Evaluation of CAD Technology for Mass Customization

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Keywords: Customization, 3D body scanning, pattern making, fit evaluation

Introduction

Utilizing computer-aided-design (CAD) in the apparel industry was a slow process because of cost and technical issues. Previous research suggested that CAD companies should provide more custom and inexpensive software for those small and middle size companies (Yan & Fiorito, 2007). CAD technologies have been used for size and fit factors and mass customization, and efficiently shortened the lead times in the apparel product development process. Researchers have categorized body shapes and tried to provide solutions for fitting each shape. Mass customization is one of the ways when sizing systems do not meet the needs of all consumers (Loker, 2007; Song & Ashdown, 2012).

In this study, to find a better CAD technical and managerial solution for apparel companies and provide a good fit for consumers' different body shapes, researchers compared the customization processes of two CAD systems in the development and production of mass customized garments. Researchers also worked to determine if body shapes have any impact on the successful customization of a garment and whether measurements extracted from a 3D body scanner are reliable and precise enough to use in each system. The pattern making and fit evaluation processes included body shape identification, measurement confirmation, selection of measurements that relate to the basic block construction, creation of the basic block for a good fit, and assembly of the prototypes to check the relationship between measurements and fit.

Methodology

A 3D body scanner was utilized for obtaining fit models' measurements. Four fit models aged 18-25 were chosen to represent the top four shapes in the marketplace, including Hourglass, Bottom Hourglass, Spoon, and Rectangle selected according to Simmons, Istook, and Devarajan's (2004) FFIT© for apparel shape categorization system. Two apparel CAD pattern making software packages were selected to develop a simple princess line shift dress. In this study, these two software packages were named as Software A and Software B. Software A is widely used in the apparel industry around the world and has a module to manage the mass customization process. This module requires pattern makers to construct a basic pattern, apply grade rules, edit number points uniquely with each piece, create alteration rules, and develop a size code table. In addition to the alteration points for the bust, waist, hip, back waist length, waist to knee length, and waist to hip length, alteration points for the high hip and bust length were added to increase the success of customized garments.

Software B is based on a customization process for an individual and can generate a basic block using its particular pattern making method. The software categorizes consumers' shapes by using its specific shape methodology and automatically creates a basic dress block from input measurements of chest, chest bust difference, bust length, bust distance, bodice length, waist,

hips, hip length, and dress length. After evaluating the accuracy of the basic block on the subject and determining whether the input measurements are precise through a shape study and analysis, pattern makers then add styling to the basic block.

For this study, basic dress blocks were developed by using Software A and Software B, and the prototypes were tried on each fit model before constructing the final garments. The first fitting results were not ideal because the measurements were not precise. Therefore, researchers manually measured the fit models, compared their manual measurements with body scanning measurements, suggested the measurement values according to the first fitting results, and then ultimately used the suggested values to create the dress blocks. In comparison to the first fitting, the overall fit of the second fitting was significantly improved except for the front princess line at the bust location. Therefore, the bust curve of the princess line was adjusted in both Software A and Software B packages. Three prototype fittings were conducted on each of the four fit models. The final garments were suitable for each fit model.

Findings and Conclusion

The results showed that it is necessary to evaluate the fit on individuals for a successful customization process. Body shapes influenced the process. Some of these issues occurred more often in extreme body shapes. This effect became more apparent through the discovery that additional alteration points were needed when using Software A in order to adjust a standard garment for various shaped subjects. Precise measurements are essential for pattern making. However, measurements extracted from the body scanner could not be depended on for precision. There are a number of reasons why this might be the case, such as lack of calibration, incorrectly defined measurements compared to the location on the pattern, or incorrectly identified body landmarks. Measurement selection and fit evaluation heavily depend on pattern makers' judgments and decisions. As the fit evaluation involves both personal judgment and body scanning measurement data uses, it is important to have all factors, such as measurements, sizes and shapes, pattern making processes, and prototype fittings, evaluated and make sure that pattern makers do not miss a relevant step. In an industry application, this method becomes especially difficult since there are so many people involved in the design and development process.

Both Software A and Software B are valuable for their specific purpose. Software A is more acceptable and sufficient for a mass customization process, which meets most of the apparel companies' demands. However, the process is time-consuming and challenging, and the fit results heavily rely on pattern makers' expertise. Software B is appropriate for a customization process. It can guarantee an acceptable fit result as long as users follow its measuring and pattern making methods. Software B is suitable for independent designers who create garments from individual design and customers' measurements. Software B is also more affordable than Software A for a designer/pattern maker. In summary, it is necessary to carefully analyze measurement data before any steps for pattern making and fit evaluation. Based on the different cost and technical considerations, apparel pattern makers and companies could weigh up the pros and cons of each CAD technology to build their competitive advantages in the apparel product development.

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