Mainstreaming the Novel Form of Zero-Waste Designs: An Aesthetic, Semantic, and Symbolic Analysis of Consumer Responses

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Introduction. Typical garment production creates 646 billion square feet of fabric waste every year (Ramkalaon & Sayem, 2021). Zero-waste pattern cutting design (ZWPCD) is the optimal method to reduce waste, as it uses every inch of fabric and produces zero textile waste (Carrico et al., 2022). However, ZWPCDs are often produced in smaller-scale businesses despite the benefit of waste reduction (McQuillan, 2019). One reason for this limited use is that ZWPCD appeal has gained limited traction, which may be partially due to ZWPCD's novelty. As Hekkert et al. (2003) suggest, moderate levels of typicality and novelty of product form resonate with highest aesthetic preference for designs, and a high level of novelty may bring negative responses from observers. Often, ZWPCDs present looser-fit garments as they optimize fabric use by avoiding the fabric scraps that often result from more form-fitting designs (McKinney et al., 2020). This aspect of ZWPCDs differs from mainstream designs, increasing the novelty factor. Although previous studies indicate ZWPCD's acceptance gap from mainstream design (Ramkalaon & Sayem, 2021; Saeidi & Wimberley, 2018), few studies have directly examined consumers' actual responses to ZWPCD's form. Thus, the purpose of this study is to describe consumers' cognitive, affective, and behavioral responses to the novel form of ZWPCD.

Theoretical Background. Based on Crilly et al.'s (2004) conceptual framework, Consumer Responses to the Visual Domain in Product Design, cognitive response was defined as consumers' judgment of a novel product form based on information, including aesthetic appreciation, semantic interpretation, and symbolic association. Affective responses include positive and negative emotions toward a product form (Bloch, 1995). Cognitive and affective responses influence behavior responses, including approach and avoidance (Bloch, 1995). Based on the above concepts, the research questions raised are: what is the level of consumer's (a) aesthetic impression, (b) semantic interpretation, and (c) symbolic association (**RQ1**), affective responses (**RQ2**), and behavioral response (**RQ3**) to the novel form of ZWPCD?

Methods. The study employed 2 (product category) × 3 (stimuli level) mixed factorial experimental design. The between-subjects factor was apparel product category (dress vs. jacket), and the within-subjects factor was a stimuli level (high acceptability/low creativity vs. medium acceptability/medium creativity vs. low acceptability/high creativity). Acceptability refers to the degree to which a design is desirable to consumers that may lead to acquisition. Creativity relates to how design is viewed as novel in garment silhouettes and has an inverse relationship to acceptability.

The stimuli for this study were collected from the 2012 to 2022 design catalogs of the International Textiles and Apparel Association, as the abstracts explain the design methods used. A keyword 'zero' was searched and 77 potential design image stimuli were identified. The

screening process proceeded using the following criteria: (1) design uses ZW pattern cutting methods, (2) design consumer category is womenswear, and (3) design product category is a dress or jacket. Two researchers systematically evaluated stimuli through a level classification procedure (low vs. medium vs. high) to select six final stimuli, with two stimuli represented in each level (Moretz, 2018, 2020; Orzada, 2014; Parsons, 2015; Rougeaux-Burnes, 2022; Smith & Moretz, 2021). Three design experts were recruited to confirm appropriate stimuli classification, in contrast to a non-expert manipulation check, given the need for the trained eye to assess creativity. "A good creative person is well trained" (Csikszentmihalyi, 1996, p. 50), and it requires a long time to build a clear eye for assessing creativity. The experts rated the stimuli, confirming the researchers' selection.

After obtaining IRB approval, an online survey was distributed via Prolific to female consumers aged 25 to 40 who were United States residents. The participants received financial compensation in return for their time. In the survey, cognitive responses were measured by adapting Homburg et al.'s (2015) product design scale with three dimensions (e.g., aesthetic, semantic, and symbolic responses). Affective response measurement was adapted from Scherer's (2005) affect categories and word stems instrument. Behavior response measurement was adapted by Baker and Churchill (1977). All items were rated on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). Data were statistically analyzed with repeated measures analysis of variance (ANOVA) using SPSS.

