# Store Design: *Visual Complexity and Consumer Responses*

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As in-store experience becomes increasingly important, retailers strive to create unique and memorable environments. A trend toward the goal is to emphasize decorative elements increasing store complexity, however, how such elevated store complexity would contribute to consumer response is yet to be explored. This study investigates the effect of visual complexity in a fashion store on affective/behavioral responses using self-report and psychophysiological measures. The moderating role of fashion involvement is taken into consideration. Two types of virtual stores were designed with different levels of visual complexity and manipulated by the presence of decorative patterns and type of layout (grid vs. free-form). Two experiments were conducted to test the proposed effects of visual complexity. The results showed that high-visual complexity in a fashion store has a negative effect on pleasure when consumers' fashion involvement level is low, but such negative effect of visual complexity diminished in consumers with high fashion involvement. Higher visual complexity was significantly related to higher arousal, regardless of consumers' fashion involvement level. The results also demonstrated the mediating role of emotions between the visual complexity of store design and consumers' approach intentions. The findings provide novel understanding of the effects of store's visual complexity to consumers.

***Keywords –*** Approach Intentions, Emotions, Involvement, Psychophysiological Measures, Store Design, Visual Complexity.

***Relevance to Design Practice –*** This study examined how store design influences consumers' experience by manipulating design elements that must be considered in a store's space design and visual merchandising. The findings are expected to offer useful insights for retail designers and managers formulating design strategies that help to ensure consumers' positive in-store experience.

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## Introduction

Modern shopping spaces are full of sensory stimuli. Retailers, challenged by efficient online operators, tend to eagerly fill their stores with fixtures, furniture, decoration, displays, and product stock to provide experiential value to shoppers. Retailer efforts to attract consumers' attention and maximize in-store experience can result in the exposure of consumers to a highly complex store environment, specifically from the visual perspective. Intangible stimuli, such as music and fragrance, are also routinely employed in stores, which may contribute to the increased sensory complexity. As visual sensation is the most dominant factor for people in perceiving and understanding the external environment, and marketing efforts heavily depend on visual communication, it is unsurprising that previous studies have emphasized the effects of visual complexity in understanding shoppers' responses to grocery or deli store environments (Gilboa & Rafaeli, 2003; Nasar, 1987; Orth & Crouch, 2014; Orth & Wirtz, 2014; Orth, Wirtz, & McKinney, 2016).

A store environment has both conscious and unconscious effects on consumers' emotions. Environment can influence shopping behaviors including purchase intention (Donovan & Rossiter, 1982; Spence, Puccinelli, Grewal, & Roggeveen, 2014; Turley & Milliman, 2000), money or time spent in the store (Baker, Levy, & Grewal, 1992; Sherman, Mathur, & Smith, 1997), approach tendency (Bitner, 1992; Donovan, Rossiter, Marcoolyn, & Nesdale, 1994; Foxall & Greenley, 1999), and patronage (Wu et al., 2013). The store environment has a considerable effect on unplanned purchases by stimulating consumers' cognitive and emotional status through product display or sensory stimuli (Chang, Eckman, & Yan, 2011; Inman, Winer, & Ferraro, 2009; Iyer, 1989; Piron, 1991; Silvera, Lavack, & Kropp, 2008). Creating an appealing store environment is an essential job for retail designers and managers, as it allows a unique and easy to recognize store image for consumers in highly competitive market conditions (Baker, Grewal, & Parasuraman 1994; Orth, Heinrich, & Malkewitz, 2012); it also positively affects consumer satisfaction and loyalty by boosting the store's attractiveness and aesthetic value (Baker, Parasuraman, Grewal, & Voss, 2002; Vieira, 2010).

The visual complexity of a store environment draws the attention of consumers and affects their emotional and behavioral response (Gilboa & Rafaeli, 2003; Orth & Wirtz, 2014; Orth et

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al., 2016). Visual complexity, which refers to the visual diversity or information rate of visual stimuli, is an important variable that influences first impressions and emotions toward and aesthetic preferences concerning the stimuli (Berlyne, 1971; Cox, D. & Cox, A., 2002; Geissler, Zinkhan, & Watson, 2006; Tuch, Bargas-Avila, Opwis, & Wilhelm, 2009). There have been several attempts to examine the effects of visual complexity on shoppers' responses, but these studies were set in grocery or deli stores (Gilboa & Rafaeli, 2003; Orth & Wirtz, 2014; Orth et al., 2016). In a hedonic shopping context, in which a more pleasurable experience is expected, however, consumers' responses to a store's visual complexity may differ from their responses in a grocery store. The effects of visual complexity need to be explored in other contexts, in which visual design is a major consideration, such as fashion stores.

This study investigated the effects of a store's visual complexity on affective and behavioral responses. Both self-report and psychophysiological measures were used to record responses to the visually complex store stimuli. Previous studies have used the self-report method to measure affective response. However, this approach could be biased by social desirability or time lag between response and experience of stimuli (Gröppel-Klein & Baun, 2001; Potter & Bolls, 2012). Psychophysiological measurement yields reliable complementary data to overcome such weak aspects in methodological perspectives. We created virtual stores using three-dimensional (3D) computer graphics and used photo-realistic interior images of the stores from the 3D models as experiment stimuli. This process enabled us to design and control the level of visual complexity, which was manipulated by the presence of decorative pattern, layout type (grid vs. free-form), and the quantity of fixtures and other objects. This study strives to contribute a deeper understanding of the effects of visual complexity of a store through more reliable and rigorous methods.

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# Conceptual Framework and Hypotheses Development

## Visual Complexity of Store Design

*Visual complexity* refers to the amount of detail or intricacy in visual stimuli (Snodgrass & Vanderwart, 1980). Visual complexity is an important predictor of people's artistic preferences, and, in the field of visual aesthetics, it is regarded as a crucial factor affecting observers' attractiveness evaluations of a given visual stimulus (Arnheim, 1966; Berlyne, 1971; Forsythe, Nadal, Sheehy, Cela-Conde, & Sawey, 2011). According to Berlyne (1971), people's perception of visual complexity rises as the amount and variety of elements, colors, materials, and surface styles increase. Furthermore, the arrangement of components (e.g., symmetry or asymmetry) also affects the perception of complexity.

