THE EFFECT OF TWO-COLOR COMBINATIONS ON CONSUMER PREFERENCE DIMENSIONS IN A RETAIL ENVIRONMENT

By

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To Chien-Chih Chao

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF TERMS

The following terms are used in this study are defined as follows:

COLOR APPEARANCE ATTRIBUTES	Hue, value, and saturation (chroma) are the three attributes for describing the color appearance. Hue is identified as the color name, such as red, blue, etc. Saturation, also known as chroma, is a measure of the purity or vividness of hue. Value is a measure of the lightness of hue (Portillo, 2009). The terms will be interchangeably used in the current study.
ADDITIVE COLOR MIXING	Additive describes color mixing with light which occurred in light-producing product, such as computer monitors. When combining color hues, the result is lighter and tends to white (Portillo, 2009).
SUBTRACTIVE COLOR MIXING	Subtractive describes color mixing to black which occurred in painting, textile, or printed output. When combining color hues, the result is darker and tends to black (Portillo, 2009).
COMPLEXITY	Complexity is one of the four information characteristics from Kaplan and Kaplan's preference theory. Complexity refers to the amount of visual information offered by an environment and has been considered to be a function of the number and variety of elements present (Berlyne, 1971).
COHERENCE	Coherence is one of the four information characteristics from Kaplan and Kaplan's preference theory. Coherence refers to "balance" and "symmetry" (Wertheimer, 1924), "coherence" (Koffka, 1935), "congruity" (Lauer, 1979), "unity" (Veryzer & Hutchinson, 1998) and "order" (Nasar, 2000). Unity is a more general principle referring to a congruity among the elements of a design while these elements looks like belonging together or there is some visual connection beyond (Veryzer & Hutchinson, 1998; Deng, 2010).
COLOR COMPLEXITY	Saturation (chroma) influences the perception of color complexity that colors with higher saturation are perceived more complex than low-saturated colors (Küller, 1972).
COLOR COHERENCE	Value influences the perception of color coherence that unequal value between colors reduces the harmony (Marshall, 1980). The higher the value of each color in a two-color combination, the more likely this two-color combination is perceived harmonious (Ou & Luo, 2006).
AROUSAL	Arousal refers to the degree of stimulation and excitement

caused by the environment (Donovan & Rossiter, 1982).

PLEASURE — Pleasure refers to the degree to which a person feels happy or satisfied in an environment (Donovan & Rossiter, 1982).

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Considering the lack of knowledge about the effects of two-color combinations within retail interiors, this study employed the Kaplan and Kaplan environmental preference framework to examine the effects of two-color combinations with two levels of complexity (simple versus complex) and coherence (coherent versus incoherent) in the regular and irregular pattern within a boutique store on consumer's color perceptions and preferences. Complementary hues (yellow/purple) with different value and saturation were manipulated to distinct different complexity and coherence levels.

The sample consisted of 153 participants between the ages of 18 and 30 recruited through the Behavior Research Lab at University of Florida. All participants were screened for color vision deficiency before participation in the study. A between-subjects analysis of variance (ANONA) was conducted to examine dependent variables (perception of complexity, coherence, color emotions, store image, arousal states, pleasure states, and preferences).

Both the quantitative and qualitative date revealed that the coherence characteristic perceived in the interior context plays a pivot role in color preferences. Due to the simultaneous contrast effect and instability of the yellow hue, the simple

(Simple/Coherent and Simple/Incoherent) color palette, appearing as a tonal, pastel complementary color combination, was perceived more coherent with the overall context especially the “high-end” store image of the boutique store and then was more preferred. Moreover, despite the lack of direct statistical supports, the irregular color pattern perceived as more coherent seems more preferred when compared to the regular pattern in the boutique store.

In additions, the highly contrasting complementary color combination that aroused more active and vibrant emotions was perceived as a less pleasing and less preferred color scheme, whereas the less contrasting complementary color combination that aroused moderate active and vibrant emotions was perceived as a more pleasing and more preferred color scheme in a retail boutique store.

The current study’s findings can help retailers and interior designers in establishing an ideal brand identity for high-end retail environment regarding their color choice but should not be followed blindly without considering thoroughly what consumers need in specific retail settings and the dimensionality issue when planning colors in an interior environment.

CHAPTER 1
INTRODUCTION

Background

The effects of colors on human had been widely studied by many researchers from different domains that colors had certain impact on people's physiological, psychological, emotional and cultural responses. For instance, exposure to different colored stimulus could lead to variations of human performance from physiological responses (i.e. frequency of eye blinks and finger rhythmic movement) to productivity (i.e. word typed, ratio of error) at work (Kwallek, Soon, & Lewis, 2007). The emotional response toward different colored stimulus also varied. Red had been associated with active, strong, passionate, warm, and conversely aggressive emotions; green had been associated with relaxing, refreshing and quiet emotions (Mahnke, 1996; Davey, 1998; Saito, 1999). Furthermore, the relationship between color and emotions closely tie to color preferences (Kaya & Epps, 2004).

Many studies regarding color from the marketing field had also been done but most of them focus on the perspectives of advertising, graphic and packaging design. Though color within shopping environments had been examined having influences on retail shoppers' preference, emotional states, perception of store image, purchasing rate, time spent in the store, and retail display attraction (Bellizzi, Crowley, & Hasty, 1983; Bellizzi & Hite, 1992; Crowley, 1993),color-related research regarding retail environment design aspect is limited. Most of the existing color-related studies compared the effects on people's preferences between single-color application interior spaces. Bellizzi et al. (1983) compared people's preference on five different (hue) color interior settings. Each experiment group from his study exposed to one single-color application interior.

Brengman (2004) conduced an 8 (hue) by 2 (saturation) by 2 (value) design through applying a total of 32 different color conditions to an experimental store environment. Although the variation of color in hue, saturation and value were taken into account in this study, each experiment group from this study still only exposed to a single-color application interior.

The result of previous color studies increased the body of knowledge and reinforced the effects of color in interior spaces, but the contribution of these studies on preference for single color could barely be helpful in a practical way to interior designers for shaping color planning, because colors were always presented together with other colors and never seen in isolation in our daily life from natural surroundings to interiors (Ou & Luo, 2004). In fact, colors placed in relation to one another could interact with each other and create illusions (Smith, 2008). Smith (2008) stated that “color interaction in three dimensional spaces such as buildings and interiors, takes on an additional meaning as the impact on aspects such as volume, mass and scale; mood and atmosphere; journey and narrative for the occupants of the spaces” (Smith, 2008, p. 313). In an actual retail environment, there are many different colors from the logo, in-store advertisement, merchandise and display fixtures, and people often perceptibly or imperceptibly evaluate the harmony of colors (Shen & Chen, 1996). Therefore, it is barely adequate to generalize findings on single color in the world, which is full of color combinations (Ou & Luo, 2004). However, effects of color combinations on preference had not been studied as broadly and intensively as single colors (Camgöz, Yener, & Güvenç, 2002). None of them had studied effects of color combinations on preference within a retail environment.

Over the past three decades, some researchers from interior design domain introduced the Kaplan and Kaplan environmental preference from studies of natural landscape and urban planning in interior environmental preference research. For example, Suzanne Scott (1989, 1992, & 1993) led the trend and examined the relationship between different visual attributes and preference in different types of interior environment by using black and white slides as stimuli in her serial studies. Later, Ham, Guerin, and Scott (2004) extended the study framework and replicated the black and white slides from previous research to the cross-cultural study on preference in Interior environments. Although the effects of color application were generally acknowledged for interior environments, colors were excluded from previous environmental preference research. Therefore, this study also introduced the Kaplan and Kaplan environmental preference theory as the study framework and concentrated on the effects of two-color combinations within an interior space so as to make an effort to fill the gap between existing literatures and increase the body of knowledge regarding two-color combinations within interior design domain.

Research Aim & Questions

Considering the lack of empirical studies, this study focused on understanding the effects of different two-color combinations on consumer color perceptions and preferences in a high-end retail environment. The specific objectives of the current study were to investigate the effects of four two-color combinations selected regarding the interaction of two different levels of complexity (simple versus complex) and coherence (coherent versus incoherent) on individual perceptions of complexity, coherence, color emotions, store image, emotional states (arousal and pleasure) and color preferences.

The four two-color combinations were the Simple/Coherent color combination (SC), Simple/Incoherent color combination (SI), Complex/Coherent color combination (CC), and Complex/Incoherent color combination (CI). Different color appearance attributes were used in order to manipulate the different complexity and coherence levels. Complementary hues (yellow and purple) were manipulated among the four combinations based on Munsell color harmony principles. Saturation (chroma) was manipulated for color complexity, since colors with higher saturation are perceived more complex than low-saturated colors (Acking & Kuller, 1972; Valdez & Mehrabian, 1994). Value was manipulated for color coherence, since colors with higher and equal were perceived more coherent than the colors with lower and unequal value (Marshall, 1980; Ou & Luo, 2006).

The level of complexity and coherence was identified as design attributes related to individual perceptions in the retail environments and as the predictors of color preferences. If these attributes (the level of complexity and coherence) contributing to individual color preferences in the high-end retail environment and the features of two-color combinations contributing to different level of complexity and coherence can be identified, interior designer should be able to use the knowledge to develop and design this type of retail environments more appealing to consumers.

In additions, color appearance attributes have been associated with different color emotions (Hogg, 1969; Hogg, Goodman, Porter, Mikellides, & Preddy, 1979; Ou & Luo, 2004; Kaya & Epps, 2004). Therefore, color emotions were also measured to see how different color appearance attributes of the four two-color combinations associated with individual perceptions of color emotions in a high-end retail environment.

Color (single color) was identified affecting individual emotional states in retail environments (Bellizzi & Hite, 1992; Crowley, 1993; Babin, Hardesty, & Suter, 2003; Kaltcheva & Weitz, 2006). Emotional states were the amount of pleasure and arousal that individuals experienced within a retail environment (Donovan & Rossiter, 1982, 1994). Both states of pleasure and arousal were measured to see how the four different two-color combinations affected individual emotional states and generated preference in a high-end retail environment.

Also, color had been identified as influencing store atmosphere by distinguishing retail brands in retail environments (Alawadhi, 2009). Hence, store images were measured to see how the four different two-color combinations affected individual perceptions of store images in a high-end retail environment. Furthermore, the four two-color combinations were applied into two different patterns (regular versus irregular) in a high-end retail boutique store to understand individual color perceptions and preferences when two-color combinations are applied into a different pattern.

To accomplish the purposes of this study, the specific research questions are as follows:

In a high-end retail environment,

1. What are the color appearance attributes of two-color combinations contributing to different levels of complexity?
2. What are the color appearance attributes of two-color combinations contributing to different levels of coherence?
3. How do two-color combinations with two different levels of complexity and coherence affect individual perceptions of color emotions?
4. How do two-color combinations with two different levels of complexity and coherence affect individual perceptions of store image?

5. How do two-color combinations with two different levels of complexity and coherence affect individual arousal state?

6. How do two-color combinations with two different levels of complexity and coherence affect individual pleasure state?

7. How do two-color combinations with two different levels of complexity and coherence affect individual color preferences?

8. How do the four two-color combinations in different patterns (regular versus irregular) affect individual perceptions and color preferences differently?

CHAPTER 2
LITERATURE REVIEW

In Chapter 2, literature was reviewed in the following three relevant topics: 1) color combinations 2) color application in retail store design 3) environmental preference. The study framework has been developed and presented to guide the current study in the end of Chapter 2.

