Preferences of dress design elements for mass customization targeting women in the U.S.

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Keywords: mass customization, formal dress, body size and shape

Introduction: Mass customization (MC) is a combination of flexibility and individualization as it delivers market products and services adapted to personalized preferences at the affordable price connected with mass production. MC is facilitated by technological advancements, such as CAD/CAM systems and online product configurators (Gupta & Zakaria, 2014). Historically, Levi Strauss and Co., provided MC with custom-made jeans in the first time in the early nineties, and consecutively Brooks Brothers and Land's End offered mass-customized garments in their retail stores located in New York (Gupta & Zakaria, 2014). However, these efforts were short-lived and only proved the concept of feasibility. Even though consumers perceive the benefits from MC options, the process contains limitations of modularity and postponement, challenges with managing the configuration complexity (Modrak, Marton & Bednar, 2014), and manufacturers' need to balance the production cost (Jost & Susser, 2019). Nonetheless, MC can potentially raise business incomes by prioritizing customer-perceived value as consumers would voluntarily pay for a 20% premium for personalized goods (Freudmann, 2020). Existing online MC offerings for apparel either focus on functional or decorative perspectives, and very few brands provide fit-focused solutions on formal wear and occasion wear. According to Statista's 2019 report, men's apparel market in the U.S. was about $114 billion, whereas women's apparel market share was about $295 billion (Statista, 2020). Ecommerce companies, such as Sumissura, eShakti, and Rita Phil, offer online customization tools to let customers select different styles of neckline, sleeves, length, fabric, buttons, etc. (Lang, Xia & Liu, 2020). However, there is still a need to better understand online apparel MC preferences of women. Therefore, in the present study we investigated American women's preferences for mass-customized formal dress designs, and if self-reported body shapes and sizes correlate with their preferred dress design elements.

Methods: In this survey study, we designed a questionnaire that included 26 close-ended questions in Qualtrics. Upon receiving an IRB approval, the survey was distributed via Amazon MTurk in September 2020. The targeted population for this survey was women, aged 18 and older, who resided in the U.S. The questionnaire included demographic information (i.e., age, ethnicity, weight, height, and residential area), body shape, and garment size (i.e., dress). Participants were also presented with the flat sketches of dress styles (i.e., sheath, shift with a seam at natural waist, and drop-waist) and indicated their preferences of dress elements (i.e., neckline, dress style, skirt type, skirt length, sleeve type, color, textile print type, and textile print size). Additionally, BMI was computed as weight (kg)/height (m^2). Statistical analyses such as crosstabs of descriptive statistics, Pearson correlations, and one-way analysis of variance were conducted by using Statistical Package for Social Science (SPSS) 25.0.

Results: A total of 351 respondents participated in the survey. Among them, only 150 responses were useable. Fifty-eight (38.67%) participants resided in the Northeast, and the other areas of residence included the South (32.67%), the Midwest (16.67%), and the West (12.00%).

Participants' race categories were White/ European American (56.67%), Asian/ Asian American (20.67%), American Indian or Alaska Native (10.00%), Black/ African American (9.33%), Hawaiian or other Pacific Islanders (1.33%). The age distribution was 18-35 (70%), 36-45 (14%), 46-55 (8.67%), 56 and over (7.33%). Self-reported body shape groups were hourglass (40%), rectangle (26%), triangle (14.7%), oval (12%), inverted triangle (6.7%), and other (0.7%). Participants' dress sizes were XS (2.7%), S (14.0%), M (25.3%), L (16.7%), XL (32.0%), and XXL (9.3%), where XL, M and L were being the most frequent sizes respectively. There was a significant correlation between body shape and dress size ($\chi^2(25, 150) = 42.360$, $p = .016$), which means hourglass shapes were more frequently seen in XS-M (21.3%) than in L-XXL (18.7%), while oval and inverted triangle presented less frequencies in XS-M (1.3%, 2.7%) than in L-XXL (10.7%, 4.0%).