The field of environmental psychology also deals with visual complexity as a variable that has a significant impact on the human psychological response to the environment (Mehrabian & Russell, 1974; Nasar, 1987, 1997). *Environmental complexity* is defined as the visual richness, amount, and diversity of decoration as well as the amount of information in an environment (Nasar, 1997). In some of the recent research applying the concept of visual complexity in the context of store environment design, visual complexity is defined as the overall visual diversity or the amount of information contained in a scene; it has also been stated that the visual complexity of a store is specifically linked to design elements such as walls, floors, ceilings, furniture and fixtures, density and layout within a store, and diversity of product assortment (Orth & Wirtz, 2014; Orth et al., 2016).

Empirically, visual complexity is known to affect the attention, affective status, and information processing rate of individuals (Deng & Poole, 2012; Nadal, Munar, Marty, & Cela-Conde, 2010; Pieters, Wedel, & Batra, 2010; Tuch et al., 2009). Studies have been conducted on the effects of visual complexity on observers' responses in a variety of domains, but there are conflicting findings. According to previous research, while visual complexity positively influences observers' attention, interest, and looking time (Eisenman, 1966; Geissler et al., 2006; Morrison & Dainoff, 1972), it negatively impacts the processing fluency for a stimulus (Reber, Schwarz, & Winkielman, 2004).

In general, the observers' preference for visual stimulation rises as visual complexity increases and then begins to reduce once it reaches a certain level, thereby creating an inverted-U shape (Berlyne, 1971; Vitz, 1966). In terms of information theory, it can be explained that people tend to avoid exposure to too much information because they cannot process all of it. Conversely, when too little information is available, the stimulus may not be strong enough to attract observers' attention. As people try to avoid the increased uncertainty and ambiguity caused by insufficient information, they ultimately aim for a medium level of visual stimuli (Geissler et al., 2006; Huffman & Khan, 1998). In a similar vein, cognitive load and processing fluency can affect the preference for complexity. Mental resources are required for processing visual stimuli

(Zhao & Meyer, 2007), and our information processing capacity is limited; thus, cognitive load caused by a lot of information leads to a decrease in processing efficiency (Fukuda & Vogel, 2009). High cognitive load and low processing fluency have been found mainly to have a negative effect on preferences for stimuli; however, several studies in the aesthetic domain suggest that attractive designs can generate positive responses even with poor information processing (Giese, Malkewitz, Orth, & Henderson, 2014; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). This implies that it is necessary to verify the impact of complexity in various contexts.

Studies on visual complexity in the marketing industry have mostly focused on consumer response to products or packaging (Cox, D. & Cox, A., 2002; Creusen, Veryzer, & Schoormans, 2010; Orth & Crouch, 2014), logos (Janiszewski & Meyvis, 2001), and visual advertisements (Pieters et al., 2010; Wang, Shih, & Peracchio, 2013). Some recent papers have investigated the context of web/mobile site design (Deng & Poole, 2012; Geissler et al., 2006; Sohn, Seegebarth, & Moritz, 2017; Tuch et al., 2009), yet research into the visual complexity of physical store design is underdeveloped. While few studies have defined the visual complexity of physical stores and examined customer responses, previous studies consistently found that a high level of visual complexity are linked to negative responses of consumers (e.g., lower perceived attractiveness or approach intentions), and general preferences are for a low level of visual complexity. Orth and Wirtz (2014) found that greater visual complexity in a store design reduces the store's perceived attraction, because visual complexity negatively affects people's processing fluency and pleasure. Similarly, other follow-up studies observe that visual complexity in a store wields a negative impact on consumers' shopping experience, suggesting that elements of a store environment could be arranged in a regular pattern and a store interior should be designed in a neat and simple manner (Orth et al., 2016). However, in a hedonic shopping context such as fashion stores where aesthetic design is emphasized, consumers may exhibit different responses toward a store's visual complexity.

## Consumer Affective Responses to Visual Complexity

Mehrabian and Russell (1974) proposed the Stimulus-Organism-Response (S-O-R) paradigm, which explains that people have different feelings toward information conveyed through various senses in an environment. This sensory information affects their responses to the environment, resulting in approach or avoidance behavior. Donovan and Rossiter (1982) applied the paradigm to the context of retail stores, confirming the significant impacts of store environments on consumer responses. Since then, numerous studies have posited that environmental factors (e.g., color, lighting, music, crowding, and fragrance) can affect the inner states and external responses of consumers, based on the S-O-R model (Foxall & Greenley, 1999; Machleit, Eroglu, & Mantel, 2000; Sherman et al., 1997; Wu et al., 2013).

The degree of pleasure reflects positive feelings such as happiness, satisfaction, and joyfulness an individual has about an environment; pleasure experienced by consumers while shopping positively affects their behavior (Babin, Darden, & Griffin, 1994; Bloch, Sherrell, & Ridgway, 1986; Hirschman & Holbrook, 1982). Pleasure caused by a shopping environment has been found to trigger positive customer approach behaviors, including how long they stay in a store, whether they engage in social interactions there, and whether they are willing to revisit the store (Baker et al., 1992; Bitner, 1992; Donovan & Rossiter, 1982). Pleasure is also found to be positively correlated with consumer evaluations of a product (Chebat & Michon, 2003), satisfaction (Mattila & Wirtz, 2001), and buying behavior (Babin & Darden, 1995; Menon & Kahn, 2002; Sherman, Mathur, & Smith, 1997).

Pleasure is related to the processing of stimuli (Reber et al., 2004). Visual complexity of store design is a key input in a consumer's information processing in a store (Orth & Wirtz, 2014; Titus & Everett, 1995). In general, the high complexity of a stimulus results in a high information rate, causing difficulty for people processing the information; a high information rate can have a negative effect on pleasure. Fluent processing of stimuli, on the contrary, is likely to generate pleasure. Because it implies a successful identification with error-free processing of stimuli, people are more likely to exhibit positive judgment of the stimuli due to positive emotional response caused by high fluency (Winkielman & Cacioppo, 2001; Winkielman et al., 2003).

Arousal is a psychological response of entering a state of being stimulated, excited, and awakened from being drowsy, bored, relaxed, or calm (Berlyne, 1971). It has been found that an arousal response triggered by a novel and complex environmental stimulus excites consumers and causes them to become immersed in the stimulus and the situation. Arousal can lead customers to stay in the store for longer while also positively affecting their buying intention (Donovan & Rossiter, 1982; Groeppel-Klein & Baun, 2001). According to Berlyne (1971), each stimulus has a different capacity to increase arousal, and arousal can be provoked by the visual complexity of the stimuli. The higher the complexity of the stimuli, the higher the required cognitive resource for evaluation or appreciation, resulting in an increase in the person's arousal (Zuckerman, 1994).

