

Instilled: 3D Printing Elastic Lace

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Researcher and designer of a variety of fields recognize the protentional of 3D printing (3DP) technology in customized applications (Sun & Zhao, 2017). Particularly in apparel design, recent explorations have been focused on trying to solve not only aesthetic design problems but also develop a functional design using this direct digital fabrication method. Some have explored the more expansive 3DP method, Selective Laser Sintering (SLS), to achieve more complex and more articulating structures (Contium, 2017). Others have enabled flexible material and overall wearing comfort through manipulating structures. The latest collections from Danit Peleg, an emerging fashion designer known for her work in 3D printed fashion, utilizes open source pattern (2017). The 3D printed structures were modified in scale and repetition for various design needs. A single unit of the structure can expand two to three hundred percent when stretched slightly. More importantly, her work has been using the convenience of low-cost commercial desktop printers, often in Fused Deposition Modeling (FDM) form and printing with various thermoplastic filaments. Research and exploration are limited in the use of a more accessible 3DP method

The purpose of this design study is to explore the elastic performance in the various 3D printed structures using flexible FDM filament (nylon) in ready to wear apparel. The goal is also to explore visual illusion in surface design through digital textile printing. Research through design (RTD) methodology was applied in this case study, and data were collected through reflexive journal documentation, video recording of the virtual design process.

The inspiration of visual illusion was referenced in developing the core focus of this study. The visual imagery of organic forms fusing and instilling together was integrated throughout the garment prototype. It consists of a torso and a skirt portion. The torso was developed in silk charmeuse and consists of a stylized neckline and waistline. The back consists of two layers, a stylized cowl neckline and a 3D printed portion (nylon in FDM). The silks are draped over the elastic 3D printed lace to juxtapose the loosely fitted and the form-fitted silhouettes. The garment is completed with a flared skirt in silk habotai with an uneven hemline. Overall, the organic engineered print and 3D printed lace patterns in the front and back help to provide a unique focal point from different angles of the garment. The intention was to develop a visual illusion that blends the two digital design applications and enable a visual rhythm. The garment is lined at the torso section with silk habotai and not additional closure was used.

The overall garment sampling and development consisted of four phases. First, the engineered textile prints were explored and sampled to determine the color scheme and the appearance of the organic shapes. Adobe programs were used to generate graphics for rendering and manipulation. Second, draping techniques were used to develop flat patterns for the garment.

Third, repeating patterns were 3D modeled in Rhinoceros (Rhino) using direct modeling techniques to reflect the style of the organic shapes found in the engineered print. The units were repeated to form the various groupings that were sampled for different elastic performance. The shapes in the 3D printed portion of the torso were customized to the shape of the flat garment pattern. They were also engineered to various scales to fit both the aesthetic and elastic need of this garment portion. The resulting 3D printed part form fits the waist and upper hip area and over the shoulder

Fourth, the 3D printed part was dyed using commercial Rit dye to achieve the same color scheme as the textile portions. The skirt was also dyed. Both sections used ombre techniques in transitioning colors.

The resulting garment prototype takes the advantage of engineered elastic performance of the 3D printed lace in form fitting. This approach also eliminates the use of a conventional closure (e.g. zipper), thus reducing procedures. This case study also suggested some challenges exist in developing a resilient and flexible structure that is both comfortable and durable in wearing. Future research should consider alternative 3D printed structures through difference 3D modeling techniques. Additionally, alternative complexity can be considered in the structure with different FDM materials.

References

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