National Textile Center
FY 2003 (Year 12) Continuing Project Proposal

Project No. S01-AC27

Competency: Management Systems

Body Scan Analysis for Fit Models Based on Body Shape and Posture Analysis

---

Project Team:

Leader: Lenda Jo Connell/Auburn University /Product Development
Email: connelj@Auburn.edu Phone: 334-844-3789
Members: Pamela Ulrich/Auburn Univeristy /**Pamela.Ulrich@auburn.edu** /Body Shape Analysis
Dave Woronka/ [TC]²/ dworonk@tc2.com/ Body Scanning
Alistair Knox/Nottingham Trent University/ alistair.knox@ntu.ac.uk/ Body Shape Analysis
Graham Hutton/Nottingham Trent Unviersity/ graham.hutton@ntu.ac.uk/ Body Shape Analysis
Susan Ashdown/Cornell/ spa4@cornell.edu/ Body Scanning

Objective:

Fit of apparel is a primary problem for more than half of the female population. Studies (Kurt Salmon Associates 1998, 1999) state that women in the marketplace cannot find apparel to fit their bodies. One problem with the fit of women's apparel is that it is based on outdated data and population averages. The purpose of this study is 1) to analyze body scan data from women 19-55 relative to body shape, posture, and weight to develop body shape analysis standards to classify female figures, 2) to produce an intelligent system based on expert analysis which can be used to classify body scans based on shape analysis as a basis for realigning sizing and pattern development for specific target markets, and 3) to develop virtual fit models and slopers based on body shapes and posture occurring in the population to enhance the fit of mass produced women's apparel.

Progress Statement:

Goal 1: To analyze body scan data from women 19-55 relative to body shape, posture, and weight to develop body shape analysis standards. Primary project work has been done in this area. Using body scan data, experts have developed a Body Shape Assessment Scale© (BSAS). The figure assessment scale for the female figure consists of nine separate assessment scales. Scales include four scales to assess a front scan view of the female figure including body build, body shape, hip shape and shoulder slope. Five scales use a side scan view to assess front torso shape, buttocks shape, back curvature, posture, and bust prominence. A separate team of five experts have been contracted to use these scales to assess 100 body scans of females to test content validity and reliability in the use of the scales. Testing of the scales will conclude in mid-January, 2003.

Goal 2: To produce an intelligent system based on expert analysis which can be used to analyze body scans as a basis for realigning sizing and pattern development for specific target markets. Researchers have begun work with [TC]² to learn a software program for shape analysis. Body scans with specific body shapes identified by the panel of experts will be used as the basis for training shape analysis software to sort subsequent body scan data body according to parameters set in the BSAS. Training of the software using expert data obtained from the BSAS© will begin in Spring, 2003.

Goal 3:To develop virtual fit models and slopers based on body shapes and posture occurring in the population to enhance the fit of mass produced women's apparel. This goal, the development of virtual fit models, will require data obtained in Goal 2 and will occur in Year 3 of the project.

Next Year's Goals:

The primary research in Year 3 of the project will focus on using the shape analysis software to identify body shapes occurring in the population. Data from the [TC]² Size USA project will be used to analyze female body shapes occurring naturally within the population. Computer-aided-design and virtual modeling will be used to build slopers for the various distinct female body shapes found in the population.

Approach:

The human body is a fairly complex form. The female form may be more complex than the male form with shape relative to fit occurring at multiple body sites. The current approach to body shape analysis is based on mathematical modeling. It has not been successful in identifying body shape classifications in a way that is useful for alignment in the product development process. The purpose of this research is to develop, test, and implement the use of an intelligent system for expert analysis of the female body shape with the result of identifying basic slopers for various female body shapes.

Body scan data has been collected for this project from over 400 females in the U.S. and the U.K. In Year 2 we used body scan data collected from females ages 19-55 to develop a tool to aid in expert analysis of body shapes. Researchers, all experts in fit, used the Douty (1963) scales, the only existing systematic attempt at body shape analysis for apparel development which was based on somatography, as a launching point for understanding body shape. They identified critical body areas for adjusting patterns for apparel fit. The result of this initial project work is the development of the NTC Women's Body Shape Analysis Scale© (BSAS) which uses the hourglass standard as a launching point for understanding body shape but identifies the three other predominant body shapes for women including the rectangle, pear and inverted triangle shape. In addition, the scales identify other pertinent body areas important for appropriate fit of apparel.