Based on the previous discussion, we expect that the visual complexity of a store design will have an effect on consumers' affective states. Specifically, when a store's visual complexity is low, a consumer will exhibit higher pleasure than when a store's visual complexity is high. Consumer arousal, on the contrary, should be higher when a store's visual complexity is high than when it is low.

> $H_1$ Visual complexity of store design will have an effect on consumers' affective states.
>
> $H_{1(a)}$ Pleasure will be higher in a low-complexity condition than in a high-complexity condition.
>
> $H_{1(b)}$ Arousal will be higher in a high-complexity condition than in a low-complexity condition.

## Moderating Role of Fashion Involvement on the Effect of Visual Complexity

*Involvement* refers to an individual's degree of an interest in the importance of a particular stimulus or situation. The level of involvement has a specific effect on consumer decision processing and evaluation (Naderi, 2013; O'Cass, 2000, 2004). In the fashion industry, where trends change rapidly and consumers' wants can be difficult to predict, consumers with high-fashion involvement are primary targets for communication and marketing activities because these consumers are often drivers or influencers of fashion (Goldsmith, Freiden, & Kilsheimer, 1993; Goldsmith, Moore, & Beaudoin, 1999).

Previous studies on visual complexity have determined that individual differences, such as the degree of prior experience or training in related stimulus, have a moderating effect. The results of previous studies have also shown that, whereas novices preferred simple stimuli, experts preferred complex stimuli (Reber et al., 2004). These results can be considered alongside the findings of Vitz (1966) that the preference for complexity increases as one becomes more exposed to complex stimuli. The higher the visual complexity of the store, the greater the amount of information contained in the store environment (Berlyne, 1971; Mehrabian & Russell, 1974; Nasar, 1997). The affective states or preferences derived from visual stimuli are affected by consumers' ability to process relevant information (Orth & Wirtz, 2014; Reber et al., 2004).

A number of studies have confirmed that high-involvement consumers tend to process relevant information more actively, pay more attention, and understand more information (Andrews, Durvasula, & Akhter, 1990; Celsi & Olson, 1988; Gordon, McKeage, & Fox, 1998; Swinyard, 1993). Knowledge accumulated by past experiences affects consumer involvement in a relevant domain, because a consumer with knowledge about the product characteristics associated with their needs or goals may feel more strongly about a product's personal relevance (Celsi & Olson, 1988). Celsi and Olson (1988) demonstrated that high-involvement consumers have greater motivation to process relevant information, show more attention, and activate more knowledge for information processing or comprehension than low-involvement consumers.

High-fashion-involvement consumers are more likely to have an interest in, or knowledge of, fashion stores or fashion products than low-fashion-involvement consumers (O'Cass, 2004). As with the findings of previous research on involvement, high-fashion-involvement consumers are expected to more easily process visual information in fashion stores using their experiences and knowledge. Thus, we expect that the consumer response toward a visually complex fashion store will vary based on the participants' levels of fashion involvement.

> ***H₂*** The effect of visual complexity of store design on consumers' (a) pleasure and (b) arousal will be moderated by consumers' fashion involvement.

Finally, based on the S-O-R paradigm, consumers' affective states triggered by store design will affect customer approach intentions toward the store (see Figure 1). In this respect, the following hypothesis was developed to test the mediation effect of affective states of pleasure and arousal.

> ***H₃*** The effect of visual complexity of store design on consumers' approach intentions will be mediated by consumers' affective states of (a) pleasure and (b) arousal.

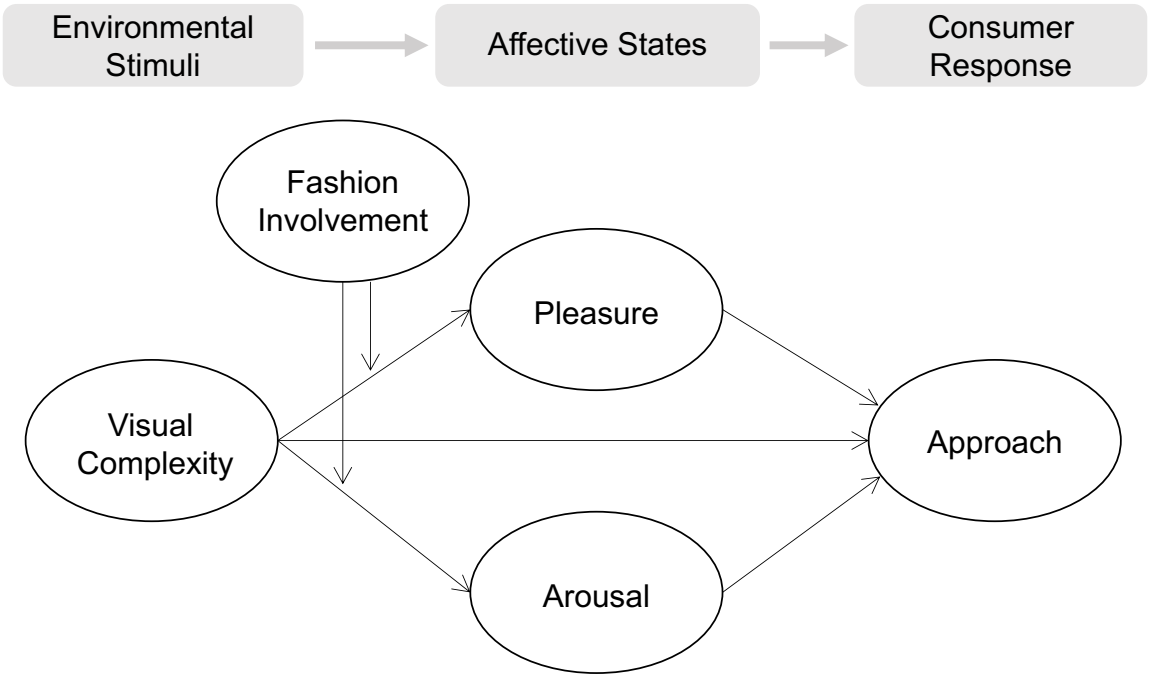


**Figure 1. Conceptual model of the study.**

## Study 1

Study 1 was conducted to investigate the effects of visual complexity on consumers' physiological affective responses in a store. Affective states, induced within a store environment, directly influence consumers' approach-avoidance behaviors and are related closely to physiological responses. Psychophysiological measures can obtain and provide a huge amount of objective and sensitive data on affective states and are used widely in media technology and environmental research (Potter & Bolls, 2012; Somervuori & Ravaja, 2013; Tuch et al., 2009).

