Development of Half Scale Dress Forms in Active Body Positions for Bicycle Clothing Design and Fit

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Keywords: Body scanning, half scale, fit models, bicycle clothing

Introduction: Precise half scale forms developed from 3D scans are a new concept in dress forms. These forms have been successfully used in academia for 7 years for pattern development, with students draping in half scale or using pattern manipulation methods with existing half scale patterns, testing and perfecting the fit on the half scale forms, and then scaling patterns up in a CAD program to full size (Ashdown, 2008). The use of half scale forms saves time, materials and studio space. Initiatives are underway to test the use of half scale forms for the industry. Ashdown, et al (2014) developed various half scale forms by using scans of individuals and investigated the methods of in-house half-scale dress form development of a firm's fit model. It was determined that the Maker-Bot models with linen covers were the most successful, although these forms can be costly depending on access to affordable 3D printing. In this study, we explore potential use of 3D body scanning technology and half scale form development of active body positions. The ultimate goal is to provide a quick, practical and less costly method of developing and fit testing activewear designs. Although 3D body scanners only capture static body shapes, active postures can be identified and captured statically. This technique has been used to study the change of body dimensions in active poses (Choi & Ashdown, 2010). Achieving data from active positions for a half scale form could provide a useful tool for design and pattern development, fit adjustments and customization opportunities for activewear. Among a variety of possible sports activities, male cyclists were chosen as the subject for this study, as the body motions during cycling provide dynamic poses with repeating patterns. Cycling exists both as an active sport, but also in commuting.

Methods: This study is based on an empirical methodology. Researchers experiment to discover effective methods for 3D body capture in the cycling position and explore materials and methods for the development of half scale dress forms in an active position. The scanning trials were realized with a Vitus Smart XXL Body Scanner. To capture the required static pose in the first trial a bicycle was mounted on a stand in the scanner booth. Twenty-five scans were realized in different positions and different orientations in the scanner. The subject kept a static pose on the bike at specific points in the cycling motion. These tests were not successful as parts of the body were obscured by the bicycle in the scanned booth causing shadowing on the body. Hence, further alternatives were tried to replace the bicycle but still capture the cycling position. The solution was found to be a bike seat installed on a single tube secured to a heavy platform with a T-bar to function as handles. The study participant would first sit on his bicycle and the heights and body angles were determined using a measurement tape and goniometer. The same distances and angles were then created by using the seat tube with the adjustable height and wooden blocks for foot placement.

The native software ScanWorX was used to create a triangle mesh of the scan and export it to binary STL format. The STL file was imported into Geomagic Studio to create 3D digital models. Besides data cleaning (removing the bicycle from the scan), patching the missing areas in the body of the scan that were not captured was also manually realized with Geomagic. The most problematic parts, where the least number of data points were obtained were back of the subject (laser lights were passing close to parallel), top of the front legs (due to the shadowing caused by the arms), inside of the arms and inside of the legs with the crotch area. The model was then cut on the sagittal plane and the side of the body with the most extreme leg angle was mirrored to make the full, symmetric model. The 3D model was sliced into horizontal sections using Polyworks. The STL files were transferred to Adobe Illustrator as a preparation for laser cutting process of the slices. Material research was realized by searching different options. Various alternatives were selected as possible materials considering the limitations of laser cutting and gluing. Approximate material use for a test model was calculated and the slices were cut by using laser cutter. Slices were attached to each other through a dowel and glued together (Figure 1).

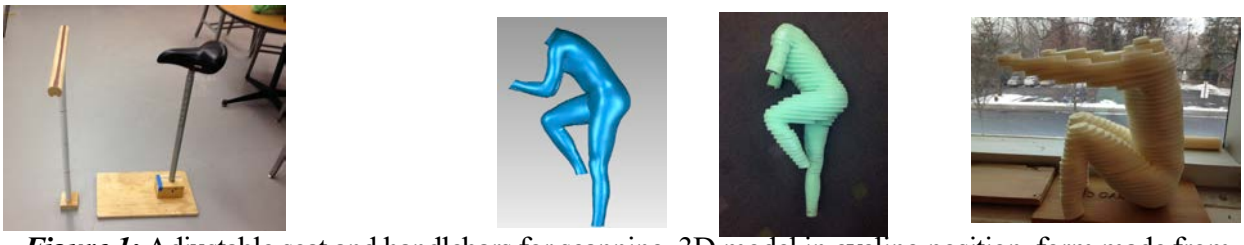

Figure 1: Adjustable seat and handlebars for scanning, 3D model in cycling position, form made from sliced foam, symmetrical form.

Results/Discussion: Even though the processes of building up a dress model needs craftwork, the forms can be built up with easily accessible in-house facilities like a laser cutter. The costs are less than for 3D printing, and the forms can be customized by using individual scans obtained from the 3D scanner.

Conclusions: For the continuation of the work, half scale models in a range of sizes will be used for fit analysis of cycling shorts. Apparel companies can benefit from the mentioned methods for developing their own fit models in different active body positions.

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