



Body Scans as Base Geometry for 3D Modeling and Printing

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The use of technology in fashion is prospering, creating new possibilities in the world of design. 3D printing technology is being used increasingly in manufacturing, product development, design, and fashion. “3D printing (3DP) is an additive manufacturing (AM) process that builds a product by depositing material into successive layers until the [designed object is complete]. To transform a 2D design into a 3D product, digital 3D computer-aided design (CAD) software is used to create the design sketch, which is then virtually sliced into the appropriate amount of horizontal layers needed to complete the product...no tooling is needed” (Vanderploeg, Lee & Mamp, 2016, p. 1).

AM and 3DP are viewed as part of the new industrial revolution. Yet the idea of AM goes back over a century to a French artist, François Willème, who “created 3D replicas of a subject by arranging it on a platform surrounded by 24 cameras” at specified angles (Zhai, Lados & Lagoy, 2014, p. 809). The fundamental principle of AM allows for “innovative multi-material fabrication...reduced tooling...instant production,” and rapid prototyping; because of these benefits, AM is being introduced into several industries including “aerospace, defense, automotive, medical, architecture, art, jewelry, and food” (Zhai et. al, 2014). Specifically, in the medical sector AM is the ideal technique to develop specialized hearing aids and prosthetics (Ford and Despeisse, 2016).

A relatively new technology in fashion, 3DP can be used to create prototypes, one off pieces, haute couture, and customized products. London based designer, Catherine Wells, created a collection of 3D printed corsets, helmets, and masks utilizing both body scanning and 3DP. The items were available to customers on demand by using the measurements acquired from the body scan and adjusting the design to fit the specified size (Vanderploeg et. al, 2016).

A major trend in fashion is personalization, customers want something that is tailored specifically to their fit and taste. “Customization will change fashion as we know it [and] 3D printing will allow companies and brands to create...items...personalized by the consumer” (Sedhom, 2015, p. 870). “Mass customization bridges the efficiencies of mass production with the advantages of [accessory] customization, resulting in a hybrid of the two processes” (Kinnicutt, Domina, Lerch & MacGillivray 2007, p. 252). The use of 3D body scans makes it possible to automate the production and manufacture of custom-made pieces, in conjunction with specialized CAD software and rapid prototyping (Kinnicutt et. al, 2007).

The application of 3DP technology in fashion is still being investigated in academia. This research examines the integration of 3D body scanning and 3DP. When developing accessories, body adornment, and clothing embellishments, the use of a body scan as base geometry allows the designer to edit and model directly onto the body resulting in an accurate fit straight from the

printer. Using a digital body scan also permits the designer to envision the finished look without having to create multiple prototypes and conduct multiple fittings.

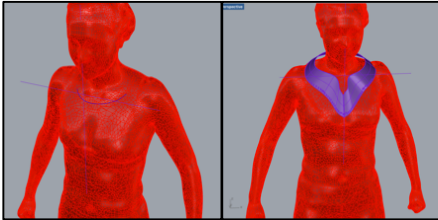


Figure 1 Body scan as base geometry in Rhinoceros with modeled neck piece.

The process begins with the capture of a body scan. The scanning process is comprised of "four red lasers at orthogonal angles to each other, [the lasers] create a 3D point cloud model of the human body" (Kinnicutt et. al, 2007, p. 253). The scan is saved as a stereolithography (STL) file using ScanWorx® software and imported into Rhinoceros 3D modeling software (figure 1). There the data is converted into a triangulated mesh. The mesh body scan is set as a layer and locked; the designer then models directly on the body scan without editing the base

mesh, generating a product that is accurate in scale and shape. Products can be easily manipulated to accommodate style preference and fit and rapidly printed in 3D for evaluation.

This research explores technique and outcomes of a process facilitated by body scanning and 3DP. The work is significant as it proposes a design process that allows for mass customization, and reduced waste via an additive manufacturing process. Many apparel design programs in higher education have adopted body scanning as a method of inquiry, and this design process proposes a new approach to also integrate 3DP.

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