

Sandal to Sneaker Transformable Footwear Design

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This design research was conducted to investigate techniques to generate a transformable footwear item for women which can convert between two styles. The difference between this design and other footwear transformable designs previously executed on the market is in the way it is transformed. Other featured transformable shoes either convert from one shoe heel height to another or transform into separate pieces. This design uses a novel approach by investigating techniques to merge two styles to complete each other and form one unified shoe style.

As researchers suggest, this approach can maximize the future basic wardrobe by more personalized products that are “able to be transformed in multifunctional pieces” (Morais & Montagna, 2015, p. 5818). The benefit of these multifunctional pieces is that transformable products will be kept for much longer than conventional ones and will not be disposed of easily (Morais & Montagna, 2015). There are several reasons for this. “Transformable garments are expected to increase the wear rate, postpone disposal, and ultimately expand the garment life cycle as consumers repeatedly transform them” (Koo et al., 2014, P. 10). Transformable prototypes, such as this, can provide understanding into the consumer’s essential needs of appearance change or emotional experience, and can also lead to products that incorporate those values in new sustainable fashion practices (Niinimäki, 2015).

In this footwear design, a variety of techniques and technologies were used to achieve the intended result. Tacit knowledge and hand craft skills played a crucial part in designing and sewing the upper part of the shoe and assembling the different parts together. Prior to prototyping the shoe, the 3D image of the virtual foot form was obtained by placing the foot flat in the middle of an angled (45°) glass and scanning it using Structure Sensor 3D Scanner on iPad (Aflatoony, 2019). This 3D image of the foot had two purposes: first to use it as a virtual form during the 3D modelling process to represent the natural form of the foot, second to 3D print it and use it as a shoe last to design the upper part of the shoe. A shoe last is a physical form of the foot which is used in footwear design to obtain the patterns of the upper part of the shoe.

The design ideation started by sketching with pencil on paper. When the ultimate result achieved, the prototyping process started using Autodesk® Fusion 360™ 3D modelling software to create the shoe sole and footbed. To provide a maximum comfort in shoe sole and footbed, they were designed to represent the exact form of the foot by tracing the perimeter of the virtual model of the foot (image 1). A series of circled patterns were created on both the shoe sole and

footbed (image 1). These patterns were raised on the bottom of the footbed $\frac{1}{4}$ " high and were engraved on the inside surface of the shoe sole $\frac{1}{4}$ " deep. This feature was added to stabilize and lock the two surfaces together when the footbed goes inside the sneaker and together they are placed on top of the shoe sole. Then, both the shoe sole and footbed were 3D printed with ABS plastic material (Acrylonitrile Butadiene Styrene) for the purpose of sampling. The lower half of the shoe sole was printed from the off-white color while the upper half was printed in white purely for aesthetic reasons.



The upper part of the shoe was created by covering the shoe last with 2" wide masking tape and drawing on top of it. At this stage, the designer paid attention to specific sections which belong to the sandal and the sneaker and identified mutual pieces which could be merged in both. The scallop shapes which exist on the bottom of the shoe sole were continued throughout the upper part as well. After achieving the desired shape, the masking tape was carefully separated from the form and placed flat on paper to transfer the pattern onto it. The patterns were digitized to obtain the vector based digital file to be then prepared for the laser cutting process. These vector-based files were first modified in Adobe Illustrator and then adjusted and saved in Corel Draw to be ready for laser cutting with Full Spectrum Laser Cutter. All the upper parts of the shoe were laser cut to guarantee the accuracy of lines and to have a clean, finished edges for the shoelace holes (Image 2). The main body of the sneaker was laser cut from a white spacer mesh. The sneaker side panels and its bottom as well as its toe cap were laser cut from a synthetic pearl-colored leather. The bottom of the sneaker has circular holes exactly at the same location of the foot bed raised textures to allow them to pass through the bottom of the sneaker. All the parts

that belong to the sandal were laser cut from a synthetic gold color leather. The upper part of the shoe then assembled by both machine and hand stitch methods. Different parts of the gold sandal were glued to the sides of the shoe sole using Gorilla Epoxy glue.

This shoe can be worn as a sandal, or by inserting the sneaker layer (Image 3) to transform into a fashionable sneaker. Although only one sneaker color is shown in conjunction with the sandal, it can be replicated in multiple colors, patterns, or materials, thereby adding to the multifunctionality of the shoe. The holes for the shoelace in both the sandal and the sneaker are exactly at the same location. By passing the shoelace through both the sneaker and sandal, they will be kept firmly together. Raised textures on the bottom of the insole which lock into the shoe sole engraved textures will also prevent the sneaker from sliding inside the sandal.

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