The impacts of inverted pleats on fabric drapability

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Fabric drape is related to garment's aesthetics, appearance, and comfort and is influenced by fiber content, yarn & fabric structures, fabric thickness & weight, and finishing process. The parameters affecting fabric drape have been the focus of many studies (e.g. Orzada, 2001; Sidabraites & Masteikaite, 2003). Drape coefficient (DC) is commonly used to quantify the drapeability of flat fabrics. Although the drape characteristics of a piece of 2D flat fabric can be measured by a drape meter or by image analysis method, when fabrics go through several operations during garment constructions, their drape behaviors are altered. For example, Jevšnik and Lojen (2007) studied the effect of seam types and directions on sewn fabric drape and found that when seams were added to the samples, their DC increased. Sharma, Behera, and Schenk (2005) also found that fabric DC is affected by different stitches and fusing of interlining types. Other than the seam, stitch, and interlining types, no study has been focused on how different forms of fabric manipulations affect the DC. Therefore, the purpose of this study is to explore the effects of inverted pleats on the drapeability of different woven fabrics, since pleat is commonly used in garment construction for functional or aesthetic purposes.

Three groups of woven fabrics, plain, twill, and satin, were chosen for the study. Each group has nine fabrics that vary in weight, thickness and rigidity. A total of 27 different fabrics were used in this study. Laboratory testing equipment was used to collect fabric parameter data. The Cusick drapemeter was used to determine the DC of the non-pleated (NP) fabrics. To observe the effects of pleats on fabric drape, the DC of the following samples were also collected: 1) completely sewn pleated samples (CSP), 2) partially sewn pleated samples (PSP) and 3) none sewn pleated samples (NSP). For each pleated sample (10" in diameters), three inverted sewn pleats along the warp direction were distributed evenly in distance. The width of each pleat was 2" wide. For CSP, after sewing the pleats, each sample was ironed to set the pleats, conditioned in standard atmosphere for at least 24 hours, and the DC of the sample was measured. To produce PSP samples, one ¼ length of the stitches was removed from both edges of the pleats on the CSP sample and the DC was measured. For NSP samples, only 1" of the stitch was left in the middle of each pleat (to hold the pleat in place) and the DC was measured. For each DC test, three samples of the same fabric type were measured on the face and the back of the sample, and the results of the six DC data were then averaged.

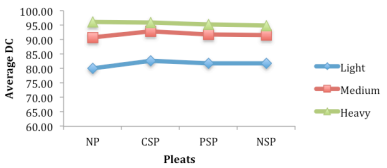
For data analysis, simple liner regression (SLR) was used to determine the effects of pleats (CSP, PSP, and NSP) on fabric drapability for all of the 27 fabrics. Strong positive correlations were found between the DC of NP and CSP (R^2= 0.91), of NP and PSP (R^2= 0.91), and of NP and NSP (R^2= 0.90). This result suggested that for all of the fabrics studied, when the pleats were added their fabric DCs changed. When looking at different fabric structures, the same positive

correlation results were also noted on the plain, twill, and satin weaves. These results were consistent with previous study showing that when the seams were added to the samples, their fabric DCs changed. Within each fabric structure, the DC data of each fabric weight samples (light, medium, heavy) were averaged to find out the trend of how different degrees of sewn pleats (CSP, PSP, and NSP) affect fabric drapability (Figure 1). The results showed that the DC increased in the light and medium weight plain weave fabrics from NP to CSP and then slightly decreased in PSP and NSP. On the other hand, the DC decreased slightly in the heavy weight fabrics from NP to CSP, PSP and NSP (Figure1a). For twill and satin fabrics, similar trend was observed in the light, medium and heavy weight fabrics in which the DC increased from NP to CSP and then slightly decreased in PSP and NSP (Figure 1b & 1c).

In summary, the results of this study suggested that fabric rigidity (DC) increased by adding completely sewn inverted pleats to the fabrics. This is because CSP contains more than one layer of fabrics completely stitched together, which lead to the increase in fabric thickness and stiffness. Although adding layers of fabrics in pleats also increases the weight of the samples, the effect of fabric thickness and stiffness outweighs the effect of fabric weight. By shortening the length of the sewn pleats (PSP and NSP), the fabric layers open up and are allowed to drape freely, which in turns reduce fabric stiffness and leads to increase fabric drapability. Understanding the complex relationship between fabric properties and various fabric manipulations during garment constructions and their effects on fabric drapabilty is important not only for the designers, but also for students and faculty in the field. This study took the first step by studying how various degrees of sewn pleats affect fabric drapability. More research is needed to understand the effects of fabric properties such as weight and thickness, and other complex clothing construction methods such as folds, and their effects on fabric drapability.

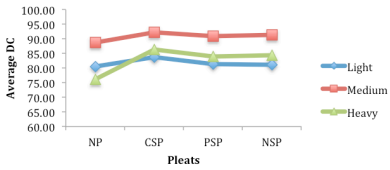
Figure 1: The Trend of Changes in the Average DC Values for Woven Fabrics

Average	NP	CSP	PSP	NSP
Light	80.02±1.15	82.77±1.15	81.86±1.15	81.77±1.15
Medium	90.80±0.86	92.85±0.86	91.83±0.86	91.47±0.86
Heavy	96.07±0.56	95.95±0.56	95.24±0.56	94.90±0.56



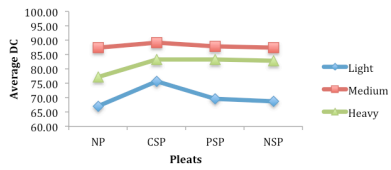
a. Plain Weave

Average	NP	CSP	PSP	NSP
Light	80.57±1.36	83.67±1.36	81.32±1.36	81.21±1.36
Medium	88.73±1.48	92.24±1.48	90.89±1.48	91.28±1.48
Heavy	76.22±4.46	86.26±4.46	84.04±4.46	84.47±4.46



b. Twill Weave

Average	NP	CSP	PSP	NSP
Light	67.13±3.74	75.69±3.74	69.67±3.74	68.74±3.74
Medium	87.35±0.86	89.21±0.86	87.84±0.86	87.45±0.86
Heavy	77.25±2.97	83.39±2.97	83.25±2.97	82.86±2.97



c. Satin Weave

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