Color Combinations

Color is a broad and complex research field involving visible radiation, color sensation to color psychology, etc (Sharp, 1974; Gao, 2007). To keep consistency in describing the quality of color among different color research, several color systems had been developed for exploring systemic rules regarding different color issues. The Munsell Color System, as one of the most common color systems in color research (Kaya & Epps, 2004; Kaya & Crosby, 2006; Kwallek et al., 2007), was proposed by Albert Munsell in 1905. He (1905) proposed a color system by using three color qualities (hue, value, and chroma), each graded in equal perceptual intervals, to describe his color order system for standardizing pigment specification. “Hue” is identified as the color name, such as red, yellow, blue. “Value” is a measure of the lightness of a color. Saturation, also called "chroma”, is a measure of the purity or vividness of hue. They were also known as the three color appearance attributes.
In the Munsell color system, the interrelation of color attributes was described in terms of tint, shade, and tone. Adding white to a hue creates a “tint” (a lighter value of the hue), whereas mixing black to a hue creates a “shade” (a darker value of the hue).Therefore, light colors are sometimes called tints, and dark colors shades. Adding gray to a hue or mixing the hue with its complementary color creates a “tone” which

corresponds to the chroma dimension of color. A hue with high chroma (saturation) color looks pure and vivid. When a hue was toned, it looks grayish and dull.

The Munsell color system had been widely used in color research. However, Kuehni (2003) pointed out that the Munsell Color System is not a uniform color system since the units of the hue, value and chroma are not identical in perceived magnitude (Gao, 2007). Therefore, the CIELab color space, as one of the most uniform color system, was recently used in many color researchers (Chen & Shen, 1996; Ou & Luo, 2004, 2006, 2010, & 2012; Deng, 2010). CIELab color model was proposed in 1976 by the Commission International I'Eclairage (CIE) based on Hurvich and Jameson's (1957) opponent theory of color processing. They claimed that brain will transform color information into a red–green system, a yellow–blue system, and a lightness system. In the CIELab system, colors are represented by three orthogonal dimensions (L*, a*, b*). L* represents the difference between light (where L*=100) and dark (where L*=0). A* represents the difference between red (+a*) and green (-a*); b* represents the difference between yellow (+b*) and blue (-b*).

Some color research involving manipulations of color appearance attributes in the study stimuli preferred the HSV (Hue, saturation, value) color space, known as HSB (Hue, saturation, brightness), in the additive system of computer monitors (Camgo, Yener, & Guvenc, 2001; Cubukcu & Kahraman, 2008). Camgo et al. (2001) studied the effect of three color attributes (hue, value, saturation) respectively on preference by presenting the color stimuli generated from the HSB color space on computer monitors. Cubukcu and Kahraman (2008) presented manipulated photographs of a building exterior on computer monitors as the study stimuli to examine the effect of three

attributes of color (hue, value, and saturation) generated from the HSV color space on preferences. In the HSV color space, color is represented by a set of three numbers representing hue, saturation, and value. Hue values vary from 0° to 360°. Saturation is measured as a percentage from 0% (white) to 100% (fully saturated color). Value is measured as percentage from 0% (black) to 100% (fully bright color) (Cubukcu & Kahraman, 2008).

Colors always work together and appear as interrelated visual sensations in reality (Gao, 2007). Therefore, how colors works together, and how they interact with each other, particularly how they harmonize with each other as a combination have interested many researchers over centuries (Munsell, 1921; Moon & Spencer, 1944a; Shen & Chen, 1996; Burchett, 2002; Ou & Luo, 2006; Gao, 2007). In the early color harmony studies, definitions of color harmony are diverse (Ou & Luo, 2006; Gao, 2007). However, a number of principles seem to be shared in common regarding the three color attributes (Ou & Luo, 2006). First, colors can harmonize if they share the same hue (Munsell, 1921; Moon & Spencer, 1944a). Second, colors can harmonize if they share the same saturation (chroma) (Munsell, 1921; Moon & Spencer, 1944a). Third, colors can harmonize if they are complementary in hue (Munsell, 1921; Moon & Spencer, 1944a; Itten, 1970; Nemcsics, 1980).

Among the conventional studies, Munsell (1921) proposed that harmony can be created by complementary colors with the same value and the same chroma or by the colors with the same hue and same chroma. In the early traditional color scheme, such as Artist's wheel, the complementary (paint-complementary) colors defined as two hues located opposite to each other in a two-dimensional color wheel. For instance, yellow

and red–blue are defined as complementary colors, since yellow is opposite to red–blue on the color circle (Portillo, 2009). Munsell's color harmony principles have been used in many studies (Granger, 1956; Nayatani, 1967, 1969) to derive qualitative rules for color harmony. However, the results were found inconsistent (Gao, 2007). Granger (1956) claimed that complementary colors are more harmonious. However, Nayatani (1967, 1969) argued that the color pairs with similar hue are more harmonious. Ou and Luo (2006) examined individual perceptions of color harmony toward two-color combinations in the CIELab color space. They compared the findings with conventional color harmony principles and argued that two-color combinations with similar hue are more harmonious than two-color combinations with contrastive hue. The contrastive hue referred to the "perceptual-complementary" colors (red-green and yellow-blue) in the CIELab color space. The relationships of colors are defined by the distance in the color space where contrastive (complementary) colors are located far away from each other in the color space. In short, these studies not only displayed a wide disagreement over the definition of color harmony regarding complementary colors but also revealed a complexity within color research that may result from the diversity of color systems.

Therefore, instead of exploring systemic rules of color harmony in color systems, some other researchers studied the perceptions of "color harmony" and its relationship with individual color combination "preference". Judd & Wyszecki (1975) stated that when two or more colors seen in neighboring areas produce a pleasing effect, they are said to produce a color harmony. Granville (1987) also described color harmony as the "color usage that pleases people" Later, Burchett (2002) gave a similar definition of color harmony with Judd and Granville (1975) that when two or more colors are brought

together to produce a satisfying affective response, they are said to be harmonized. Furthermore, color harmony was defined as a matter of likes and dislikes (Judd & Wyszecki, 1975). Ou and Luo (2006) adopted “pleasing effect’ as the operational definition of color harmony in the study of color harmony on two-color combinations.

In Gao’s (2007) color harmony research, he reviewed literature on color harmony and concluded that there is a strong correlation between color harmony and color combination preferences. Color harmony is not the only one relationship among color combinations related to preference. Deng (2010) indicated that similarity is the most basic relationship among colors relating to color combination preferences. According to the Gestalt theories of figural goodness (Wertheimer, 1924), a “good” figure should be “similar”, “balanced” and ”symmetrical” to each other. A “good” figure can be easily perceived as a “coherent” object (Koffka, 1935). “Unity” is also related to the idea of good figure (Veryzer & Hutchinson, 1998). “Unity" can refer to a “congruity” among the elements of a design which makes the elements of a design belong together (Lauer, 1979). Unity can be achieved through visual matching of design components which increase aesthetic preference (Deng, 2010). Nasar (2000) stated that coherence is related to the order of an environment. According to Gao (2007), “order” is recognized as the main principle of color harmony in prior Ostwald’s (Birren, 1969b) and Itten’s (1970) conventional color harmony principles. Besides, Munsell (1921) identified “balance” as key to creating color harmony (Ou & Luo, 2006). These literatures lead to a conclusion that the similarity of colors can refer to the “balance” and “symmetry” (Wertheimer, 1924), “coherence” (Koffka, 1935), “congruity” (Lauer, 1979), “unity” (Veryzer & Hutchinson, 1998) and “order” (Nasar, 2000) of colors and the qualitative

rules for color harmony, since they all related to the perception of “goodness” (preference).

Another perspective of color relationship associated with preference is complexity. According to Berlyne's theory of aesthetic response (1974), preference is determined by the arousal potential of a stimulus. Arousal denotes the degree to which individuals feel stimulated, excited, or active. Arousal increases linearly when increasing the complexity of stimuli (Berlyne, 1960; Mehrabian & Russell, 1974). Berlyne (1974) pointed out that viewers' pleasure in response to an object increase with increased complexity, to an optimal level. After that, with increased complexity, pleasure begins to decline. In other words, when increasing the complexity of stimuli linearly, the responses will show an inverted U-shaped curve for pleasure. That is to say, the optimal arousal potential occurs at moderate levels of arousal.

Küller (1993) examined the effects of interior color in terms of visual complexity by creating two experimental rooms. One room was full of colors and patterns to represent an ambient surrounding with high visual complexity, whereas another room was colored in monochromatic grey to represent an environment with low visual complexity. Küller’s findings align with Berlyne’s theory that the high contrast and gray rooms were both perceived as somewhat unpleasant, closed, and original in character (Küller, 1993). They only differed significantly in terms of complexity and unity (coherence). Furthermore, the semantic scales used in the Küller’s experiments (1993) were employed to study almost 100 colored varieties of the same room presented either as color slides of sketches or as full scale mock-ups in his early study with Acking (Acking & Küller, 1972). They (1972) found that the higher the chromaticity of the interior walls,

the higher the perceived complexity of the room, inversely, the lower the perceived unity (coherence) of the room (Acking & Küller, 1972). The results indicated that the variation of hue and saturation can determine viewers' evaluation toward visual complexity and coherence. Beside, Valdez and Mehrabian (1994) investigated the effects of color hue, saturation, and value on individual emotional reactions by Mehrabian and Russell's pleasure-arousal-dominance (PAD) scales through the color swatches generated in the Munsell color system. They (1994) found that arousal increased linearly strongly with color saturation. According to Berlyne's theory of aesthetic response (1974), arousal increases linearly when increasing the complexity of stimuli. That is to say, the complexity of stimuli should increase when increasing the color saturation of stimuli (Kaltcheva & Weitz, 2006). However, though existing research depicted the relationship between saturation and complexity of single color stimuli, none of them was about color combinations.

In addition, many researchers had examined the relationship between the color appearance attributes of color combination and color combination preferences on color swatches or small objects in order to explain why some color pairs are preferred and some are not (Camgöz, et al., 2002; Schloss & Palmer, 2011; Deng 2010). Camgöz and his colleagues (2002) investigated the preference on the combinations of foreground-background colors on color swatches selected from the HSB color space. Eight background colors selected from HSV color space on which color squares of differing hues, saturations levels, and value levels were presented. They found that colors having maximum saturation and value were most preferred and suggest that increasing of saturation and value levels leads to an increased pleasantness.

Ou and Luo (2006) studied color harmony for two-color combination on color swatches selected from the CIELab color space. According to the experimental results, they indicated that people tend to feel pleasant when seeing two colors with same hues combined together and two colors with higher value combined together.

Schloss and Palmer (2011) examined preference for the color pair, harmony of the color pair, and preference for figural colors against colored backgrounds on color swatches selected from the CIELab color space. They found that color pair preference and harmony both increase as hue similarity increases, but preference relied more strongly on value contrast. Moreover, the color pairs with highly contrastive hues are generally judged to be neither preferable nor harmonious. They indicated that though the definition of “contrasting” refers to the perceptual complementary colors (red-green and yellow-blue) in the CIELab color space, the results showed there is little evidence of preference for contrastive hue combinations using the paint-complementary colors: yellow-purple, blue-orange, and red-green in the Artist wheel.

Deng (2010) adopted the visual coherent and complexity perspectives and interpreted them to the CIELab color space for studying preference on color combination through a product self-design task. He assumed what is chosen to apply on the product is what is most preferred by people. Two “identical matches” colors, the same point in the color space or two distinct, but closely related colors (very close in the color space) should be preferred based on the concept of unity and similarity or two distinct colors “moderately” distant from each other in the color space based on the concept of moderated information rate should be preferred. The contrastive colors (i.e., maximally separated in the color space, such as red and green) should not be most

preferred, since they were in opposition to the visual coherence perspective. The results confirmed his assumptions that people generally combined colors that were relatively close or exactly match; colors of the same value that differ greatly in hue or saturation (e.g. contrastive colors) were seldom combined.

In addition, many color researchers had examined the relationship between color emotion and color preference on the basis of color attributes, such as hue, value, and chroma. They usually ask their study participants to list or rate colors with certain pairs of adjectives so as to define meanings, reflection of color, and preference. The word pair is known as the color-emotion scale. Hogg et al. (1979) studied color emotions for simulated interior spaces by using color samples from the Munsell color system. They classified 12 color-emotion scales and identified the following five factors: dynamism (obtrusiveness), spatial quality, emotional tone, complexity (usualness), and evaluation (preference) on a basis of the three color attributes. They found that dynamism and emotional tone are associated with chroma and hue, respectively; the spatial quality and complexity are associated with value. However, the evaluation of preference on the pleasant-unpleasant scale was not found in connection with any of hue, value and saturation. The results reflected the determinants of evaluative judgments (preference) are more complex and independent of the basic color attributes (Hogg et al., 1979).