Attempting to examine consumers' affective response according to the level of visual complexity of store design, Study 1 measured the participants' psychophysiological indicators in real time while they were looking at the stimulus of store design ($H_1$). It also aimed to discover whether physiological affective response to a store environment is moderated by the level of the participants' fashion involvement ($H_2$). Note that in the text, figures, and tables below, visual complexity is abbreviated to *VC* and fashion involvement to *FI* where appropriate.

### Stimuli

For this study, we developed two types of virtual fashion stores with different levels of visual complexity using the 3D modeling program AutoCAD 3D Studio Max with V-ray engine. The stores were designed by a commercial interior designer. Baker (1986) categorized visual design factors of a store into aesthetic and functional dimensions. Aesthetic dimensions include color, texture, and pattern. Such aesthetic elements can help consumers to feel pleasure in a store setting. However, functional dimensions include layout, comfort, and signage; a store's layout, especially its spatial arrangement, can facilitate consumers' approach and purchasing behaviors. Based on the categorizations provided by Baker, we defined the visual complexity of a store by the patterns of walls, floors, ceilings, or furniture as the aesthetic dimension, and store layout as the functional dimension. We manipulated the levels of visual complexity with the presence of decorative patterns as a design element and the type of layout (grid vs. free-form).

When manufacturing stimuli, we endeavored to refer to an actual store and to closely reproduce it, so that the virtual store design could have greater realism and external validity. More specifically, for a store with high visual complexity, decorative patterns were applied not only to the ceiling and walls, but also to interior props, such as display stands, chairs, and floor carpets (see Table 1). For the store with low complexity, the average colors derived from multi-toned patterns of each part in the high complexity store were extracted and homochromatically applied to the walls, the ceiling, the floor, and the interior props. In this way, we intended to manipulate the visual complexity of a design while maintaining the style and atmosphere of the designs of the two mock stores (see Table 1).

**Table 1. Stimuli manipulation criteria.**

| Condition | Store Stimulus | Design Manipulation |
|---|---|---|
| **Low-complexity** |  | • Grid layout<br>• Homochromatic walls, ceiling, and floor (colors were extracted from patterns of high-complexity store) |
| **High-complexity** |  | • Free-form Layout<br>• Multi-tone decorative patterns applied to the store interior elements |
| **Controlled** | • Store size, Assortment/Number of products and fixtures, Average color tone in each element | |

Store layout can be divided into two types. Grid layout is formed of aisles in a repetitive and symmetrical rectangular shape, enabling consumers to shop fast and efficiently, whereas free-form layout, which consists of aisles, display stands, or racks arranged freely, not in a grid form, provokes interest and allows for diverse shop arrangements (Ebster & Garaus, 2011). Orth and Wirtz (2014) found that stores with low spatial complexity arranged components in regular rows and columns, but those with high complexity positioned components in an irregular manner. Considering their findings, we decided to manipulate the layout by using a grid-style arrangement for the store with low visual complexity, while adopting a free arrangement for the store with high complexity.

Previous studies included diversity of assortment and number of in-store products in the operational definition of visual complexity, so that the store with high visual complexity could display greater numbers of more diverse products. However, some research has shown that product assortment of a store, in itself, is a factor that considerably affects people's selection and assessment of the store (Arnold, Oum, & Tigert, 1983; Craig, Ghosh, & McLafferty, 1984), and a store with a larger and more varied assortment is preferred by consumers (Hoch, Bradlow, & Wansink, 1999; Morales Kahn, McAlister, & Broniarczyk, 2005). To avoid any confounding effect, this study used the same store size and the same assortment and number of products and fixtures.

## Psychophysiological Measures

### *Pleasure: Facial Electromyography*

Facial electromyography (EMG) is a measure of affective valence (e.g., pleasure/displeasure). Face muscles have proven to be most consistently activated according to the valence of affective stimuli, and the zygomaticus major muscle is associated strongly with the pleasant dimension of affective valence (Bolls, Lang, & Potter, 2001; Cacioppo & Gardner, 1999; Cacioppo, Petty, Losch, & Kim, 1986; Hazlett, R. & Hazlett, S., 1999; Lang, Greenwald, Bradley, & Hamm, 1993; Neumann, Hess, Schulz, & Alpers, 2005). Thus, high EMG activity of the zygomatic muscle is the result of a positive emotion: high pleasure.

### *Arousal: Electrodermal Activity*

Electrodermal activity (EDA), also known as skin conductance or galvanic skin responses, is a measure of arousal. As arousal increases, the sweat glands react through the nervous system. Skin perspiration is associated with changes in skin conductance; thus, high EDA activity is the result of high arousal (Gangadharbatla, Bradley, & Wise, 2013; Groeppel-Klein & Baun, 2001; Mandryk, Inkpen, & Calvert, 2006; Potter & Bolls, 2012; Somervuori & Ravaja, 2013).

In line with our hypothesis, we expect that zygomatic EMG activity (pleasure) would be higher in a low-complexity condition than a high-complexity condition, whereas a person's EDA activity (arousal) will be higher in a high-complexity condition than in a low-complexity condition. Furthermore, the effect of visual complexity of store design on consumers' EMG and EDA responses will be moderated by consumers' fashion involvement.

## Participants and Procedure

This experiment was conducted over 15 working days from October 15 to November 4, 2015 at Cornell University's D.U.E.T Lab (Design, User Experience, and Technology Lab). Considering that the perception of a stimulus's visual complexity, and responses to the stimulus, might be affected by observers' individual characteristics such as gender and age (Wang, 2014; Zukerman, 1994), the study participants were limited to female consumers in their 20s-30s, and women's clothing store images were presented as stimuli. Participants were recruited via convenience sampling and advertisements at Cornell University. Twenty-seven undergraduate and graduate students were recruited to take part in the experiment as consumers.