Results. One hundred responses (jacket: $n = 51$, dress: $n = 49$) were eligible for the final sample ($M_{age} = 32.3$, $SD_{age} = 4.5$), and the instruments had adequate reliability. Regarding cognitive responses (**RQ1**), a significant within-subjects effect emerged for stimuli level on aesthetic impression [Wilks' $\lambda = .93$, $F(1, 99) = 3.23$, $p < .05$] and semantic interpretation [Wilks' $\lambda = .51$, $F(1, 99) = 45.69$, $p < .001$], but not symbolic association [Wilks' $\lambda = .98$, $F(1, 99) = .83$, $p > .05$]. Pairwise comparisons revealed significantly higher aesthetic impressions related to high acceptability/low creativity as compared to low acceptability/high creativity apparel [$M_{high\text{-}acc/low\text{-}cre} = 4.8$, $M_{low\text{-}acc/high\text{-}cre} = 4.3$, $MD = .52$, $SE = 2.0$, $p < .05$]. Pairwise comparisons also confirmed that semantic interpretations were significantly higher for high acceptability/low creativity as compared to medium acceptability/medium creativity and low acceptability/high creativity stimuli levels, with all pairs being significantly different from each other [$M_{high\text{-}acc/low\text{-}cre} = 5.3$, $M_{med\text{-}acc/med\text{-}cre} = 4.7$, $M_{low\text{-}acc/high\text{-}cre} = 3.4$, $MD_{med\text{-}acc/med\text{-}cre} = .56$, $SE_{med\text{-}acc/med\text{-}cre} = .16$, $p_{med\text{-}acc/med\text{-}cre} = .02$, $MD_{low\text{-}acc/high\text{-}cre} = .56$, $SE_{low\text{-}acc/high\text{-}cre}$, $p_{low\text{-}acc/high\text{-}cre} < .001$].

With respect to affective responses (**RQ2**), the stimuli levels did not significantly affect affective responses [Wilks' $\lambda = .96$, $F(1, 99) = 1.64$, $p > .05$]. Regarding behavioral responses (**RQ3**), there was a significant within-subjects effect for stimuli levels [Wilks' $\lambda = .71$, $F(1, 99) = 19.25$, $p < .001$]. Pairwise comparison revealed that behavioral responses were significantly higher for the apparel with greater acceptability levels, with all pairs being significantly different from each other [$M_{high\text{-}acc/low\text{-}cre} = 3.9$, $M_{med\text{-}acc/med\text{-}cre} = 3.3$, $M_{low} = 2.5$, $SD_{high\text{-}acc/low\text{-}cre} = 1.9$, $SD_{med\text{-}acc/med\text{-}cre} = 1.9$, $SD_{low\text{-}acc/high\text{-}cre} = 1.6$, $p < .05$]. Additional analyses revealed that there were no significant differences in response to jackets and dresses, except in the case of aesthetic impressions, where the effect of apparel product category approached significance with aesthetic impressions of ZWPCD jackets emerging higher than that of dresses [$F(1, 99) = 3.59$, $M_{jacket} = 4.8$, $M_{dress} = 4.4$, $MD = .43$, $SE = .23$, $p = .06$].

Discussion. This study examines consumers' cognitive, affective, and behavioral responses toward a novel form of ZWPCD. Findings indicate ZWPCDs that are more acceptable and less creative elicit higher aesthetic, semantic, and behavioral responses. ZWPCDs with silhouettes that are closer to mainstream designs will support market acceptance. Yet, this relationship does not emerge for symbolic and affective responses. There is insignificant difference in response between jacket and dress, and future studies can further examine the relationships using other product categories of ZWPCDs. The study extends the use of Crilly et al.'s (2004) framework to explain consumer response to ZWPCDs and provides insights into increase the market acceptance of ZWPCDs.

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