The Exploration of Geometric Modular System in Textile and Apparel Design

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The fashion industry today is plagued with large quantities of textile waste. The waste of resources caused by fast fashion because of the short-term life cycle of each garment has awakened wide concern in society (Li, Chen, &Wang, 2018). In order to minimize clothing waste and prolong the garment life cycle, one strategy is to increase the efficiency of each garment. Fletcher and Grose (2012) stated that "longer-lasting materials and products are often promoted as a strategy to increase resourcefulness and sustainability across product groups including fashion." Modular design is a design approach that features small standardized units that can be independently combined in various configurations to create different forms and provide multiple functions. Developed as a design principle in the computer industry between 1944 and 1960 (Baldwin, 2000) the principle of modularity is based on versatility and independence. With the concept of modularity, it is possible to change pieces of a design without redoing the whole. Additionally, modular design is a type of inventive problem solving that would easily allow for mass customization since it could provide variety in the aspect of satisfying consumer's needs and wants (Yang, Kincade, & Chen-Yu, 2015).

As a concept, modular design has been explored by textile and apparel designers. For example, the Fragment Textiles designed by Soepboer and Van Balgooi developed two small wool forms, squares and stars, which were assembled to create a fabric (Stam & Eggink, 2014). Fashion Designer Kosuke Tsumura created cocoon shape garments using individual sonic-cut units with materials that he invented called Felibendy (Mini, 2009). For most of the designs created with the modular concept, sewing is not required since the modular pieces are slotted together to create the final textile. However, most designers who explore modular textile and apparel designs, such as those of Soepboer, Van Balgooi, and Kosuke Tsumura, focused on two-dimensional products or more boxy silhouettes that did not contour closely to the body since most of their works were made from one size of modular shapes to create a flat textile with no darts or shaping to couture the body. There was also little information about the methods of developing more fitted garments with the modular system.

To investigate the concept of modularity in textile and apparel design and explore the possibilities of creating fitted garments allowing more modular design options, the researcher focused on creating two modular designs based on a modular system to test out the effectiveness of the design research. Both designs were for women since the goal was to create garments that were fitted and shaping is more pronounced on a woman's body. The purpose of this design research was to develop a modular system for textile and apparel design allowed for the creation of fitted garment constructions to elevate the potential of modular design and provide a framework for research in modular design practice.

The project started by developing basic module shapes based on research and literature review. One of the classifications of modular designs, known as geometric modular design, was created by Li, Chen, and Wang (2018) and chosen as the basic modules for both designs. This type of modular design used geometric shapes such as a triangle, quadrangle, or polygon to form the textiles and garments. Using inspiration from the flora and fauna in nature, a triangle shape was chosen for the first design and polygon was used for the second. Both shapes were then developed in Adobe Illustrator to add interesting outlines and functional cutouts for joining. Inspired by aquatic life, Module Design I represented a tail fin created from a triangle shape (Figure 1). For Module Design II, a flower shape was developed using a polygon (Figure 2). Both modular shapes then joined together through the slots on the sides to create the bodice of the two garments. After the two modular shapes were developed, methods of creating fitted garments with the modules were explored. For fitted garments, the shape of the body at the front,

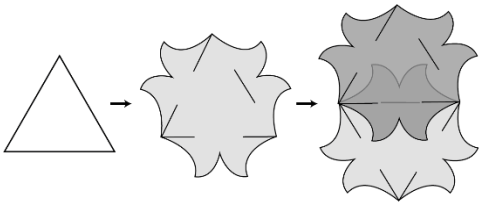

Figure 1. Modular Design I and the interlocking method.

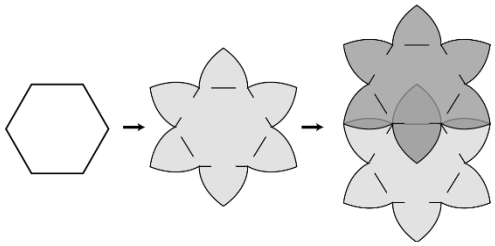

Figure 2. Modular Design II and the interlocking method.

as well as the sides, needed to be addressed in the pattern including chest, waist, and hip measurements (Anand, 2011). Therefore, the first method was to gradually increase the size of the modular shapes to fit the three measurements of a dress-form at the same time making sure the slots were still functional. The second method was inspired by the use of darts on traditional pattern pieces especially around the bust. Since darts are used on flat fabric to take in ease and provide shape to a garment, special modules were engineered on Adobe Illustrator to take the corresponding eases out while keeping the same outer designs. Once the two methods were developed and tested on paper, the researcher then selected two different fabrics to complete the final designs.

Figure 3. Garment design created with Modular Design I.

Modular Design I was hand-cut on lenticular fabric in four different sizes, based on the method one discussed above, which provided dynamic 3D effects simulating the glow and movement of fish scales. Those modular shapes then joined together through the slots on the sides to create the bodice of the dress. A digitally printed skirt was formed with black and blue

printed panels on silk dupioni fabric was used to finish the dress (Figure 3). Modular Design II were laser cut on digitally printed silk charmeuse and silk organza in five different sizes to form a cocktail dress. The placement of the digital printed modular shapes was also considered during this process to create a gradually changing color effect (Figure 4). Additionally, the dart method was used on both designs at the bust area to take in ease.

The outcome of both designs achieved the goals of creating a fitted garment design while forming aesthetically pleasing garments. The two methods of creating fitted garment designs with a modular system for textile and apparel design provided more design possibilities for the creation of fitted garment constructions and established a framework for research in modular design practice. Different techniques and fabrics were explored in combination with the modular concept. Future studies will include continued exploration with different methods for complex garment constructions and different garment types with modularity.

Figure 4. Garment design created with Modular Design II.

References

Anand, N. (2011). Pattern engineering and functional clothing. *Indian Journal of Fibre & Textile Research. 36*(4), 358-365.

Baldwin, C. Y., & Clark, K. B. (2000). *Design rules. Vol. 1: The power of modularity*. Cambridge, MA: The MIT Press.

Fletcher, K., & Grose, L. (2012). *Fashion & sustainability: Design for change.* London, England: Laurence King Publishing Ltd.

Li, M., Chen, Y., & Wang, Y. (2018). Modular design in fashion industry. *Journal of Arts & Humanities, 7*(3), 27-32.

Mini, M. (2009, May 12). Kosuke tsumura: Cocoon cradle and mother piece for tokyo fiber 09 senseware. *Design Boom.* Retrieved from https://www.designboom.com/design/kosuke-tsumura-cocoon-cradle-and-mother-piece-for-tokyo-fiber-09-senseware/

Stam, L. & Eggink, W. (2014). How to interest people for the hare instead of the chase, an exploration of open script design to change consumer behaviour. In Y. K. Lim, K. Niedderer, J. Redström, E. Stolterman, & A. Valtonen (Eds.), *Proceedings of the annual Design Research Society conference (DRS); Umea Institute of Design (Sweden); 16-19 June 2014; Design's Big Debates (pp. 1535-1547).* Umea, Sweden.

Yang, J., Kincade, D. H., & Chen-Yu, J. H. (2015). Types of Apparel Mass Customization and Levels of Modularity and Variety. *Clothing and Textiles Research Journal,33*(3), 199-212.