Each experiment was conducted individually with the researcher, and took approximately 30 minutes. The research procedure was explained to the participants in person as soon as they arrived at the venue of the experiment. They were first asked to respond to a questionnaire regarding their demographic information (e.g., gender, age, and ethnic background) and five items of fashion involvement (Choo, Sim, Lee, & Kim, 2014; O'Cass, 2000) using a 5-point Likert scale. After completing a questionnaire, sensors were attached to their bodies to record their psychophysiological data. The respondents were assigned randomly to one of two conditions (high-complexity vs. low-complexity) and they were asked to view a store image for 11 seconds on a 65-in. ultra-high definition (4K resolution) television screen while their peripheral vision was covered. While the respondents were viewing the virtual fashion stores on the television screen, their psychophysiological data were recorded using BIOPAC hardware and AcqKnowledge software. The participants were also asked to answer four questions on visual complexity (Orth & Wirtz, 2014) using a 5-point Likert scale after viewing the stimulus. For statistical analysis, physiological data for the first second after stimuli onset was used as the baseline activity. We then calculated the change amount per second after 10 seconds from the baseline activity score using the change scores method (Potter & Bolls, 2012). After eliminating unusable data from three participants, where signals had been interrupted due to movement or insufficient contact of sensors, 24 participants' data were used for the analysis.

## Results

### *Manipulation Checks*

For the manipulation check, a *t*-test was performed with the visual complexity condition as the independent variable on the averaged value of four items of perceived visual complexity ($\alpha$ = .860). Visual complexity as perceived by the participants was found to differ significantly according to the levels of visual complexity ($M_{vc\text{-}low}$ = 2.58 vs. $M_{vc\text{-}high}$ = 4.46; $t(17)$ = -9.066, $p < .001$). Fashion involvement level was determined by the mean value of five items

($\alpha$ = .965) and a median split into the two groups (i.e., high, low; $M_{FI\_low}$ = 2.91 vs. $M_{FI\_high}$ = 4.60). Thus, the manipulation checks were all successful, which indicated that the research could proceed to the main analysis.

### *EMG Response*

Psychophysiological data were analyzed using repeated measures analysis of variance (ANOVA) with 2 (Visual Complexity: high vs. low) × 2 (Fashion Involvement: high vs. low) × 10 (Time) as independent variables to test the hypotheses on zygomatic EMG (an index of pleasure). The results of a repeated measures ANOVA indicated an insignificant main effect of visual complexity ($p$ = .964) and fashion involvement ($p$ = .103), which rejects $H_{1(a)}$. A marginally significant Visual Complexity × Fashion Involvement interaction, $F(1, 20) = 3.292$, $p = .085$, on EMG activity was observed. The low-fashion involvement group displayed greater pleasure (i.e., greater zygomatic EMG activities) in the low-complexity condition than in the high-complexity condition. In contrast, the high-fashion involvement group exhibited higher levels of pleasure in the high-complexity condition than in the low-complexity condition (see Figure 2). Thus, $H_{2(a)}$ is supported.

### *EDA Response*

An analysis of repeated measures ANOVA on EDA activity (an index of arousal) revealed a significant main effect of a store's visual complexity, $F(1, 20) = 4.639$, $p = .044$; thus, $H_{1(b)}$ is supported (see Figure 3). However, the main effect of fashion involvement ($p$ = .854) and the interaction effect between visual complexity and fashion involvement ($p$ = .854) were insignificant, which rejects $H_{2(b)}$. Participants' physiological arousal in the high-complexity condition was higher than in the low-complexity condition regardless of their fashion involvement level.

## Discussion

The findings in Study 1 imply that visual complexity may have a positive effect on a specific group of consumers, conflicting with the findings of some previous studies (Orth & Wirtz, 2014) that showed visual complexity of a store design negatively affects consumers' affective response. When a fashion store presents a highly complex visual design, consumers with low involvement in fashion may experience difficulty processing the information that they receive and not feel any positive response. Conversely, those who are highly involved in fashion are able to accept and comprehend the store design information more easily, which is why they experience a positive affective state in the same situation. In a store with low visual complexity, in particular, consumers deeply involved in fashion presented the least pleasure. This may be in line with previous studies' findings that those with more experience of a given stimulus tend to prefer higher complexity as the optimal level (Cox, D. & Cox, A., 2002; Reber et al., 2004; Vitz, 1966). They may find the amount of environmental information from the store insufficient, uncertain, or ambiguous and are not given a stimulus strong enough to trigger positive feelings in them.

According to Berlyne (1971), observers' arousal response to visual stimuli is influenced by the stimuli's own arousal potential, which comes from the stimuli's visual complexity. Berlyne did not find consumers' fashion involvement or their individual traits to have a moderating effect, but did find that arousal response to stimuli in a store environment is caused by the level of visual complexity.

