



The Visual and Abstract Minded:
Exploring Spatial Visualization in Apparel Design and Product Development

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In the age of modern technology, apparel designers are expected to adopt more knowledge and skillsets in the rapid advancement of digital tools. For instance, students are expected to acquire more 2D to 3D conversion skills in applying 3D computer-aided design programs (Park, Kim & Sohn, 2011) in both traditional apparel manufacturing and novel fabrication integration like 3D printing. Currently, the 2D and 3D learnings for apparel design students are mainly rely on hands-on product development trainings, including flat patternmaking and draping techniques. Often, these processes involve converting design ideas from 2D shapes and fit 3D body forms. As apparel design students mainly rely on 2D visuals to interpret forms, one often encounters cognitive and visual disconnects between what can be sketched on paper and developed into wearable garment parts. Previous research has also suggested the importance of spatial visualization ability, a more abstract cognition, in apparel design student's product development training (Workman, Caldwell & Kallal, 1999). However, the current apparel design curricula have limited 3D visualization training in hands-on practices and need to be evolved to better prepare future talents for the digital world. The aim of this research is to investigate the role of spatial visualization for apparel design student in garment product development. It mainly explores how apparel design student visualize and interpret flat patterns and fabric drapes in 2D and 3D formats during product development. **Research questions include the following:** a) How do apparel design students mentally visualize flat patterns (flat pattern sketch) from garment design sketches? What are the challenges? b) How do apparel design students transition between mental (flat pattern sketch) and physical (draping) visualizations in knit garment prototyping? What are the challenges?

With a qualitative approach, this study collected data from a knit design project in an intermediate apparel design product development course at a southeastern US institution. Upon IRB approval and informed consent, 18 students' final design prototypes and design journal documentations were collected and analyzed. In the project development, students were instructed to first sketch out a rough design for the knit design project, then use flat pattern sketching to help mentally visualize the design in components and prepare for the draping process. The product development process concluded with the final prototype construction. To prepare students for the project, students were able to learn and practice draping and flat patternmaking with knit material. Additional information on material property and various fabric samples were also provided for students to become familiarized with knit. In data analysis, common themes were found to identify major findings.

In **mental visualization using flat pattern sketch** to forecast the flat pattern shapes, student participants often approach in two ways: 1) starts from retrieving memories of the curves on a 3D body form, then visualizing the curves lying flat and converting 3D surfaces to shapes (3D to 2D), and 2) begin with visualizing the basic flat pattern sloper, identify seam placement in their design, then adjust the flat pattern based on body form curvature and relevant dimensions (2D to 3D). The main challenges here included 1) differentiating the flat pattern shapes with various stretch amount in knit fabrics, 2) adding fitting/style ease in consideration of the knit fabric stretch, and 3) lack of understanding in body form surface and curvature. In **physical visualization using draping techniques**, most student participants judge based on the “tightness” and “looseness” of the design for the body form. After applying the basic draping techniques for knit, students frequently encountered uncertainty in determining fit and stretch amount for knit. The main areas of challenges include neckline, bustline, and armhole shaping and fitting. In comparing the two visualization steps, most student participants noted that the mental visualization (flat pattern sketching) is much like puzzle seeking, and the physical visualization (draping) reflects puzzle completion. Although the draping (physical visualization) process provides more creative freedom in allowing a hands-on tactile experience with the form and material, the flat pattern sketching (mental visualization) helps to organize and guides the development process, evaluate design feasibility, foresee garment parts in assembly/construction, and is overall enjoyable. In final prototypes, half student participants reflected changing the amount in shaping devices, such as darts and related seam positions.

The finding of study suggests that apparel design students today are in need of effective and efficient spatial visualization techniques. The use of flat pattern sketching as mental visualization tool helps to exercise design students' 2D to 3D conversion skills, hence spatial visualization. Overall, it enables students at the intermediate level to be more confident in executing design ideas. However, more techniques should be emphasized on proper inclusion of fitting/style ease. Also, the current textile knowledge taught, particularly of knit material, across many design programs across the country maybe inadequate for intermediate product development. Additionally, spatial visualization training should be explored in the future to include in earlier apparel design trainings as well as other non hands-on courses such as fashion illustration and computer-aided design.

References

- Park, J., Kim, D. & Sohn, M. (2011). 3D simulation technology as an effective instructional tool for enhancing spatial visualization skills in apparel design. *International Journal of Technology and Design Education*, 21, 505-517.
- Workman, J. E., Caldwell, L. F. & Kallal, M. J. (1999). Development of a test to measure spatial abilities associated with apparel design and product development. *Clothing and Textile Research Journal*, 17(3), 128-133.