Ou and Luo (2004) conducted two studies of color emotion and preference for single and two-color combinations using color swatches. Based on previous color emotion research, they classified the color emotion responses into the three color appearance attributes based on their study results of single color study. For instance, hue is corresponding to the warm/cool response, value is corresponding to the

heavy/light response, and saturation is corresponding to the active/passive response. The results of the two-color combination study revealed an additive relationship between single-color and two color-combination emotions which can predict color emotions for two-color combination by averaging the color emotions of single colors. However, this relationship does not apply to the color preference on like-dislike scale. Moreover, regarding color preferences, the results aligned with prior studies (Hogg, 1969; 1979) reflecting that neither single colors nor two-color combinations preferences was found associated with color attributes. These findings implied that color preference for two-color combinations has some qualities completely different from those for other color emotions.

Instead of investigating the relationship between color attributes, color emotions and preferences, color symbolism was found affecting how individuals associate colors with things, objects or physical space and further their preference. Kaya and Epps (2004) examined college students' color-emotion associations by using color samples from the Munsell color system. Particular colors have been found associated with positive feelings and highly preferred. One of their findings is that the color "yellow" (7.5Y 9/10) was generally seen to be energetic and elicited positive emotions including happiness and excitement, because it was associated with the sun and summer time (Kaya & Epps, 2004). The result suggested that though color had a strong impact on our emotions and feelings, color preferences are associated with whether a color evokes positive or negative feelings which are dependent on personal preference and individual past experience with the particular color (Kaya & Epps, 2004). In sum, either

single colors or color combinations preferences involve more complex determinants than the relationships between other color emotions and basic color attributes.

Color Application in Retail Store Design

Retail store design involves many different design concepts including space planning, decoration, graphic design, ergonomics, and advertising to conceptualize and construct the retail space associated with the creation of store atmosphere and the perception of brand (Alawadhi, 2009). Store atmosphere can be created through many in-store environmental elements, such as lighting, music, and scent in a store, and color is identified as one of these elements having store atmosphere creating power for retail environments to develop a distinguished retail brand (Alawadhi, 2009; Bellizzi et al., 1983; Bellizzi & Hite, 1992; Baker, 1992; Crowley, 1993).

To investigate the impact of different psychical in-store environmental element on consumer in the retail environments, the Mehrabian and Russell (1974) model had been broadly adopted in many studies (Alawadhi, 2009; Bellizzi & Hite, 1992; Baker, 1992; Crowley, 1993; Donovan & Rossiter, 1982; Donovan et al., 1994; Kaltcheva & Weitz; 2006; Park & Farr, 2007; Park et al., 2010). Mehrabian and Russell (1974) (as known the M-R model) proposed a model of stimulus–organism–response (S–O– R) to study viewer's behavior responses toward the stimulus within an environment. This model demonstrates that individual emotional state (O) is the median between the physical environment (S) and human behavior (R). The information rate of stimuli within the physical environment refers to the amount of information in an environment including visual stimuli of value, saturation, color hues, texture, shapes, sizes, and the composition of those elements. The amount of information directly correlates with the

arousal level (the amount of pleasure, arousal and dominance) and leads to behavioral responses (approach or avoidance behavior) toward the stimuli.

In order to investigate the impact of colors on consumer in the retail environments, Bellizzi et al. (1983) studied effect of five individual color hues in an interior furniture store. The study participants were shown life-size photographic of the store in five experimental colors projected on the screen. The results suggested that cool-colored (blue and green) store environments are preferred over warm-colored (red, orange and yellow) store environments, but the warm colors, particularly yellow in color have the power physically drawn participants to the experimental wall within the interior furniture stores. Although Bellizzi et al. (1983) didn't apply the M-R model in their studies, the findings support Mehrabian and Russell's theory that color hue can not only affect consumer preferences but also psychically attract shopper to a retail display. Later, the M-R model had also been applied in some color research for studying the impact of color on consumer preference and behavior in a retail environment (Babin et al., 2003; Bellizzi & Hite, 1992). Bellizzi and Hite (1992) compared the effects of red and blue in a retail related context by showing the life-size photographic of the simulated interior furniture stores in predominately red or blue projected on screen. They found that a blue hue background can decrease the likelihood of postponing purchase compared to a red hue background. Babin et al. (2003) examined how color perceptions, alone and in combination with store lighting, influence patronage intentions for fashion-oriented stores through a two (color: orange versus blue) by two (lighting: bright versus soft) by two (item price: low versus high) study design. The study participants were asked to read the scenario with a detailed description of a hypothetical fashionable retail clothing

store. The results suggested that blue interiors are more preferred associated with greater excitement, higher store patronage intentions and purchase intentions than the orange interiors. Both studies have suggested a positive relationship between pleasure and preference.

These color studies related to the M-R model only examined different color hues respectively. None of them takes the other two attributes of color (value and saturation) in to consideration until Kaltcheva and Weitz (2006) referring the studies of visual complexity (Berlyne, 1974; Valdez & Mehrabian,1994) used different levels of color saturation, color warmth, and complexity of store layout for the manipulations of arousal levels within the stimulus shopping environment to investigate the relationships of consumer's motivational orientations and the emotional responses within a store environment on the M-R model. The study participants were shown a picture of a retail store ambience on individual computer screens and to imagine visiting the store with a task-oriented or recreational motivation. Their study findings showed that when consumers have a recreational motivational orientation, high arousal has a positive effect on pleasantness; whereas when consumers have a task-oriented motivational orientation, high arousal decreases pleasantness. This research indicates that the level of excitement (arousal) retailers should create in their stores based on the shopping motivation of their customers. For instance, it was suggested that a grocery store with more task-oriented customers should have less store design with less saturated cooler colors; a sporting-goods retail store with more recreational-oriented customers should have more complex layout with warm and highly saturated colors throughout the store. However, due to the study design, the effects of color could not be segmented from the

study findings. Moreover, like the prior color studies (Bellizzi & Hite, 1992; Babin et al., 2003; Valdez & Mehrabian, 2004), they only examined different color attributes with "single" colors. Therefore, the impact of colors combinations on consumer in the retail environments hasn't been revealed yet.

Color can create the store atmosphere for developing a distinguished retail brand in retail environments (Alawadhi, 2009). In other words, the atmosphere within a retail environment is strongly associated with the brand. Hence, the application of colors in stores should be emphasized on the brand's own identity instead of using a neutral color scheme (Floor, 2006), since colors can evoke emotion, express personality, influence the mood and the behavior of customers, and stimulate brand (Wheeler, 2006). Interesting enough, the effect of store atmospheres were found varying toward different types of product and store. Store atmospheres influenced the perceptions of social identity products, such as clothing but had little effect on the perceptions of utilitarian products (Schlosser, 1998). The atmosphere around a luxurious brand is more successful in attracting consumers (Schlosser, 2001). That is, it's more effective to create store atmosphere around the branding especially for a high-end retailing apparel store to attract consumers than a promotional-oriented utilitarian products store.

For establishing an ideal store atmosphere, colors applications should be developed based the type of brand identity related to the psychological color studies. The color images and responses from previous color research were systematically collected by Kobayashi and the Nippon Color and Design Research Institute in 1990. Colors were classified by their image toward different target market for design purpose in this book. They developed over 180 adjectives correlating to individual colors (total of

120 chromatic colors and 10 achromatic colors). From designer's aspect, the findings on color images are beneficial, since designers can follow these principles to select colors with appropriate adjective to reflect the store atmosphere based on the targeted market they want to appeal. In the Kobayashi's color image scale book, the colors with young flamboyant, merry, enjoyable and vivid image are associated with young, student market; yellow, especially yellow with bright tone, is particularly associated with youthful (Kobayashi, 1990). However, although the color image may suggest color scheme for distinguishing a desired brand and store atmosphere of interior design to target and appeal a specific type of market, the color palette was developing in two dimensions (color swatches) rather than in an environmental context. Portillo (2009) discussed the issues of color planning for interiors with different case studies in designed spaces. She indicated that colors are actually planned with the consideration of compositional quality by noted colorists. Applying the color palette to actual three-dimensional spaces is a complicated and challenging task. The interaction of lighting, materials, and form on color placement, viewing distance, scale, and proportion may influence the interpretation of color image.

Environmental Preference

In environmental psychology, the Kaplan and Kaplan's environmental preference theory is originally developed for explaining why people approach and interact with some natural environments, but fail to approach and interact (i.e. avoid) with other environments in the landscape domain (Kaplan & Kaplan, 1982). Complexity, coherence, mystery, and legibility are the four informational variables which are combined to influence people's preference for certain types of landscapes (Kaplan & Kaplan, 1982). Complexity refers to the amount of visual information offered by an

environment (Berlyne, 1971); coherence refers to the visual information offered by the environment unified by symmetry, repeating elements and unifying textures that contribute to a “good gestalt” (Kaplan & Kaplan, 1982). Mystery refers to the promise of new information if one could travel deeper into the environment relative to the presence of hidden information within a scene (Kaplan & Kaplan, 1982; Kent, 1989); legibility refers to being able to predict and to maintain orientation throughout the environment (Kaplan & Kaplan, 1982).

The different responses are dependent on the satisfaction of people’s two basic needs to understand and to explore, when they interact with an environment. People can either use information in the environment that is allowed immediately perceived or use information in the environment to make inferences so as to achieve these basic needs. The two motivations (understanding and exploration) for approaching and interacting with an environment, and the two approaches (immediate and inferred) to processing information in that environment combined to determine the type of information that is most diagnostic for making an approach/avoidance decision. Kaplan and Kaplan (1982) proposed that certain information characteristics within the environments will support a certain type of understanding or exploration (immediate or inferred) Then, they drew a two (understanding and exploration) by two (immediate and inferred) matrix. There are a total four categories of environments with different information characteristics shown in Figure 2.1.

For instance, environments with more coherence will allow for immediate understanding (belong to the immediate understanding category) while environments with more complexity will allow for immediate exploration (belong to the immediate

exploration category). Environments with more legibility will allow for inferred understanding (belong to the inferred understanding category) while environments with more mystery will allow for inferred exploration (belong to the inferred exploration category). Coherence, complexity, legibility and mystery present the four environmental preferences with different information characteristics.

	Understanding	Exploration
Immediate	**Coherence** Orderly, unified, repeated elements, regions	**Complexity** Richness, intricate elements
Inferred	**Legibility** Finding one's way there and back	**Mystery** Promise of new but related information

Figure 2-1. Kaplan and Kaplan environmental preference matrix

The theoretical framework and empirical findings in the field of landscape and urban planning has been broadly and intensively referred for investigating the effects of visual attributes and information characteristics within a specific built environment (i.e. a piece of architecture, façade) regarding certain aspects. For instance, Kent (1989) investigated whether mystery is related to preference for scenes of shopping mall environments. A moderately high positive correlation between mystery and preference was obtained. The results confirmed that mystery is a useful predictor of preference in built environments. Ikemi (2005) examined the effects of mystery on residential facades. It was found that mystery enhances rated preference for residential facades. The results

reinforced that the information characteristics for landscape preference can also be the predictors of preference in built environments.

Scott (1989, 1992 & 1993) first applied the Kaplan and Kaplan environmental preference to her series research regarding interior preferences. She examined complexity and mystery as predictors of interior preferences within commonly encountered public, institutional, and commercial interiors. Her findings confirmed that the theoretical perspectives of landscape preference are relevant to interior setting. In order to eliminate the potential of eliciting negative responses to distorted color rendition, she only used black and white interior scenes as the study stimuli. Later, Ham, Guerin, and Scott (2004) replicated the black and white slides from previous research to the cross-cultural study on preference in interior environments. Unfortunately, the effects of color, as the visual stimulus contributing to the information rate within a physical environment, on interior preferences haven't been revealed yet. None of these studies was conducted in retail environments. Until, Giboa and Rafaeli (2003) studied individual emotion response and approach behavior by applying two environmental aesthetics including complexity and order in the retail environments. They used complexity and order as predictor of the three emotional dimensions in the M-R model. The emotional responses were found mediating an inverted-U relationship between complexity and approach behavior tendencies; order had a positive correlation with approach behavior tendencies. Moreover, the results showed that the complexity and coherence attributes for landscape preference can also be the predictors of interior preferences in the retail environments.