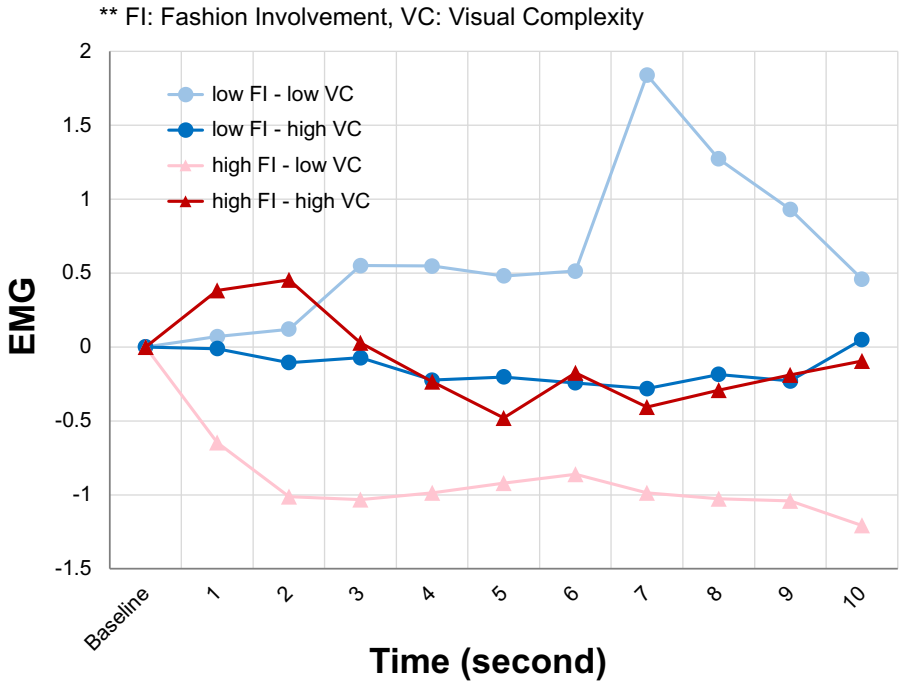


**Figure 2. Zygomatic EMG response to visual complexity level of store design.**

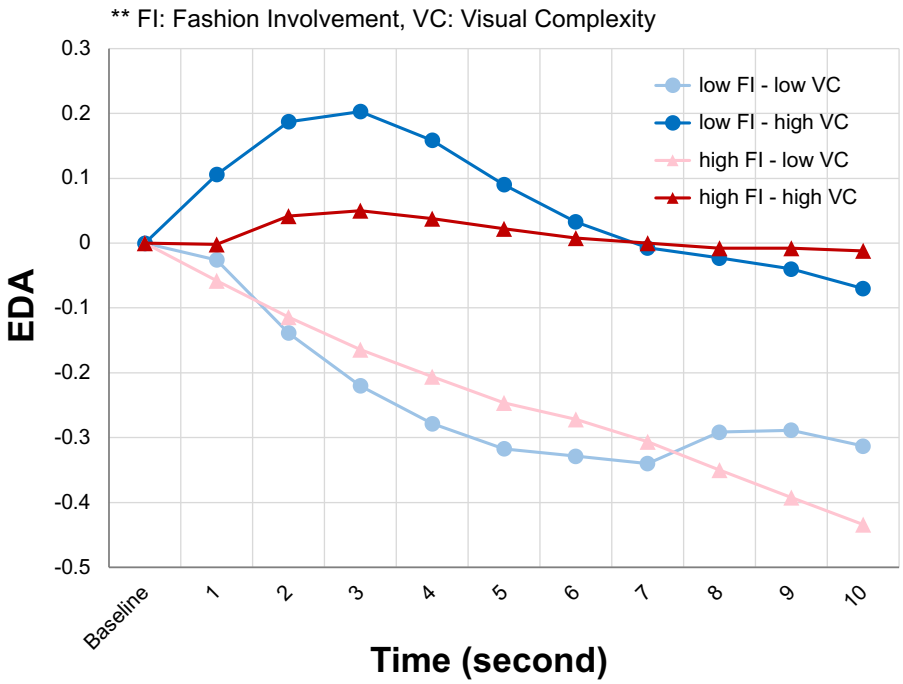


**Figure 3. EDA response to visual complexity level of store design.**

## Study 2

Study 2 was performed to reconfirm the results of Study 1 through survey research ($H_1$, $H_2$), and to investigate how visual complexity of store design affects approach intentions to a store with the mediation of pleasure and arousal ($H_3$).

### Participants and Procedure

The survey's participants acting as consumers were women in their 20s-30s, and the survey was conducted by utilizing Mechanical Turk (MTurk), an online survey web service provided by Amazon. The data were collected over three days from February 26 to 29, 2016, and a total of 284 participants responded to the survey.

The stimuli used in Study 1 were used again in Study 2. The participants were randomly assigned to either of the two conditions (high complexity and low complexity) and were first asked to answer questions about their demographic characteristics and fashion involvement. They were then presented with images of the virtual fashion stores and were asked to answer questions on approach intentions toward the stores (seven items, Mattila & Wirtz, 2001; Orth & Wirtz, 2014), and whether they felt pleasure and arousal while viewing the stores (four items each, Bradley & Lang, 1994; Mehrabian & Russell, 1974) using a 5-point Likert scale. Finally, for manipulation check, the questions on visual complexity used in Study 1 were also used in Study 2.

Of the total, 21 responses (approximately 7%) were excluded at the preliminary stage of data examination due to the incompleteness of the survey. Data from 263 respondents proceeded to further analysis.

### Results

#### *Manipulation Checks*

For the manipulation check, a t-test was performed with the visual complexity condition as the independent variable on the averaged value of four items of perceived visual complexity ($\alpha$ = .760). Manipulation of the visual complexity of store design was successful: participants assigned to the high visual complexity condition perceived the store design to be highly complex ($M_{vc\text{-}high}$ = 3.72), while the others in the low condition perceived lower complexity ($M_{vc\text{-}low}$ = 2.80; $t(261)$ = -9.160, $p < .001$).

#### *Affective Response to the Visual Complexity of Store Design*

To test $H_1$ and $H_2$, data were analyzed using Hayes' (2013) PROCESS Model 1 for simple moderation with 5,000 bootstrap samples. The analyses were performed separately for pleasure and arousal as the dependent variable, with visual complexity condition as the independent variable and fashion involvement as the moderator (continuous).

The first analysis was conducted to test the effects of visual complexity and its interaction with fashion involvement on pleasure. The results revealed a moderating effect of consumers' fashion involvement between visual complexity and pleasure ($b$ = 0.38, $t$ = 3.40, $p < .001$), which supports $H_{2(a)}$. The main effect of visual complexity was insignificant ($b$ = -0.19, $t$ = -1.51, $p$ = .133); therefore, $H_{1(a)}$ was rejected.

To identify the ranges of consumers' fashion involvement level for which the simple effect of the visual complexity was significant, the Johnson-Neyman technique was used. The results revealed that consumers experienced greater pleasure in the low-complexity store than the high-complexity store when their fashion involvement value was less than 2.95 ($b_{JN}$ = -.25, $t$ = -1.97, $p$ = .05). Conversely, when consumers' fashion involvement value was greater than 4.79 ($b_{JN}$ = .45, $t$ = 1.97, $p$ = .05), they felt more pleasure in the high-complexity store than in the low-complexity store (see Figure 4).

The second analysis was conducted to test the effects of visual complexity and its interaction with fashion involvement on arousal. There were significant main effects of visual complexity ($b$ = 0.48, $t$ = 4.64, $p$ < .001) and fashion involvement ($b$ = 0.15, $t$ = 3.30, $p$ = .001), whereas the interaction between visual complexity and consumers' fashion involvement was insignificant ($b$ = -0.02, $t$ = -0.23, $p$ = .821; see Figure 5). Arousal was higher in the high-complexity store than in the low-complexity store regardless of consumers' fashion involvement level, which supports $H_{1(b)}$ and rejects $H_{2(b)}$. Thus, the results of hypothesis testing with self-reported data in Study 2 coincide with the results with psychophysiological data from Study 1: In both studies, $H_{1(b)}$ and $H_{2(a)}$ were supported, while $H_{1(a)}$ and $H_{2(b)}$ were not.

