Development of a test method to measure the drape of hemmed samples by using a 3D body scanner

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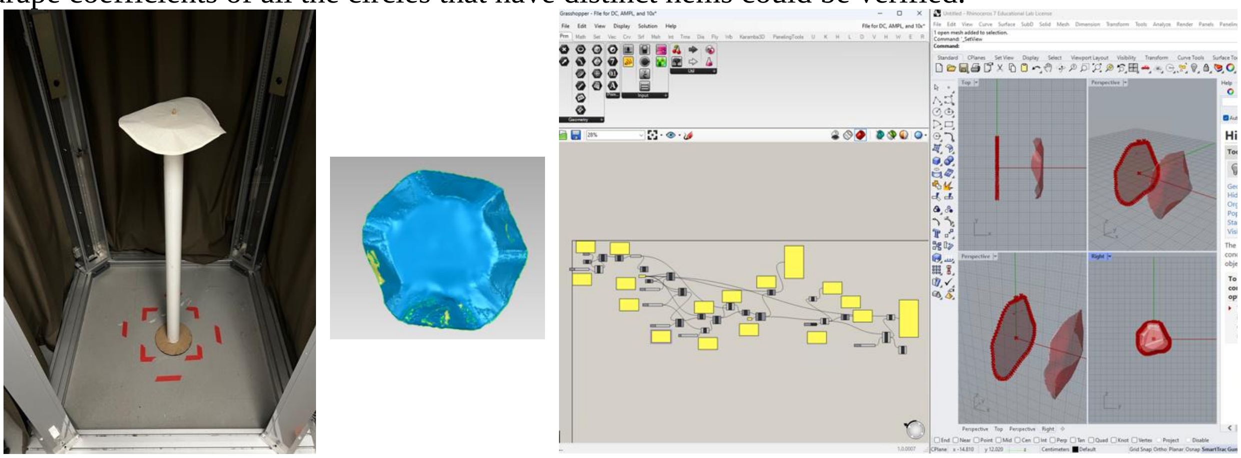
Introduction: Drape refers to "the quality of textile materials that permits a fabric to organize itself into elegant folds or pleats when pressed upon by the force of gravity" (Chu, Cummings, & Teixeira, 1950, p. 539). This feature identifies textiles made from different materials that can have a comparable bending length. It is a crucial quality because it not only affects the look of the fabric and the garment, but it also adds to the comfort of the apparel fabric, in addition to other qualities such as performance considerations (Cusick, 1965). Hence, drape is a feature that specifies a significant visual component of the qualities of the fabric.

To quantify drape, Cusick's drape meter test equipment is widely used in the apparel industry (Cusick, 1965). The apparatus is the standard for determining how well a fabric drapes. The testing approach involves tracing the silhouette of the textile after it was draped. Fabric is located on a circular platform, which casts a shadow in the shape of a draped textile (Cusick, 1965). The measurement of the drape coefficient (DC) is obtained by the following drape coefficient formula: DC%= (area of projected drape - area of support disk)/ (area of the specimen- area of support disk) * 100 (Cusick, 1965). The term "drape coefficient" refers to the ratio, stated as a percentage, of the area of the section by vertically projecting the shadow of a draped specimen to the entire area. Despite this, the sample that is used for determining the drape is a circular piece of fabric with unfinished edges. A garment's hem finishes, which are also known as edge finishes, refer to the way the fabric is finished at the bottom edge of the garment. Because of how the fabric is finished, hem finishes can have a significant impact on how a garment drapes. Therefore, the purpose of this study was to examine how different hem finishes impact the drape coefficients.

Methods: The ISO-9073-9 standard was followed to prepare the test samples for assessing drape qualities based on the deformation caused by gravity. We quantified the drape of a 100% cotton muslin fabric, which weighed 122.31 g/m^2 by scanning and evaluating the drape coefficients by following the methods used by Choi et al. (2007). The thread was selected as 27 Tex from A&E LLC. To represent various hemming techniques for skirts, the following six hem types were selected for the circular samples: raw edge, serged (overlocked) edge, serged edge & top stitched, serged edge & catch stitched, catch stitched, and cover stitched. When considering medium-weight fabrics, a 30 cm disk is suitable (ISO 9073-9:2008, n.d.). Therefore, a 30 cm diameter disk with a 1.27 cm seam allowance was cut out, folded once, and sewn together to serve as the test specimen. An imitation drapemeter was constructed in adherence to the ISO-9073-9 standards, except for its height of 110.49 cm and drape platform of 18 cm. To ensure stable and centralized specimen positioning, a pin was attached to the midpoint of the platform. The specimens were conditioned at a relative humidity of 65 ± 2 and a temperature of 20 ± 2 degrees Celsius for 24 hours before scanning. The specimens were draped three times to obtain averages and each time they were captured, a laser-based Human Solutions Vitus head scanner was used for scanning. For pilot testing, Anthroscan was used to save the scan files as OBJ. The drape scans were cleaned using Geomagic Wrap Software, while the projected drape area was calculated using Rhino and Grasshopper to input it into the drape coefficient formula. The surface area of the draped cloth was determined by using a Monte Carlo simulation (Raychaudhuri, 2008). R Studio was used to calculate descriptive statistics so that the various drape coefficients of all the circles that have distinct hems could be verified.



a *b* *c*

Figure 1. *(a) Cusick Drapemeter "test apparatus" & hemmed circle, (b) post scans with a cleaned scan using Geomagic Wrap Software, and (c) Rhino & Grasshopper—projected drape.*

Results: Based on the initial findings from the pilot test, the average drape coefficients were as follows: the Serged Edge & Top Stitch" sample exhibited the highest mean drape coefficient of 76%. This suggests that the fabric becomes less drapeable because of this seam and stitch combination. On the contrary, "Raw Edge" exhibited a significantly reduced mean drape coefficient of 69%, and the following "Catch Stitch" was at 71%. The drape coefficients for the "Serged Edge & Catch Stitch" and "Coverstitch" samples were 74% on average. Standard deviations (SD) were calculated as follows: 0.0086 for the raw edge, 0.0062 for the serged edge, 0.0057 for serged edge & top stitched, 0.0047 for serged edge & catch stitched, 0.0070 for catch stitch, and 0.0058 for the cover stitched edge. As expected, "Raw Edge" samples exhibited the lowest drape coefficient. According to the preliminary findings, the groups consisting of serged and top stitch, serged and catch stitch, and cover stitch contribute the most in terms of weight and are much greater than those of the other groups. The test apparatus proved to provide a stable basis for future data collection. The added pin would need to be made thinner.

Conclusion and Discussion: The present study was an initial attempt to develop a test apparatus and measurement methods to calculate the finished fabric drape. There are innumerable additional types of textiles out there, each of which has a unique drape quality; thus, it is essential for the research of the future to thoroughly investigate various types of materials.

This includes having a range of circles with larger diameters and a variety of hem allowances for each of those circles. The present study was constrained by its sample size. Therefore, future research should use more samples to enhance the statistical power of the study and promote the generalizability of the findings. Nonetheless, this study served as an initial foundation for comprehending the correlation between drape coefficients and hems.

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