From retailer's perspective, the purpose of a retail space is selling. To achieve this goal, the displays within a retailing environment should contain elements that are easily understood. Complexity and coherence are the two information characteristics satisfied "immediate" understanding or exploration needs of consumers and predicted preference (Kaplan & Kaplan, 1987). Besides, Giboa and Rafaeli (2003) have suggested the importance of examining complexity and order (coherence) as the predictors of consumer's approach-avoidance behavior tendency in the contents of retail environments. Complexity is considered as distinct information attributes enhancing preference by stimulating or motivating one to explore the environment (Ikemi, 2005). Coherence or order is conceptualized to be as distinct information attributes enhancing preference by making the environment easier to comprehend and reducing the uncertainly posed by its complexity (Kaplan & Kaplan, 1982). Berlyne (1971) suggested that order has an effect above and that of complexity on external environment. That it, applying order to a complex configuration created different effects from those brought about by complexity alone. He reported that when order was added to a set of stimuli with a low level of complexity, the interest level decreased. In contrast, when order was added to stimuli with high complexity the effects were positive. Interest can be defined as emotional state that represents the perception of complexity (Silvia, 2005a & 2005b). Therefore, when applying order to a set of stimuli with a low level of complexity, the perception of complexity decreased. In contrast, when applying order to a set of stimuli with high complexity, the perception of complexity increased.

Ulrich (1977) indicated that people's preference for higher level of complexity depends upon whether the information is ordered or unordered, because the unordered

complex setting are too difficult to comprehend, that is, complexity provides visual richness, while order structures this diversity and reduces the uncertainty of the scene (Nasar, 2000). Conversely, when “ambiguity” introduced by disorder within an environment, it may make boring setting more interesting to people (Findlay & Field, 1982). In short, these findings suggested that coherence may affect the overall complexity of an interior scene (Scott, 1993).

Donderi (2006) and Pieters (2010) also stated the similar ideas about the impacts of order on design complexity. The following are the several conclusions drawn by Pieters: design complexity is greater (1) when the objects are dissimilar rather than similar in shapes, textures, orientations, or colors, (2) when the objects form asymmetric rather than symmetric arrangements, (3) when the objects form an irregular rather than a regular pattern. That is, a dissimilar, asymmetric, and irregular pattern arrangement within a design may increase the perception of design complexity.

The Study Framework

Guided by the Kaplan and Kaplan environmental preference framework, this study examines the effects of two-color combinations with two different levels of complexity (simple versus complex) and coherence (coherent versus incoherent) in a boutique store on consumer preference dimensions. According to Schlosser (1998 & 2001), the effect of store atmospheres varied toward different types of product and store. Moreover, it was found more effective to create store atmosphere around the branding especially for a high-end retailing apparel store to attract consumers than a promotional-oriented utilitarian products store (Schlosser, 1998 & 2001). Therefore, the current study applied the different two-color combinations within a boutique store as the study stimuli.

In this study, instead of studying all four information characteristics from Kaplan and Kaplan, only complexity and coherence regarding two-color combination were examined due to the interest of interplay effect between complexity and coherence within a high-end retail environment. Besides, Giboa and Rafaeli (2003) have suggested the importance of examining complexity and coherence as the predictors of consumer behaviors within retail environments. The two different levels of complexity and coherence regarding two-color combination formed a total of four different two-color combinations including the Simple/Coherent (SC) , Simple/Incoherent (SI) , Complex/Coherent (CC) , and Complex/Incoherent (CI) color combinations in this study.

According to previous literature review, the level of visual complexity regarding single colors is associated with the purity or vividness of color (saturation) (Acking & Küller; Valdez & Mehrabian, 1994). Although none of existing color research elaborated the relationship between color attributes and perception of complexity regarding color combinations, it was suggested averaging the color emotions of single colors can predict color emotions for two-color combination (Ou & Luo, 2004). In color emotion research (Hogg et al., 1979), “complexity” was identified as one of five emotion factors including the simple/complex emotion scale. The literature suggested a link between saturation and complexity regarding color combinations. Coherence, referring to the “similarity”, “balance” and “symmetry” (Wertheimer, 1924), “coherence” (Koffka, 1935), “congruity” (Lauer, 1979), “unity” (Veryzer & Hutchinson, 1998), “order” (Nasar, 2000), is similar to color harmony and related to the perception of “goodness” and preference regarding color combinations.

The perceptions of color harmony are associated with variations of three color attributes. According to Munsell color harmony principles, harmony can be created by complementary color hues with the same value and the same saturation. Moreover, value is especially associated with the perceptions of color harmony. “Colors fall into a natural order, just as musical notes. If a color is lighted or darkened so as to be out of its natural order of tone, then used in combination, the resulting scheme will be discordant” (Marshall,1980, p. 234). Besides, the higher the value of each color in a two-color combination, the more likely this two-color combination is perceived harmonious (Ou & Luo, 2006). These literature showed a strong link between value and coherence regarding color combinations. To control the two different levels of complexity and coherence in the four two-color combinations, different color attributes associated with the perceptions of complexity and coherence respectively were manipulated. Saturation was manipulated for different two levels of complexity. All the four two-color combinations were applied into two different patterns (regular versus irregular) due to the interplay effects between coherence and complexity (Berlyne, 1971; Donderi, 2006; Pieters, 2010; Rafaeli, 2003). Therefore, a total of eight conditions were examined as the stimuli in the current study framework.

The Mehrabian and Russell (1974) model were also integrated in the current study model as the theoretical base to examine the effects of two different levels of color complexity and coherence on emotional states including pleasure and arousal. Mehrabian and Russell (1974) suggested a stimulus–organism–response (S–O– R) model for studying viewer’s emotional and behavior responses toward the stimulus within an environment (Figure 2-2).

Mehrabian and Russell Model

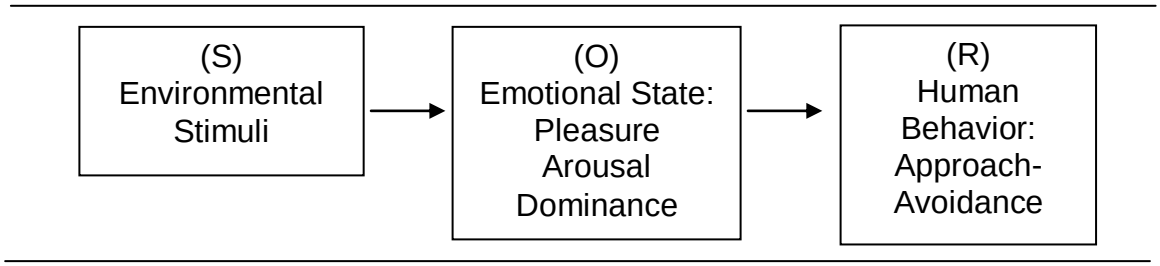


Figure 2-2. Outline of the M-R Model (Mehrabian & Russell, 1974)

This model demonstrates that individual emotional state (O) is the median between the stimuli within physical environment (S) and human behavior (R). The environmental stimuli (S) refers to the amount of information in an environment including visual stimuli of value, saturation, color hues, texture, shapes, sizes, and composition of those elements. Emotional states (O) refer to the amount of arousal, pleasure that users feel in the physical environment elicited by environmental stimuli (S). Pleasure is the degree to which individuals feel good or pleased in a condition; arousal is the degree to which individuals feel excited, stimulated or active in a condition (Park et al., 2010).

According to Mehrabian and Russell (1974), individual behavioral responses generated by the emotional states (O) among all environments can be categorized into the “approach” and “avoidance” groups. Mehrabian and Russell (1974) defined the approach-avoidance responses in a broad sense including “physical movement toward, or away from, an environment or stimulus, degree of attention, exploration, favorable attitudes such as verbally or nonverbally expressed preference or liking, approach to a task (the level of performance), and approach to another person (affiliation)” (Mehrabian & Russell, 1974, p. 96). Based on the M-R model, the manipulations of different color attributes (saturation and value) formed different level of information rate within the

high-end retail environment which affected individual emotional states of pleasure (viewers feel pleased, good, happy) and arousal (viewers feel excited, stimulated, or active) and then further determined the individual behavior response (preference) in the high-end retail environment.

Although dominance is one of the emotional states from the M-R model, the basic emotion states of the M-R model are defined as pleasure and arousal. Dominance doesn't have a significant effect on individual approach or avoidance behavior (Donovan & Rossiter, 1982; Marcoolyn & Nesdale, 1994; Park & Farr, 2007; Park et al., 2010). Therefore, only individual "pleasure" and "arousal" states were measured in the current study. The measure of pleasure and arousal states were developed in bipolar semantic scales to evaluate individual emotion responses (i.e. pleasing/displeasing; excited/ calm) toward the eight conditions with different levels of information rate (manipulation of two different levels of complexity and coherence in the regular and irregular pattern) in the high-end retail environment.

In addition to emotional states, color emotions are tied to color preference (Kaya & Epps, 2004). Different color attributes of two color-combination applications may affect individual perceptions of color emotions and then further influence color preferences. Besides, colors can create the store atmosphere for developing a distinct retail brand and then influence the behavior of customers (preference) (Wheeler, 2006). Therefore, the differences of individual perceptions of color emotions and store images toward the eight conditions in the high-end retail environment were also assessed.

Furthermore, different color attributes associated with the perceptions of complexity and coherence were manipulated in the current study based on a review of

color research. However, most of them were conducted through color swatches. Brengman (2004) indicated that it was not clear that the findings concerning affective response to color swatches can be generalized to colors applied to environment. Therefore, the perceptions of complexity and coherence toward the eight conditions in the high-end retail environment were measured.

In sum, this study combined the Kaplan and Kaplan's environmental preference and M-R model in the study framework for investigating the effect of two different levels of complexity and coherence in a high-end retail environment (boutique store) on individual perceptions of complexity, coherence, color emotion, store image, arousal states, pleasure states, and color preference (Figure 2-3).

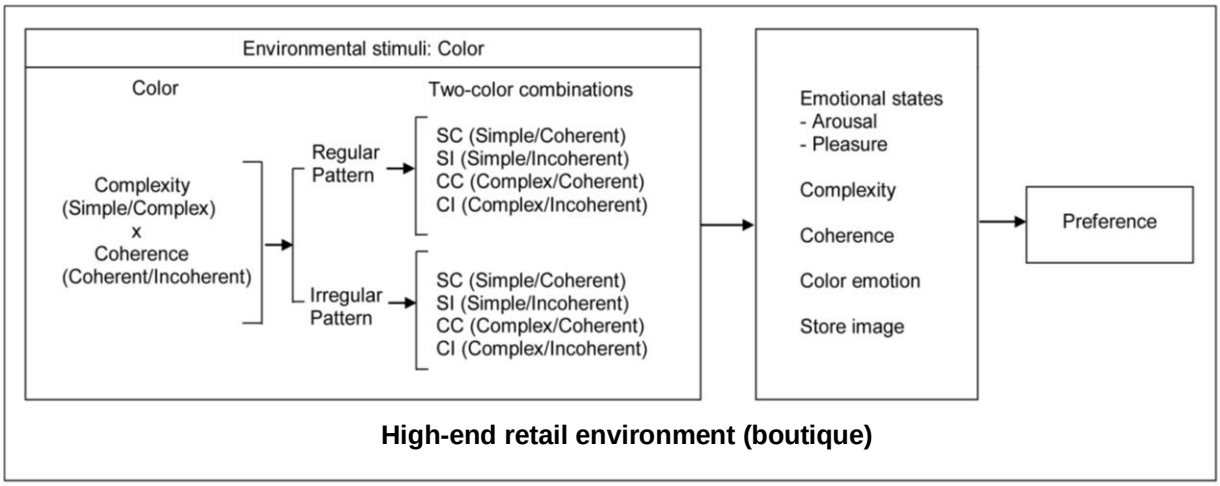


Figure 2-3. The study framework

CHAPTER 3
METHODOLOGY

Chapter 3 presents the research methods of this study and rationale for selecting the experimental settings. Next, it discussed the details of experimental method including two-color combination applications, the participants, the instruments, the date collection procedure and the data analysis in this study.

