecting, organizing, and analyzing body scan data and makes recommendations for use in the future collection and analysis of body scan data. It will be submitted for publication review to the International Journal of Clothing Science and Technology in December 2002. The questionnaire data were statistically analyzed and results summarized in two manuscripts, "Consumer Reactions to Body Scanning" and "Consumer Interest in Commercial Applications of Body Scan Data." The first is currently under review for publication in the Clothing and Textile Research Journal and the second will be submitted to the Journal of Textiles and Apparel, Technology and Management in January 2003.

Next Year's Goals:

1. Use the final scan data analyses and measurements to develop and test a prototype mathematical model that can be applied to improve pant sizing systems for the current target market under investigation.
2. Improve the scanning protocol to reduce the labor intensive process caused by missing data in shadow areas.
3. Automate the processes used for taking measurements from the body scans.
4. Experiment with other pant styles designed for the current target market to add the style factor variations into the mathematical model.

Approach:

A newly improved module to the Polyworks software suite, IMInspect, will be purchased to help automate measurements from scan data. We will streamline the measurement process and then compare results from the manually cleaned and modified scans and the scans automatically modified using a software package developed by [TC]². With this automation, we will be able to focus our efforts on developing appropriate assumptions to produce a robust mathematical model.

Data collection in the next year will take two directions. First, approximately 50 subjects will be scanned in standing and sitting positions for analysis based on Pilot II results. A mathematical model will be developed that will pinpoint the most significant measures needed to determine good fit for the current target market, Liz Claiborne Misses and Women's sized pants. Then, the model will be tested using a second style of Liz Claiborne pants that contrasts with the first in silhouette and fit ease values. The target markets will remain the same, allowing us to statistically compare scanned body measurements with the new pant style measurements without collecting and cleaning new pant scans on new subjects. Recommendations for appropriate sizing groups, fit model specifications, and grade rules will be made based on the revised model.

Outreach to Industry:

We continue to work with our industry partner Liz Claiborne. We are collaborating with the VP for Manufacturing Services—Casual concerning characteristics of garment fit, evaluation of pant scans for good fit, and pattern corrections for misfit. We are sharing data from the body scans with another apparel company for the development of patterns and a sizing system for a similar target market. We have joined [TC]² and its SizeUSA project as a bronze sponsor in order to establish the generalizability of our scan data for our target market. We will compare our sample's linear measurements with SizeUSA data that was collected to be representative of the general population.

We will disseminate our research on body proportions and fit and on the comparisons of body measurements for sitting/standing body scans at conferences, in published form for industry and academic journals and Cornell's Apparel Industry Outreach newsletter, *Topstitch*, and through industry organizations such as [TC]² and AAFA's Sewn Products Resource Council.

New Resources Required:

Collaboration with the Liz Claiborne VP of Manufacturing Services—Casual and our team member from FIT with pattern making expertise will be crucial to next year's work. We plan to purchase IMInspect, a newly improved module to the Polyworks software suite that we are using for 3-D visualization, data cleaning, and measurement of volumes and surface areas.