### *Mediating Effect of Pleasure and Arousal on Approach Intentions*

Hypothesis 3 predicts the mediating effects of affective states on approach intentions. Hayes' (2013) PROCESS Model 7 with 5,000 bootstrap samples was used to examine the mediating effect of pleasure on approach intentions. The visual complexity of store design was entered as the independent variable, fashion involvement as the moderating variable, pleasure as the mediating variable, and approach intentions as the dependent variable. The analysis proved the mediating effect of pleasure, which was moderated by consumers' fashion involvement (Effect = 0.2726, 95% CI [0.1132, 0.4272]). It was found that, in the indirect path that is mediated by pleasure, the interaction term between a store's visual complexity and consumers' fashion involvement had a significant influence on pleasure ($b$ = 0.38, $t$ = 3.4007, $p$ < .001), and pleasure, in turn, had a significant effect on people's approach intentions toward a store ($b$ = 0.72, $t$ = 26.5634, $p$ < .001), proving the mediating effect of pleasure moderated by fashion involvement. Therefore, $H_{3(a)}$ was accepted. More specifically, for consumers with low fashion involvement (-1 *SD*), visual complexity of store design affected their store approach intentions negatively through pleasure (Effect = -0.4498, 95% CI [-.7055, -0.2034]). Conversely, for consumers who were highly involved in fashion (+1 *SD*), the path was not significant (Effect = 0.1739, 95% CI [-0.0844, 0.4247]). Furthermore, the direct path in which visual complexity influenced approach intentions in the same model proved to be marginally significant (Effect = -0.1174, $t$ = -1.9524, $p$ = .052).

Next, the mediating effect of arousal on approach intentions was examined through PROCESS Model 4, which found that arousal had a significant mediating effect (Effect = 0.2311, 95% CI [0.1264, 0.3544]); moreover, the Sobel Test verified statistical significance by presenting a z-value of 3.8829 ($p$ < .001). Therefore, $H_{3(b)}$ was supported. More specifically, visual complexity in fashion store design positively influenced arousal ($b$ = 0.47, $t$ = 4.4490, $p$ < .001), and the impact of arousal on store approach intentions was positively significant ($b$ = 0.49, $t$ = 8.1523, $p$ < .001). The direct effect of visual complexity on approach intentions was found to be negative (Effect = -0.5051, $t$ = -4.7320, $p$ < .001).

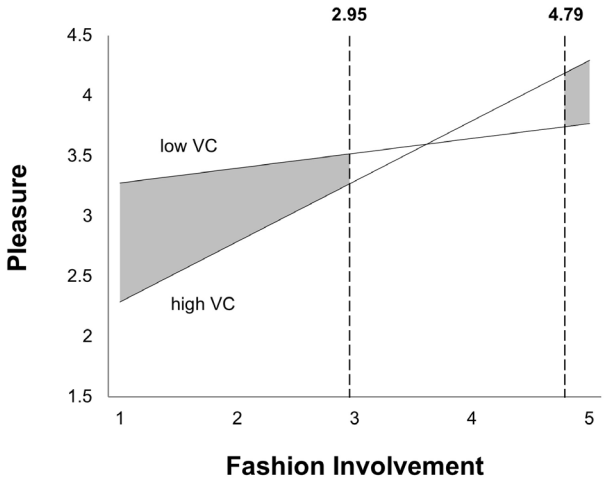


**Figure 4. Conditional effect of store's visual complexity on pleasure with Johnson-Neyman point for consumers' fashion involvement.**

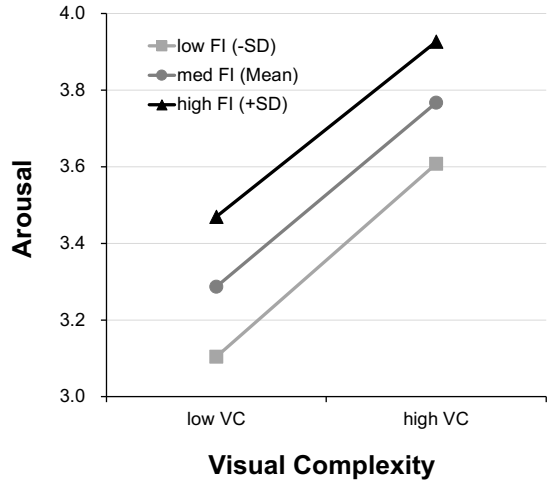


**Figure 5. The effect of visual complexity of store design on arousal by consumers' fashion involvement level.**

## Discussion

In Study 2, self-report data was collected through a written survey method; the survey produced results consistent with those of Study 1 (which analyzed psychophysiological data) on the effects of visual complexity of store design on pleasure and arousal.

The analysis on the moderated mediating effect of pleasure on approach intentions showed that the negative effect is prevalent for low fashion involvement consumers, while no effect was found for highly involved consumers. This suggests that the research findings of Orth and Wirtz (2014), that visual complexity of a store negatively impacts consumers' affective and behavioral responses, are applicable to those who are less involved in fashion shopping.

The analysis results of the mediating effect of arousal provide important insight on the role of arousal in the shopping context. The findings suggest that the visual complexity of a fashion store alone could wield a negative effect on consumers' approach intentions. Yet visual complexity could positively affect store approach if consumers feel arousal. Arousal in particular was found to have a positive influence on consumers' intentions to approach a store regardless of the level of their fashion involvement. This proves that the arousal response acts as a vital mediator in the effect of a visually complex environment on consumers.

# General Discussion

The present study tested consumers' affective and behavioral responses to distinct degrees of visual complexity in a store design. To achieve an in-depth understanding of affective states, which play a key role in consumer behavior in the shopping context, we adopted a multi-methods approach. In Study 1, we collected psychophysiological responses of 24 participants in a highly controlled laboratory. In Study 2, we utilized a written survey method to collect self-report data from 263 participants. Our multi-methods approach ensures that the findings of the present study are highly reliable and valid. Analysis results of the visual complexity effects on pleasure and arousal were identical between the two studies.

Visual complexity of store design seems to impact both the pleasure and arousal states of consumers, but in different patterns. The effect of visual complexity on pleasure was dependent on the consumers' involvement with fashion: For high-fashion-involvement consumers, visual complexity leads to pleasure, while the opposite effect was found for the low-fashion-involvement consumers. This indicates that the findings of previous research (that a store's visual complexity negatively influences consumer response) should be applied differently depending on consumer characteristics. The effect of visual complexity of store design on consumers' arousal is rather simple: Consumers exhibit greater arousal in a store with high visual complexity regardless of their involvement in fashion, indicating that the triggering of arousal by visual complexity is universal.