Rationale for Experimental Settings

In order to investigate the effects of two-color combinations in a boutique store on consumer color perceptions and preferences, the research participants were shown the experiential boutique store scenes on color perspective images. These color images present different two-color combination applications of a boutique store. Even though the true experimental design has the many advantages of enabling variables to be systematically manipulated, compared, and controlled, the process usually costs highly and requires longer time to process (Sommer & Sommer, 1997). Due to the restriction of budget and timeframe, it is neither time nor cost efficient to conduce true experimental design in the current study.

According to Stamps (1990), ratings by people viewing simulated experimental stimuli tend to be similar to those given by people rating the actual scenes. Moreover, simulation research provides more control for examining cause-effect relationships through isolating particular contexts and manipulating variables (Groat & Wang, 2002; Sommer & Sommer, 1997), since there were different visual stimuli involved in real-world situations which were difficult to be accurately isolated (Groat & Wang, 2002). For instance, while studying the relationship between different visual attributes and preference in interiors, Scott (1989, 1992, & 1993) used black and white images as

study stimulus in order to isolate the impact of color or color combination within real-world environments.

Research on environmental preference (Ikemi, 2005; Kent, 1989; Scott, 1989, 1992, & 1993) have generally relied on photographs or other digital media to represent three-dimensional space though a two-dimensional medium as an alternative method so as to save experimental cost and take advantage from the flexibility of digital media. As mentioned earlier in Chapter 2, Scott (1989, 1992 & 1993) used black and white images of different interior environments in a series of studies. Kent (1989) studied the role of mystery in preferences for shopping mall environment through a group of 45 color slides taken inside the malls, in or from the pedestrian or eating areas. Ikemi (2005) used 12 monotone photomontages to study the effects of mystery on preference for residential façades.

More examples of simulation research can be seen that have successfully examined the effects of different visual stimuli on people with interior environment (Park, Jae, & Meneely, 2010; Smith, 2009; Suk, 2010). Park et al. (2010) used a set of simulated color perspective slides of the hotel guestroom generated by Computer Aided Design (CAD) and 3d Max software in order to study the effects of lighting in hotel guestroom on the emotional states, preference behavior intentions of consumer. Moreover, it is also beneficial to color-related research by using alternative experimental media (Smith, 2009). Smith (2009) observed the impacts of environment color through a set of scenes of environment photographed in color or copied from design books. She (2009) found that it is extremely difficult to isolate the impact of a color, or a combination of colors in a true experimental. Therefore, using alternative research in a color-related

research provides more control for examining cause-effect relationships through manipulating color stimuli.

Moreover, though the color mixing methods (additive versus subtractive) are different depending on the mediums the researcher selected (computer monitor versus print-out), Suk (2010) compared emotional responses to color stimuli on different media and examined that whether a digital media, such as a CRT monitor, is comparable to that presented as object colors, such as a paper. The results tend to support that emotional responses to color are universal across the media (Suk, 2010). Therefore, individual responses to the simulated store scenes in different two-color combinations presented in the additive system of computer screen in the current study may be generalized to colors in the additive system of painting or textile applied to an actual retail environment.

The simulated boutique store scene in the current study was adapted from the image taken in a luxurious- and modern-oriented boutique store for young adults (Retrieved March 12, 2012, from http://us.bape.com/) that represented a “high-end” store image. In order to minimalize the possible effects of other environmental stimuli and control the manipulations of two-color combinations, the original lighting fixtures and color applications on the ceiling were removed and replaced with the achromatic color similar with the surrounding color scheme (Figure 3-1). Different two-color combination applications were manipulated on the ceiling of the simulated boutique store scene as the study stimuli.

Figure 3-1. The experimental achromatic boutique store scene.

Two-Color Combination Applications

The color palette for this study was identified through the three attributes of color (hue, value, and saturation) based on previous color literature in Chapter 2 and the color design guild book, the Color Image Scale, published by Shihenobu Kobayashi (1990). First, complementary color hues were selected, since complementary color hues in hue were strongly associated with color harmony and preference (Munsell, 1921; Moon & Spencer, 1944a). Besides, according to Kobayashi's color image scale book (1990), yellow, especially bright yellow, was particularly associated with youthful and appropriated for targeting young consumer market. Hence, yellow and purple hues were selected as the two-color combinations of this study. Second, saturation (chroma) influenced the perception of complexity; colors with higher saturation were perceived

more complex than low-saturated colors (Acking & Kuller, 1972; Valdez & Mehrabian, 1994). Third, perception of harmony (similar to coherence) was influenced by value (value). The higher the value of each color in a color pair, the more likely this pair was perceived harmonious (Ou & Luo, 2006). Besides, the unequal value of colors in a color pair will be perceived as a discordant (incoherent) color scheme (Marshall,1980).The colors were selected from a HSV (hue, saturation, value) color model, where any color was represented by a set of three numbers representing hue, saturation, and value. In HSV system, hue varied from 0° to 360°, each representing a distinct color The hues used in this study included yellow (Hue: 60°) and purple (Hue: 270°). Saturation was manipulated for distinguishing the level of complexity (simple versus complex). It was measured as a percentage from 0% (black and white) to 100% (fully saturated color) in HSV system. Both color hues in a pair with 25 % saturation was considered as “simple” (low level of complexity); both color hues in a pair color hue with 100 % saturation represented “complex’ (high level of complexity). Value was manipulated to distinct the level of coherence (coherent versus incoherent). It is measured as percentage from 0% (black) to 100% (fully bright color) in HSV system. Both color hues in a pair with equal 100% value represented “coherent” (high level of coherence), color hues in a pair had unequal level of value (50% versus 100%) was considered as “incoherent” (low level of coherence)

As can be seen in Table 3-1, a total of four two-color combinations were generated from the study color palette: 1) Simple-Coherent (SC) combination; 2) Simple-Incoherent (SI) combination; 3) Complex-Coherent (CC) combination; 4) Complex-Incoherent (CI) combination.

Table 3-1. Study color palette. Four two-color combinations selected from the HSV color model

Two-color combinations of yellow and purple		Hue (°)	Saturation (%)	Value (%)
Simple-Coherent (SC)		270	25	100
		60	25	100
Simple-Incoherent (SI)		270	25	50
		60	25	100
Complex-Coherent (CC)		270	100	100
		60	100	100
Complex-Incoherent (CI)		270	100	50
		60	100	100

In order to check the manipulation of the four two-color combinations regarding different levels of complexity and coherence prior to the applications of store scenes, each two-color combination was made of two 3 by 3 inch color swatches presented side by side without a gap with medium gray (Hue: 0°, Saturation: 0%, Value: 75% in HSV system) background for a pilot study (Figure 3-2). In order to find out how participants response toward different two-color combination design applications in a boutique store, the four two-color combinations were applied respectively in the image of the achromatic boutique store to create two sets of four store scenes with four two-color combinations in the regular and irregular pattern. In the regular pattern set, each two-

color combination was assigned side by side to form a repeated pattern on the ceiling of the store scene (Figure 3-3). In the irregular pattern set, each two-color combination was assigned randomly to form an irregular pattern on the ceiling of the store scene (Figure 3-4).

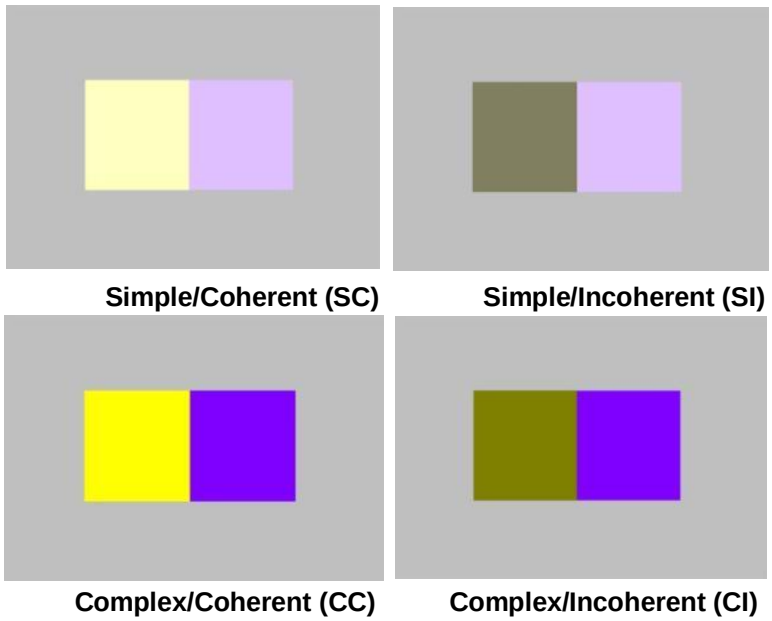


Figure 3-2. Four two-color combination swatches

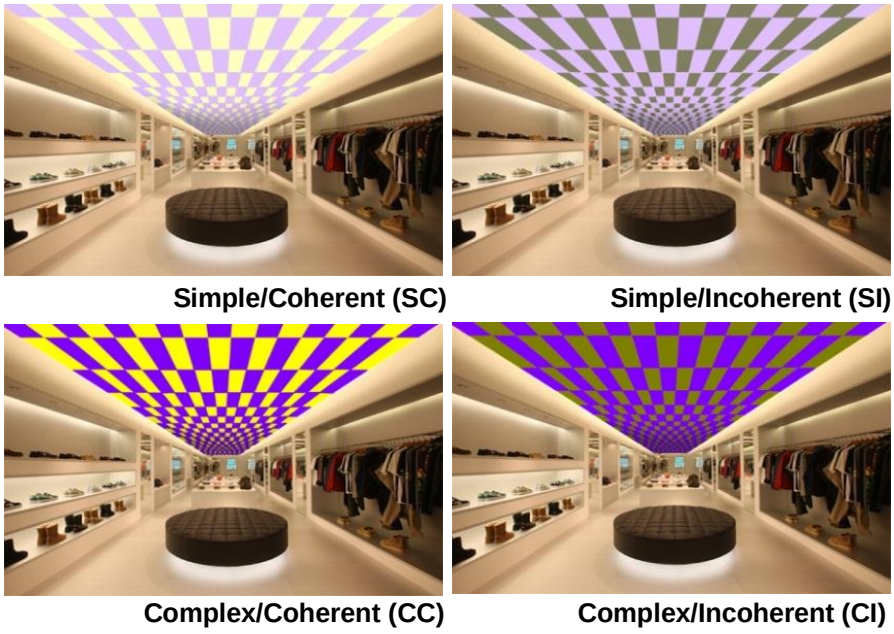
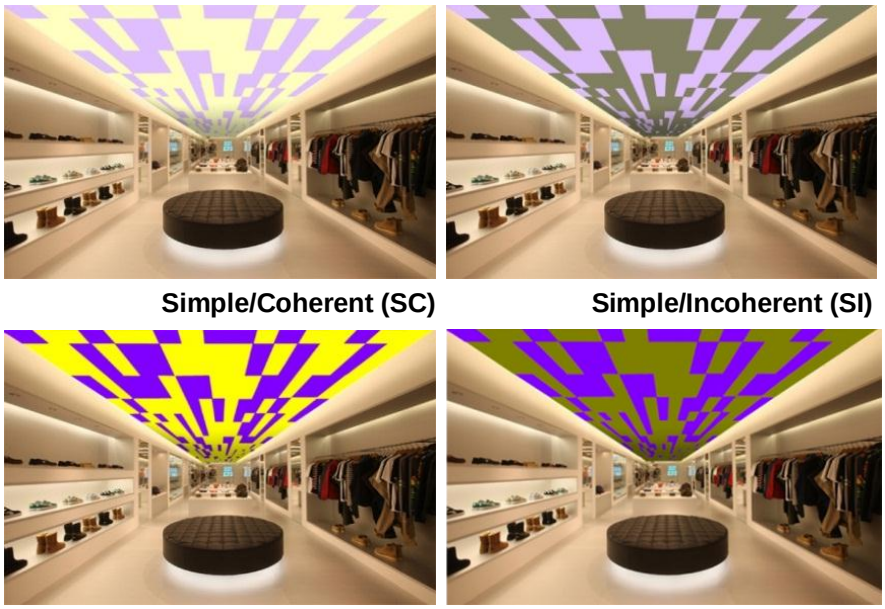


Figure 3-3. Four two-color combinations in the regular pattern set



Simple/Coherent (SC) **Simple/Incoherent (SI)**

Complex/Coherent (CC) **Complex/Incoherent (CI)**

Figure 3-4. Four two-color combinations in the irregular pattern set

The rationales for applying two sets of patterns were to understand how the levels of complexity and coherence of two-color combinations are influenced by design pattern, since the irregularities of elements and their arrangement in the image increase complexity. When the objects are dissimilar rather than similar in shapes or form asymmetric rather than symmetric arrangements or form an irregular rather than a regular pattern, the complexity also increase (Berlyne, 1974; Donderi, 2006; Pieters 2010). Hence, different two-color combination arrangements allow this study to observe the possible effect of pattern. All color stimuli in the current study were generated in Photoshop CS 5 and presented in RGB mode and JPG format.