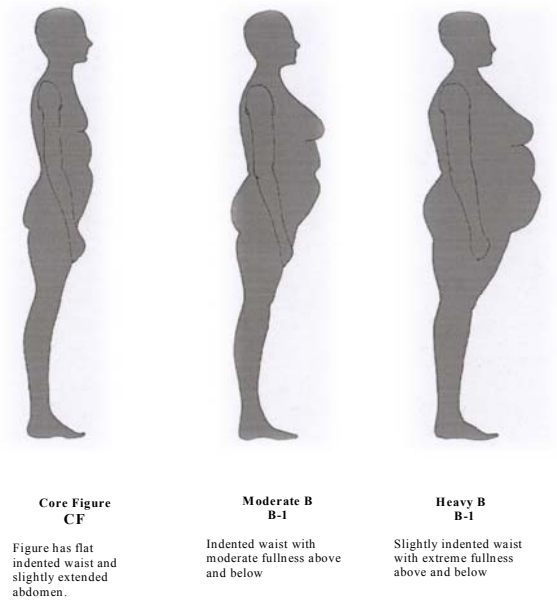

Figure 1: BSAS© Side View Abdomen Analysis

Figure1 was developed from actual body scans and shows a side view of a scale used for analysis of the abdomen area crucial in defining fit in women's apparel. The NTC BSAS© guide developed in Year 1 consists of

shaded line drawings of nine figure scales which can be used to assess body build, body shape, posture, hip shape, front torso shape, buttocks shape, back curvature, bust prominence and shoulder slope. These scales were developed by the project investigators from figures existing within the body scan data. The scales were then confirmed by a team of independent experts to be characteristic of the figure trait being evaluated.

To establish validity and reliability for the BSAS©, the scales are currently being tested by experts in fit from academia and industry. Five experts qualified by experience in teaching and practicing pattern development and fit are using the tool to assess 100 body scans on the nine scales. Inter-rater reliability will be calculated. Content validity will be assessed. The experts will be interviewed for feedback on the ease of use and accuracy of the scales in classifying body shapes within the sample.

After establishing reliability, researchers will work with [TC]² and Nottingham Trent to train shape analysis software using the body scans rated by the team of fit experts. [TC]² has developed a shape analysis software which needs to be populated with valid data based on expert analysis for shape definition. Nottingham Trent has also developed shape analysis software based on mathematical modeling that has primarily been used in a proprietary manner. This collaborative approach allows the body shape analysis software to be defined by both technical and discipline specific experts. The resulting software will be Beta tested at Cornell with additional testing for reliability.

After software is developed to analyze the shape component of body scans, researchers at Auburn will use the software to evaluate additional body scans seeking to understand critical relationships within body shape that may have an impact on fit. Relationships may include some of the following: Are there hip shapes that are related to body shape? Is posture related to buttocks shape or shoulder curvature? Is body build related to torso shape? Is torso shape related to posture? Is torso shape related to hip shape? Is torso shape related to body shape? Is shoulder shape related to back curvature? To make apparel that fits target markets, product developers must understand the relationship of body components to height and weight.

But apparel product development is more than understanding numbers generated from a body scan. Researchers have also collected demographic and psycho graphic data relative to fit issues. Body shape groupings identified by the BSAS© analysis will be explored to determine if the groups exhibit characteristics that are unique relative to body cathexis, clothing benefits sought, and fit problems and preferences. These preferences often make the difference in whether a consumer evaluates a garment as a good fit. Fit preferences and problems identified for each body shape group can then be used in determining the amount of ease that is used beyond basic body measurements to satisfy fit requirements for specific body shape groups.

Using body shape groupings identified by the BSAS© analysis coupled with fit preference information, experts in pattern development will begin the process of 3-D modeling and pattern development. Pattern development involves shaping a 2-D fabric to fit a dimensional body shape using darts, dart equivalents, gathers, pleats, tucks, and ease are used to adjust the flat surface of fabric to the curvature of a body shape. Basic slopers will be developed for each body grouping.

Outreach to Industry:

PAD and Gerber have been involved in supplying CAD and 3-D software for project use. The retail industry is critically involved with this project both directly in discussions regarding fit for specific target markets, i.e. mBrio an emerging brand promoting comfortable fit for women over 35 and indirectly through membership in the Size U.S.A. project with [TC]².

New Resources Required:

The team is in place to continue the project. A software upgrade for 3-D modeling will be the only new resource necessary.