The preferences of dress style were shift (46%), sheath (44%), and drop waist (10%). For the preferences of skirt type, 40.7% participants selected H line, and 40% subjects chose flared, whereas A line (19.3%) was the least preferred. The most preferred skirt length was mid-thigh length (42%), and the secondly preferred skirt length was knee length (37.3%) and calf length (20.7%) was preferred least. The most preferred neckline was crew neckline (40.7%). Most of the participants preferred sleeveless (48%), whereas cap sleeve (26%) and short sleeve (26%) were less preferred. The ranks of preferred fabric color were white (66.7%), black (52.7%), blue (40.7%), pink (34%), red (30%), yellow (16%), and green (14%). The preferences of print type were floral (54%), geometric (47.3%), ethnic (42.7%), and abstract (23.3%). Either small (51.3%) or medium size (65.3%) of textile print was preferred by the majority, whereas large size (13.3%) was not preferred much.

There were significant correlations between dress size and skirt length ($r(148) = .276$, $p=.001$).The dress size group of XS to M preferred mid-thigh skirt length (30%) more than knee length (21%) and calf length (8%), while XL preferred knee length (13%) more than mid-thigh length (9%) and calf length (9%). Meanwhile, XXL preferred all three types of skirt lengths as the same as 3% each. Textile print size didn't indicate any significant differences in the comparative analysis among dress size groups ($F(5, 189)=1.454$, $p=.207$). There were no significant correlations between all dress design factors both with BMI ($r(148)=-.100-.109$, $p=.185-984$) and race categories ($r(148)=-.113-.064$, $p=.168-.909$). Four dress design factors (i.e., dress style, skirt type, skirt length, and sleeve type) out of eight presented significant correlations with body shape ($r(148) = .190-.294$, $p = .000-.003$). Additionally, there were significant differences in preferences of dress style between body shape groups ($F(4, 144) = 2.711$, $p= .032$). Hourglass-shaped participants preferred sheath (21.3%) as the first rank and the shift dress (17.3%) as the second rank. In the same way, the body shape group of rectangle (26%) preferred sheath (13.3%) as the best and shift (9.3%) as the next. On the other hand, two body shape groups of triangle and oval mostly preferred shift (15.3%), whereas sheath (6.6%) and drop waist (4.7%) were less preferred. On the contrary, the body shape group of inverted triangle preferred both sheath (2.7%) and shift (3.3%). All five body shape groups less-preferred drop waist when compared to the other two dress styles. For skirt types, hourglass and rectangle body types preferred H-line skirt (33%) more than A-line skirt (12%) and flared skirt (21%);

while triangle, oval, and inverted body types preferred flared skirt (19%) more than H-line skirt (8%) ($F(5, 144) = 2.953$, $p=.014$). For sleeve types, hourglass and rectangle body shapes significantly preferred sleeveless (37%) more than cap sleeve (16%) and short sleeve (14%), whereas oval and inverted triangle body shapes preferred short sleeve (8%) more than sleeveless (5%) cap sleeve (5%) ($F(5, 144) =2.016$, $p= .080$). Contrary to the Pearson correlation results, there was no significant difference in the comparative analysis in skirt length among body shape groups ($F(5, 144)=1.082$, $p=.373$).

Discussion and Conclusion: In summary, the most preferred MC dress style was a sleeveless shift dress with a crew neckline, H-line or flared skirt type at the mid-thigh level. Also, the most preferred colors and prints were white and black, and small- or medium-sized floral textile prints. None of the dress design elements indicated significant correlations with BMI and race categories. However, different body shape groups had significant distinctive characteristics in the three design components (i.e., dress style, skirt type, and sleeve type). Also, dress size presented significant differences only in skirt length, for which knee length was preferred more than mid-thigh length as the dress size increases. Eventually, our findings implicate that for a successful MC for women's formal dress, body shapes as well as sizes should be considered. The follow-up study would be an experimental study with human subjects through an online MC design process.

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