Participants

The research participants in the pilot study and main study were recruited through the Behavior Research Lab in the Retailing Education and Research Center at University of Florida. The Behavior Research Lab was administered in conjunction with the Marketing Principles (MAR3023) and/or Business Statistics (QMB3250) classes.

They participated voluntarily in return for one extra credit. Participants' ages were limited to the range from 18 to 30 years to meet the study focus for the young consumers' color preference in a retail environment. Besides, color perception ability was very critical to understand the color combination preference and required for the participants in this study. Therefore, the participants had any visual impairment that cannot be corrected by eyeglasses or contact lenses (such as color deficiencies) were excluded from the study. The participant who had architecture and design background was excluded from the experiment, since people with design background tend to perceive the environment differently than people with non-design background (Gifford, 2002). For using human subject in this study, data were collected after obtaining the approval from the University's Institutional Review Board (IRB) (Appendix A). All participants had to review and sign the consent form before data collection (Appendix B).

Instruments

As the study instruments, two sets of questionnaires were developed for the pilot and main study.

Pilot Study

The data-collection instrument for this pilot study was a self-administered questionnaire, present in three sections: 1) the manipulations of two-color combinations on color swatches; 2) the store image of the achromatic boutique store; 3) Demographic information. In the Section One, a total of four two-color combination swatches were presented. Complexity was assessed by the simple/complex 7-point bipolar semantic scale. Coherence was assessed by a set of four 7-point bipolar semantic scales, including incoherent/coherent, unbalanced/ balanced, disharmonious/harmonious,

dissimilar/similar. These scales were adopted from prior studies (Shen & Chen, 1996; Ham et al., 2004; Chang & Dooley, 2002, Ou & Luo, 2006) relevant to Kaplan and Kaplan's environmental preference, Gestalt theories of figural goodness and color harmony research.

In Section Two, in order to evaluate the store image of the boutique store, the original achromatic boutique store scene without any color combination application was present. The perception of store image was assessed by a set of four adjectives on a 7-point Likert scale ranging from 1 as being "strongly disagree" to 7 as being "strongly agree". These scales including sophisticated, upper class, modern and traditional were adopted from the color image scale book (Kobayashi, 1990). In addition, each participant was asked to list adjectives that describe the impression of this store image in an open-end question (Appendix C).

In Section Three, demographic information was collected for each participant's information and background such as gender, age, and color vision (color deficiency) in order to control for any confounding variables.

Main Study

The data-collection instrument for the main study was a self-administered questionnaire, presented in three sections. The Section One presented a series of questions which was corresponding to each boutique store scene from the two sets (regular/irregular pattern) of four two-color combination applications (SC, SI, CC and CI) to ascertain the effect of two-color combinations on dependent variables including1) preference, 2) pleasure states, 3) arousal states, 4) complexity, 5) coherence, 6) color emotions, and 7) store image. The Section Two was designed to rank two-color combination preferences among the four boutique store scenes respectively in the

regular and irregular pattern set. The Section Three was designed to obtain demographic and background information on each participant (Appendix D).

Section One. Participants were randomly assigned to view one of the nine boutique store scenes including one achromatic and the other eight store scenes involving four two-color combination applications in two pattern sets and response to each study variable as follow:

1) To investigate participants' preference for the boutique store scene applied with two-color combination, participants were asked to rate the preference of the store scene (overall how much you like this boutique store?) using a 9-point Likert scale ranging from -4 as being "dislike very much" to +4 as being "like very much". In addition, explaining what they like or dislike about this scene in two open-end questions. 2) The measures for pleasure states were selected from Mehrabian and Russell's pleasure-arousal scales (Mehrabian & Russell, 1974). The pleasure scale has three items with bipolar semantic differentials, including displeasing/pleasing, ugly/beautiful, and unsatisfying/ satisfying on 7- bipolar semantic scales. 3) The measures for arousal states were selected from Mehrabian and Russell's pleasure-arousal scales (Mehrabian & Russell, 1974). The arousal scale has two items with bipolar semantic differentials, including calm/excited and relaxed/ tense on 7- bipolar semantic scales. 4) Complexity was measured using the simple/complex 7-point bipolar semantic scale selected from Kaplan and Kaplan's environmental preference. 5) Coherence was measured by a set of six 7-point bipolar semantic scales including incoherent/coherent, disharmonious/harmonious, separated/unified, disorderly/orderly, unbalanced/ balanced, and dissimilar/similar (Shen & Chen, 1996; Ham et al., 2004; Chang &

Dooley, 2002, Ou & Luo, 2004) Color emotions were measured using 7-ponit bipolar semantic scales like those used in prior color emotions research (Osgood, 1957; Hogg, 1969; Hogg et al., 1979; Kobayashi, 1990; Sato, 2000), including dynamic/static, still/vibrant, lifeless/lively, passive/active, light/heavy, and youthful/mature. 7) To verify if participants perceived the experimental boutique store with two-color combination application as a boutique store scene, the two adjectives associated with the high-end store image including sophisticated and upper class from prior pilot study were used in the main study on 7-point Likert scales scale ranging from 1 as being “strongly disagree” to 7 as being “strongly agree”.

Section Two. All participants viewed the two sets of four boutique store scenes named scene A through scene D in both the regular and irregular pattern set. They were asked to rank the four boutique store scenes in each set from the most preferred to the least preferred store scene, "1" as the most preferred one to "4" as the least preferred one. In addition, they were asked to indicate the reasons for the most and least preferred one in two open-end questions.

Section Three. Demographic information was collected on gender, age, and color vision (color deficiency) in order to control for any confounding variables.

Both of the pilot study and main study used electronic questionnaires created by the Qualtrics Survey Software. The survey combined the study stimuli and questionnaire together which allows participants to view the study stimuli, then directly click or type in their answers to the computer at the UF Behavior Research Lab.

Data Collection

Behavior Research Lab

Both of pilot study and main study were conducted at the Behavior Research Lab of the Retailing Education and Research Center at University of Florida. The lab is a 810 square feet (75 m²), 30’ by 27’ (9.1m by 8.2m) rectangular room located in the Bryan Hall at the UF campus. The interior of the behavior research lab was designed with a neutral color scheme. The ceiling and wall were painted in white and the floor was covered with gray carpet. In the behavior research lab, there are two sources of lighting including daylight from the windows on the left side of the room and artificial light from linear pendant light fixtures. To prevent possible disruption of the perceptions of color caused by lighting, all lighting fixtures were turned off and the windows were blocked out to maintain the minimum general lighting throughout entire experimental sessions. There were 24 stations in the behavior research lab. Each station equipped a PC and 15 inch flat-screen monitor.

Each monitor was set to 1024 x 768 HI Color (16 bit) and adjusted to achieve the same viewing angle and distance from the seat. The carrels had a noise-dampening construction that prevents cross-participant interference. An experimenter station was located at the back of the room which allows the researcher to monitor each participant's workstation through central computer system.

Data Collection Procedure

Participants were randomly assigned by the researcher to one station when arriving in the behavior research lab. Although all participants joined this study voluntary for extra class credit, they were asked to read and sign the consent form in the beginning of the data collection in both pilot study and main study (Appendix B). In

order to minimalize the effect of missing data, all questions in the Qualtrics were set up to be force response. A reminder, “Sorry, you cannot continue until you answer the question”, popped out systematically when participants tried to skip any question during the data collection

Pilot study. In the Section One, all participants were randomly assigned to evaluate one of the four color swatch. Each participant evaluated all the four pairs of color swatches. The sequence of the four color swatches were randomized by the Qualtrics Survey Software. In the Section Two, all participants were asked to evaluate the achromatic boutique store scene. In the Section Three, all participants were asked to complete the demographic questions. The average length of time for participants to complete the questionnaires was approximately 10-15 minutes.

Main study. In the Section One, each participant was randomly assigned to evaluate only one of the nine store scenes including one achromatic boutique store scene and the other eight boutique store scene with four two-color combinations in the regular and irregular pattern set. In Section Two, each set (regular/irregular pattern) of four two-color combinations boutique store scenes was shown respectively. Each participant evaluated all the two sets of four two-color combinations. In Section Three, participants were asked to complete the demographic questions. The average length of time for participants to complete the questionnaires was approximately 20-25 minutes.

Data Analysis

All the quantitative data collected from the pilot study and main study was analyzed by using the Statistical Package of the Social Sciences system (SPSS). First, the descriptive statistics including mean and standard deviation of each dependent

variable were obtained to determine the distributional characteristics in both pilot study and main study.

Pilot Study

The demographic characteristic of the participants was analyzed by the basic descriptive statistics (frequencies). A within-subjects analysis of variance (ANOVA) was used for evaluations of complexity and coherence involving the basic design independent variables (2 levels of complexity x 2 levels of coherence) on two-color combination swatches for manipulation check. The alpha level of 0.05 (p-value) was used to determine statistical significance. The evaluation of store image toward the achromatic boutique store scene was analyzed by the basic descriptive statistics including mean and standard deviation. A content analysis was conducted for the written comments in the questionnaire.

Main Study

The demographic characteristic of participants was analyzed by basic descriptive statistics (frequencies). Then, reliability test was conducted to assess the internal consistency of scales using Cronbach's alpha. The acceptable level of internal consistency (0.60) was used to determine the reliability of dependent variables (Agresti & Finlay, 1997). A between-subjects analysis of variance (ANONA) was conducted for dependent variables (preference, arousal states, pleasure states, complexity, coherence, color emotion and store image) involving the basic design independent variables (2 levels of complexity x 2 levels of coherence) of the four two-color combination applications for each regular and irregular pattern set. The responses regarding the achromatic boutique store scene were not included in this section. The alpha level of 0.05 (p-value) was used to determine statistical significance (Agresti &

Finlay, 1997). The ranking of preference was analyzed by the basic descriptive statistics (frequencies) to determine the distributional characteristics. Content analyses were conducted for all the qualitative data.

CHAPTER 4
FINDINGS

Chapter 4 presents the findings of the study. It begins with the pilot study for checking the success of manipulations to verify if the experiment worked or not including 1) the manipulation of four two-color combinations (2 levels of complexity x 2 levels of coherence) on color swatches 2) the manipulation of the high-end store image of the achromatic boutique store scene. The findings of the main study with descriptive statistics on the demographic characteristics of participants and the results of the Cronbach's alpha test are then presented. Later, the findings of each dependent variable on two sets (regular/ irregular pattern) of four boutique store scenes are presented respectively based on the study frameworks from Chapter 2. Finally, content analyses of the qualitative data related to the two-color combination preferences are presented in the end of Chapter 4.