In Study 2, the path models explaining the effect of visual complexity of store design on consumer approach intentions were specified with consideration of the moderated mediating role of pleasure and the mediating role of arousal. The PROCESS model analysis results confirmed the valid roles of pleasure and arousal in predicting consumers' behavioral responses as proposed. For consumers with low fashion involvement, visual complexity of fashion store design negatively affects approach intentions toward the store, and this relationship was mediated by pleasure. For those highly involved in fashion, neither the direct effect nor mediating effects via pleasure were significant. Meanwhile, the results verified the mediating role of arousal. In the path model with arousal as a mediator, both direct and indirect effects were significant. It is interesting that the indirect effect of visual complexity (i.e., when mediated by arousal) on approach intentions was positive, while the direct path showed a negative effect. As such, it was found that when consumers feel excitement due to a store design's visual complexity and become immersed in the shopping situation, they may display a positive response.

## Theoretical Implications

Confronted by fierce competition from online players, conventional retailers need to find unique propositions for their physical stores. As the concept and value of off-line stores is changing and it is becoming harder to predict consumer behavior, a variety of store design elements are being adopted to respond to the situation; however, the consequent complexity of a store has rarely been examined. While previous studies of visual complexity in a store design were performed only in the context of the food retail industry, this study's significance lies in its examination of consumer response by introducing a consumer variable of fashion involvement in the context of fashion store environment, where visual aesthetics is a key value.

While most previous studies emphasized the negative effect of a store's visual complexity, the results of this study show the impact of visual complexity is different with the presence of moderating and mediating variables. We found that higher visual complexity in a fashion store can have a positive impact, via increased arousal, on consumers. Consumers who are deeply involved in fashion particularly feel pleasure when exposed to highly complex visual store designs. In this sense, this study advanced discovery of the boundary conditions for product and consumer characteristics regarding the effect of visual complexity on consumer response, and also confirmed the conventional S-O-R model where affective states experienced within a store lead to a behavioral response.

Previous research has identified pleasure as one of the most important factors in determining behavioral responses to a certain environment; the effect has been tested intensively. However, the correlation between arousal and shopping behavior is currently inconclusive. As such, this study is meaningful in identifying the role of arousal in consumer responses.

Regarding methodology, this study created 3D virtual stores as stimuli and presented them on a high-resolution TV screen in order to overcome limitations of the existing research on store design, thereby increasing the validity of the findings. Previous studies on store visual complexity have often conducted experiments by offering stimuli in the form of photographs and using different levels of assortment of in-store products. Previous methodology has failed to control product assortment and other factors that could affect consumer response, such as brightness value, saturation, and the viewing angle of the photographs.

Unlike those studies, this research strictly controlled the image quality of the two conditions by using a 3D modeling program and found the effect of a store environment after eliminating the effect of product assortment.

This study also utilized a self-report survey and psychophysiological indices to examine affective responses more objectively and more reliably. Through the measurements of psychophysiological signs, the participants' minute emotional responses could be recorded in real time while they were viewing the stimuli. The physiological indicators secured significant results about the hypotheses based on a relatively small dataset in comparison to self-report methods. The results derived from the two datasets were found to have the same directionality; thus, this study is meaningful in terms of methodology in confirming that psychophysiological indices can be a useful tool in measuring affective response, which could provide efficient, objective, and strong evidence.

### Managerial Implications

This study provides practical knowledge helping retailers in developing a visual design strategy for their stores. Retailers are required to offer a positive in-store experience to consumers by utilizing limited space and product assortment. In this study, we manipulated the degree of visual complexity by using different decorative patterns in the aesthetic perspective and different types of store layout in the functional perspective, while controlling the size of the virtual store, the assortment and numbers of products, and the furniture within the store. The use of decorative elements and compartmentalization must be considered during a store's visual merchandising process to construct its image and utilize space efficiently. As such, the findings of this study could serve as a reference for people on the ground who are engaged in designing a store.

According to this study's results, when decorative patterns are applied to the walls, floor, ceiling, and fixtures of a store and when environmental factors are freely arranged, consumers who enter the store perceive a high level of visual complexity. In contrast, when a store environment consists of a single color with no decorative patterns and when environmental elements are arranged in a fixed line, visual complexity perceived by consumers is low. It must be noted, though, that an excessively monotonous environment could make consumers lose interest and feel bored. Considering this, stores need to attract consumers' attention by using decorative patterns or provide appropriate visual complexity by arranging design elements freely, thereby drawing an arousal response from consumers and encouraging them to experience excitement and to focus on the shopping environment.

Furthermore, this study verified that consumers respond differently to visual complexity in a fashion store design depending on their level of fashion involvement. Those with little interest in fashion were found to have greater pleasure in a store with low visual complexity than in a store with high visual complexity. Fashion consumers with low involvement tend to primarily consider utilitarian attributes such as price or classical design for high usability to make a product purchase decision. In store selection, they also place emphasis on shopping convenience or diverse assortment to achieve their shopping goals (Sullivan, Kang, & Heitmeyer, 2012; Tigert, King, & Ring, 1980). Therefore, stores that mainly sell basic fashion products (i.e., low-trendiness) or stores with a large assortment that targets a wider range of consumers who are not especially involved with the product, should lower the visual complexity of the store design. By avoiding excessive use of decorative patterns and arranging environmental factors in a grid layout, retailers will be able to offer consumers a more efficient shopping experience.

For consumers with high fashion involvement, it was found that visual complexity in a store design does not negatively affect pleasure. As those consumers value trendiness, product design, and store atmosphere for hedonic shopping experience (Ballantine, Jack, & Parsons, 2010; Tigert et al., 1980), stores that sell highly trendy products or have a wider range of products with a small assortment should adopt aesthetic design and free arrangement to set up an environment that attracts consumer attention and offers a variety of information and enjoyment. Considering that fashion involvement is an essential element for establishing a marketing strategy targeting each consumer subgroup, this study's findings are expected to serve as a useful reference for those seeking to understand consumer response according to target consumers' characteristics and to develop an appropriate store strategy.

Sometimes complexity is preferred over simplicity, and there are many cases wherein the visual complexity provides attractiveness in and of itself. Norman (2011) proposed to distinguish between the terms *complexity* and *complicated*; *complicated* describes the state of mind including the meaning of confusion, whereas *complexity* describes the state of the world as a tool we deal with. In his work, *Living with Complexity*, Norman (2011) suggested that complexity is no longer confusing if it is understandable. This is consistent with the discussions of fluency studies in which aesthetic pleasure depends on the perceivers' processing dynamics (Reber et al., 2004). In the world of complexity, it will be an important challenge to designers to effectively handle the complexity on the basis of their understanding of target customers.

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