Pilot Study

Demographic Characteristics of Participants

A total of 141 participants participated in the pilot study. Twenty-one of 141 participants were eliminated because twenty of them had incomplete responses and one participant reported himself as lacking full color vision. Therefore, 120 valid participants were used for data analysis. Table 4-1 presents the frequency and percentage distributions of the participant demographic characteristics. The 120 participants included 50 (41.67%) males and 70 (58.33%) females. The majority of participants (76.67%) were 18 to 21 years old, 27 (22.50%) were 21 to 25 years old; one (0.83%) was at age 26 to 30.

Table 4-1. Demographic characteristics of the participants in the pilot study

Characteristics	Total (N=120) n	%	Characteristics	Total (N=120) n	%
Gender			Age		
(1) Male	50	41.67	(1) Less than 21 years	92	76.67
(2) Female	70	58.33	(2) 21-25 years	27	22.50
			(3) 26-30 years	1	0. 83

Two-Color Combinations on Color Swatches

Data collected from the pilot study (120 responses) were conducted to check the manipulation of four two-color combination applications (2 levels of complexity x 2 levels of coherence) on color swatches. A within-subjects analysis of variance (ANOVA) was used for evaluations of complexity and coherence involving the basic design independent variables (2 levels of complexity x 2 levels of coherence). There were four pairs of color swatches for the following four two-color combinations: Swatch 1 (Simple-Coherent), Swatch 2 (Simple-Incoherent), Swatch 3 (Complex-Coherent), and Swatch 4 (Complex-Incoherent).

Complexity

Complexity was measured by a bipolar semantic scale (simple/complex). Table 4-2 shows the mean and standard deviation for participants' evaluations of complexity on color swatches. As can be seen in Table 4-3, the differences between two levels of complexity were statistically significant on evaluation of complexity (F (1, 119) = 35.48, $p < .001$). All participants evaluated complex color scheme (M = 4.53, SD = .11) as the more complex combination than the simple color scheme (M = 2.96, SD = .13). The differences between two levels of coherence were statistically significant on evaluation of complexity (F (1, 119) = 11.18, $p < .00$). All participants evaluated coherent color

scheme (*M* =3.92, *SD* = .12) as the more complex color combination than the incoherent color scheme (*M* = 3.57, *SD* = .10). A significant two-way interaction was obtained (F (1, 119) = 35.48, $p < .001$). As illustrated in Figure 4-1, all participants evaluated Swatch 3 (Complex x Coherent) as the most complex color combination (*M* = 4.71, *SD* = 1.54) and Swatch 1 (Simple x Coherent) as the least complex color combination (*M* = 2.42, *SD* = 1.30).

Table 4-2. Mean and standard deviation (SD) scores for participants' evaluations of complexity on color swatches

Source	n	Mean*	SD	p-value
Complexity				.000
Simple	120	2.96	.11	
Complex	120	4.53	.13	
Coherence				.001
Coherent	120	3.92	.12	
Incoherent	120	3.57	.10	
Complexity by Coherence				.000
Swatch 1 (Simple x Coherent)	120	2.42	1.30	
Swatch 2 (Simple x Incoherent)	120	3.49	1.55	
Swatch 3 (Complex x Coherent)	120	4.71	1.54	
Swatch 4 (Complex x Incoherent)	120	4.35	1.73	

*7-point Bipolar Semantic Scale: 1 = Simple; 7 = Complex

Table 4-3. ANOVA summary table for participants' evaluations of complexity on color swatches

Source	df	SS	MS	F	p-value	
Complexity	1	296.10	296.10	143.15	.000	***
Coherence	1	15.05	15.05	11.18	.001	**
Complexity x Coherence	1	60.92	60.92	35.48	.000	***
Error	119	204.33	1.72			
Total	120					

*p < .05; **p < .01; ***p < .001

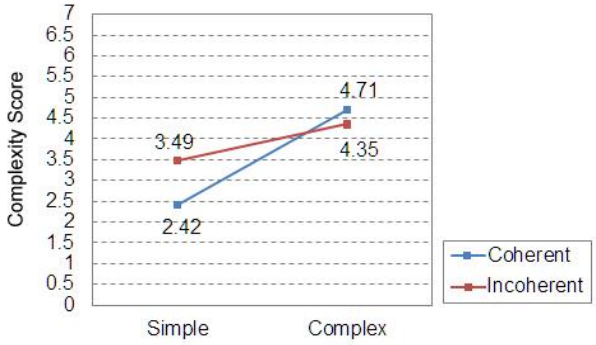


Figure 4-1. Interaction effect for complexity by coherence on participants' evaluations of complexity

Coherence

Coherence was measure by four bipolar semantic scales including incoherent/ coherent/, disharmonious/ harmonious, unbalanced/ balanced, dissimilar/similar.

Incoherent/coherent scale. Table 4-4 shows the mean and standard deviation scores for participants' evaluations of coherence on color swatches in the incoherent/coherent scale. As can be seen in Table 4-5, the differences between two levels of complexity were statistically significant on evaluation of coherence in incoherent/coherent scale (F (1, 119) = 37.52, $p < .001$). All participants evaluated simple color scheme (M = 4.26, SD = .12) as the more coherent combination than the complex color scheme (M = 3.25, SD = .11). A significant two-way interaction was obtained (F (1, 119) = 35.48, $p < .001$). As illustrated in Figure 4-2, all participants evaluated Swatch 1 (Simple x Coherent) as the most coherent color combination (M = 4.91, SD = 1.59) and Swatch 3 (Complex x Coherent) as the least coherent color combination (M = 2.69, SD = 1.52).

Table 4-4. Mean and standard deviation (SD) scores for participants' evaluations of coherence on color swatches in the incoherent/coherent scale

Source	n	Mean*	SD	p-value
Complexity				.000
Simple	120	4.26	.12	
Complex	120	3.25	.11	
Coherence				.323
Coherent	120	3.82	.12	
Incoherent	120	3.70	.11	
Complexity by Coherence				.000
Swatch 1 (Simple x Coherent)	120	4.94	1.59	
Swatch 2 (Simple x Incoherent)	120	3.58	1.62	
Swatch 3 (Complex x Coherent)	120	2.69	1.52	
Swatch 4 (Complex x Incoherent)	120	3.82	1.60	

*7-point Bipolar Semantic Scale: 1 = Incoherent; 7 = Coherent

Table 4-5. ANOVA summary table for participants' evaluations of coherence on color swatches in the incoherent/coherent scale

Source	df	SS	MS	F	p-value	
Complexity	1	121.00	121.00	37.52	.000	***
Coherence	1	1.75	1.75	.98	.323	

Table 4-5. Continued

Source	df	SS	MS	F	p-value	
Complexity x Coherence	1	186.25	186.25	77.91	.000	***
Error	119	284.50	2.39			
Total	120					

*p < .05; **p < .01; ***p < .001

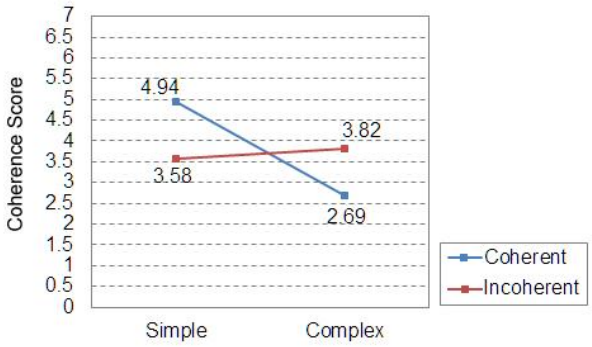


Figure 4-2. Interaction effect for complexity by coherence on participants' evaluations of coherence in the incoherent/coherent scale

Disharmonious/harmonious scale. Table 4-6 shows the mean and standard deviation sores for participants' evaluations of coherence on color swatches in the disharmonious/harmonious scale. In Table 4-7, the differences between two levels of complexity were statistically significant on evaluation of coherence (F (1, 119) = 66.19, p < .001). All participants evaluated simple color scheme (M = 4.31, SD = .12) as the more harmonious combination than the complex color scheme (M = 2.95, SD = .11). The differences between two levels of coherence were statistically significant on evaluation of coherence (F (1, 119) = 6.05, p < .05). All participants evaluated coherent color scheme (M =3.76, SD = .09) as the more harmonious color combination than the incoherent color scheme (M = 3.50, SD = .10). A significant two-way interaction was obtained (F (1, 119) = 82.65, p < .001). As illustrated in Figure 4-3, all participants evaluated Swatch 1 (Simple x Coherent) as the most harmonious color combination (M = 5.16, SD = 1.57) and Swatch 3 (Complex x Coherent) as the least harmonious color combination (M = 2.37, SD = 1.47).

Table 4-6. Mean and standard deviation (SD) scores for participants' evaluations of coherence on color swatches in the disharmonious/harmonious scale

Source	n	Mean*	SD	p-value
Complexity				.000
Simple	120	4.31	.12	
Complex	120	2.95	.11	
Coherence				.015
Coherent	120	3.76	.09	
Incoherent	120	3.50	.10	
Complexity by Coherence				.000
Swatch 1 (Simple x Coherent)	120	5.16	1.57	
Swatch 2 (Simple x Incoherent)	120	3.47	1.74	
Swatch 3 (Complex x Coherent)	120	2.37	1.47	
Swatch 4 (Complex x Incoherent)	120	3.54	1.67	

*7-point Bipolar Semantic Scale: 1 = disharmonious; 7 = Harmonious

Table 4-7. ANOVA summary table for participants' evaluations of coherence on color swatches in the disharmonious/harmonious scale

Source	df	SS	MS	F	p-value	
Complexity	1	221.41	221.41	66.19	.000	***
Coherence	1	8.01	8.01	6.05	.015	*
Complexity x Coherence	1	246.53	246.53	82.65	.000	***
Error	119	354.97	2.98			
Total	120					

*p < .05; **p < .01; ***p < .001

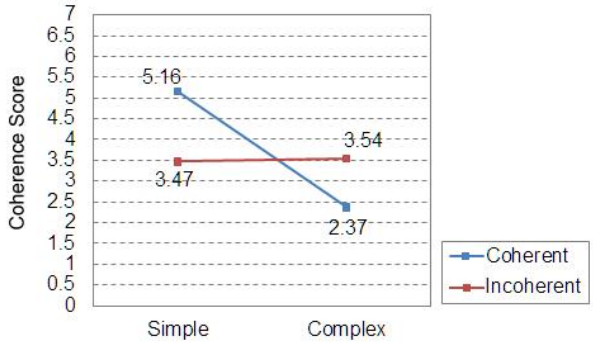


Figure 4-3. Interaction effect for complexity by coherence on participants' evaluations of coherence in the disharmonious/harmonious scale

Unbalanced/balanced scale. Table 4-8 shows the mean and standard deviation scores for participants' evaluations of coherence on color swatches in the unbalanced/balanced scale. As can be seen in Table 4-9, the differences between two levels of complexity were statistically significant on evaluation of coherence (F (1, 119) = 65.00, p < .001). All participants evaluated simple color scheme (M = 4.23, SD = .12) as the more balanced combination than the complex color scheme (M = 2.97, SD = .10).

A significant two-way interaction was obtained (F (1, 119) = 58.38, p < .001). As illustrated in Figure 4-4, all participants evaluated Swatch 1 (Simple x Coherent) as the most balanced color combination (M = 4.91, SD = 1.59) and Swatch 3 (Complex x Coherent) as the least balanced color combination (M = 2.69, SD = 1.52).

Table 4-8. Mean and standard deviation (SD) scores for participants' evaluations of coherence on color swatches in the unbalanced/balanced scale

Source	n	Mean*	SD	p-value
Complexity				.000
Simple	120	4.23	.12	
Complex	120	2.97	.10	
Coherence				.593
Coherent	120	3.63	.09	
Incoherent	120	3.57	.10	
Complexity by Coherence				.000
Swatch 1 (Simple x Coherent)	120	4.90	1.64	
Swatch 2 (Simple x Incoherent)	120	3.57	1.82	
Swatch 3 (Complex x Coherent)	120	2.37	1.48	
Swatch 4 (Complex x Incoherent)	120	3.57	1.65	

*7-point Bipolar Semantic Scale: 1 = Unbalanced; 7 = Balanced

Table 4-9. ANOVA summary table for participants' evaluations of coherence on color swatches in the unbalanced/balanced scale

Source	df	SS	MS	F	p-value	
Complexity	1	192.53	192.53	65.00	.000	***
Coherence	1	.53	.53	.39	.593	
Complexity x Coherence	1	192.53	192.53	58.38	.000	***
Error	119	392.47	3.30			
Total	120					

*p < .05; **p < .01; ***p < .001

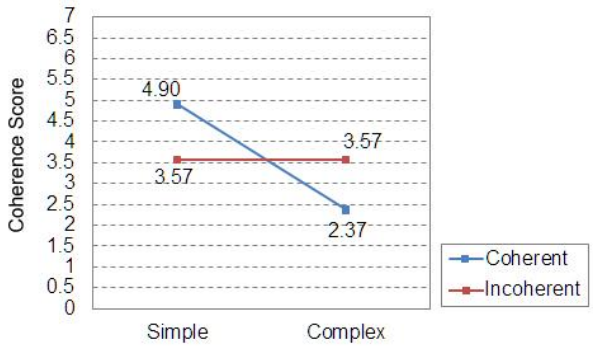


Figure 4-4. Interaction effect for complexity by coherence on participants' evaluations of coherence in the unbalanced/balanced scale

Dissimilar/similar scale. Table 4-10 shows the mean and standard deviation scores for participants' evaluations of coherence on color swatches in the dissimilar/similar scale. In Table 4-11, the differences between two levels of complexity were statistically significant on evaluation of coherence (F (1, 119) = 63.57, p < .001). All participants evaluated simple color scheme (M = 3.87, SD = .12) as the more similar combination than the complex color scheme (M = 2.66, SD = .10). The differences between two levels of coherence were statistically significant on evaluation of coherence (F (1, 119) = 16.70, p < .001). All participants evaluated coherent color scheme (M =3.51, SD = .10) as the more similar color combination than the incoherent color scheme (M = 3.02, SD = .10). A significant two-way interaction was obtained (F (1, 119) = 61.94, p < .001). As illustrated in Figure 4-5, all participants evaluated Swatch 1 (Simple x Coherent) as the most similar color combination (M = 4.69, SD = 1.84) and Swatch 3 (Complex x Coherent) as the least similar color combination (M = 2.33, SD = 1.39).

Table 4-10. Mean and standard deviation (SD) scores for participants' evaluations of coherence on color swatches in the dissimilar/similar scale

Source	n	Mean*	SD	p-value
Complexity				.000
Simple	120	3.87	.12	
Complex	120	2.66	.10	
Coherence				.000
Coherent	120	3.51	.10	
Incoherent	120	3.02	.10	
Complexity by Coherence				.000
Swatch 1 (Simple x Coherent)	120	4.69	1.84	
Swatch 2 (Simple x Incoherent)	120	3.04	1.68	
Swatch 3 (Complex x Coherent)	120	2.33	1.39	
Swatch 4 (Complex x Incoherent)	120	3.00	1.48	

*7-point Bipolar Semantic Scale: 1 = Dissimilar; 7 = Similar

Table 4-11. ANOVA summary table for participants' evaluations of coherence on color swatches the dissimilar/similar scale

Source	df	SS	MS	F	p-value	
Complexity	1	174.00	174.00	63.57	.000	***
Coherence	1	28.52	28.52	16.70	.000	***

Table 4-11. Continued

Source	df	SS	MS	F	p-value	
Complexity x Coherence	1	162.17	162.17	61.94	.000	***
Error	119	311.58	2.62			
Total	120					

*p < .05; **p < .01; ***p < .001

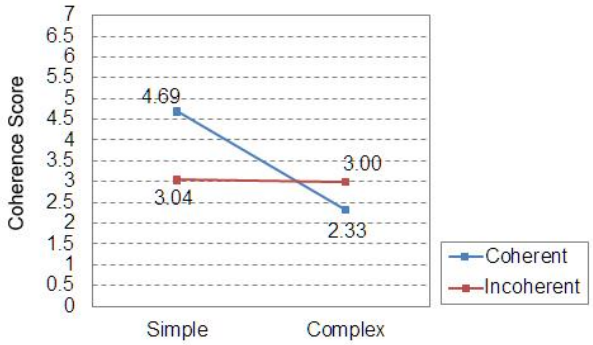


Figure 4-5. Interaction effect for complexity by coherence on participants' evaluations of coherence in the dissimilar/similar scale

Prior results show that the manipulation of four two-color combination applications (2 levels of complexity x 2 levels of coherence) on color swatches was successful. The complex color scheme was perceived significantly as the more complex combination. The coherent color scheme was perceived significantly as the more harmonious and similar combination.

Store Images of the Original Store Scene

Data collected from the pilot study (120 responses) were also conducted to check the manipulation of the high-end store image of the achromatic boutique store scene selected in current experiment. All participants were asked to evaluate the achromatic boutique store scene with four adjectives including sophisticated, upper class, modern, and traditional on 7-point Likert scales ranging from 1 as being "disagree strongly" to 7 as being "agree strongly". As illustrated in Figure 4-6, "modern" was rated highest with a mean over six (*M* = 6.12, *SD* = 1.27). "Upper class" was rated the second highest with a mean over six (*M* = 6.06, *SD* = 1.00). "Sophisticated" was rated the third highest among

these store images (*M* = 5.77, *SD* = 1.27). “Traditional” was rated the lowest with a mean less than three (*M* = 2.30, *SD* = 1.34). The results show that the manipulation of high-end store image of the achromatic boutique store scene in the study experiment was successful. As expected, the achromatic boutique store scene represents a “modern”, “sophisticated”, “upper class”, and “non-traditional” store.

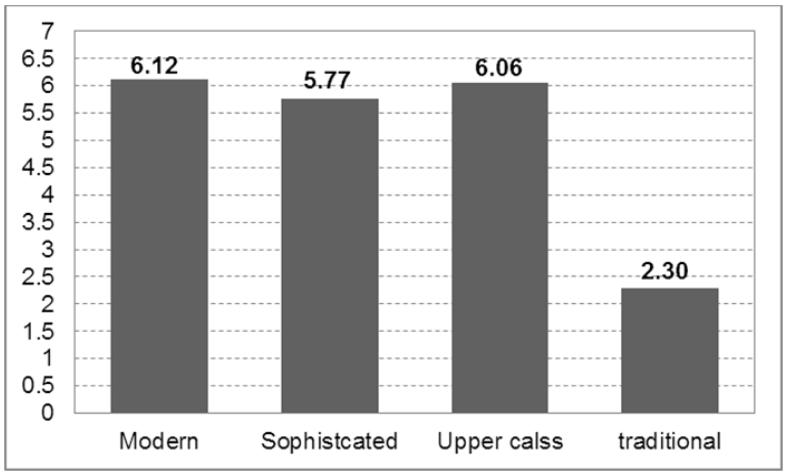


Figure 4-6. Participants’ evaluations of store images for the achromatic boutique store scene

In addition, participants were asked to list adjectives to describe their overall impression of the achromatic boutique store scene. The study obtained a total of 509 adjectives made by participants. A content analysis was conducted (Appendix E). The adjectives with similar meanings were grouped into one category. Each category was renamed as the adjective with highest frequency in the category. For instance, “luxurious”, “expensive“, “high-end”, “upscale” and “sophisticated” were grouped into the “luxurious” category. A total of 10 categories were identified including “luxurious”, “modern, “clean”, “bright”, “nice”, “white”, “open”, “calm” and “others”. Among these categories, “luxurious” (n=118, 23.97%), “modern” (n=121, 23.77%) and “clean” (n=117, 22.97%) were the three most cited categories with frequencies over 100. The adjectives

were grouped into “others” category due to the diversity and low frequency of them (with frequency less than 5) (Appendix E). The findings of qualitative analyses were consistent with the quantitative analyses that validate the high-end store image.

Main Study

Demographic Characteristics of Participants

A total of 187 participants participated in the main study. Thirty-four of 187 participants were eliminated because thirty-two of them had incomplete responses and two reported themselves as colorblind. Therefore, 153 valid participants who met the requirements for the study were used. Table 4-12 presents the frequency and percentage distributions of the participant demographic characteristics. The total 153 participants were 66 (43.14%) males and 87 (56.86%) females. Majority of participants (65.36%) were 18 to 21 years old, 52 (33.97%) were 21 to 25 years old, one (0.65%) was 26 to 30 years old.

Table 4-12. Demographic characteristics of the participants in the main study

	Total (N=153)			Total (N=153)	
Characteristics	n	%	Characteristics	n	%
Gender			Age		
(1) Male	66	43.14	(1) 18-21 years	100	65.36
(2) Female	87	56.86	(2) 21-25 years	52	33.97
			(3) 26-30 years	1	0. 65

Reliability of Measures

Prior to the inferential analysis of dependent variables, Cronbach’s alpha test was performed to evaluate the internal consistency of scales measuring variables of pleasure and arousal states. The results of reliability analysis were employed in Table 4-13. The measures for pleasure and arousal states were selected from Mehrabian and Russell’s pleasure-arousal scales (Mehrabian & Russell, 1974). To measure

participants' state of pleasure, three of bipolar semantic scales were combined including displeasing/pleasing, ugly/beautiful, and unsatisfying/ satisfying. The reliability value was very good at 0.91. Participants' state of arousal was measured by two items of bipolar semantic scale including relaxed/tense and excited/calm. The reliability was acceptable at 0.65. Both of the measures for pleasure and arousal states reaching the acceptable level of internal consistency (0.60) were used for further analysis (Agresti & Finlay, 1997).

Table 4-13. Results of reliability analysis

Variable	N of Items	Min.	Max.	Mean	SD	Cronbach's Alpha
Pleasure	3	1	7	4.66	1.47	0.91
Arousal	2	1	7	4.24	1.06	0.65

Perception of Complexity

A between-subjects analysis of variance (ANOVA) was used for participants' evaluation of complexity involving the basic design independent variables (2 levels of complexity x 2 levels of coherence). The analysis was employed for both the regular pattern set and irregular pattern set in a boutique store.

Regular Pattern

Complexity was measured by a 7-point bipolar semantic scale (simple/complex). Table 4-14 shows the mean and standard deviation scores for participants' evaluations of complexity for the regular pattern set. As can been seen in Table 4-15, the results of ANOVA test shows no significant differences along any of the dimensions was obtained within the evaluations of complexity. The mean of the scenes with simple color scheme was 3.97 (SD = 1.99) and the mean of the scenes with complex color scheme was 4.34 (SD = 1.09).

Table 4-14. Mean and standard deviation (SD) scores for participants' evaluation of complexity for the regular pattern set

Source	n	Mean*	SD	p-value
Complexity				.419
Simple	35	3.97	1.99	
Complex	32	4.34	1.66	
Coherence				.423
Coherent	33	4.33	1.93	
Incoherent	34	3.97	1.75	
Complexity by Coherence				.667
Simple x Coherent	17	4.06	2.14	
Simple x Incoherent	18	3.89	1.91	
Complex x Coherent	16	4.63	1.71	
Complex x Incoherent	16	4.06	1.61	

*7-point Bipolar Semantic Scale: 1 = Simple; 7 = Complex

Table 4-15. ANOVA summary table for participants' evaluation of complexity for the regular pattern set

Source	df	SS	MS	F	p-value
Complexity	1	2.29	2.29	.66	.419
Coherence	1	2.24	2.24	.65	.423
Complexity x Coherence	1	.64	.64	.19	.667
Error	63	217.41	3.45		
Total	67	1376.00			

*****p < .05; ******p < .01; *******p < .001

Irregular Pattern

Table 4-16 shows the mean and standard deviation scores for participants' evaluations of complexity for the irregular pattern set. As can been seen in Table 4-17, a significant main effect on complexity evaluation was complexity levels (F (1, 63) = 11.87, $p < .01$). All participants perceived the scene with complex color scheme (M = 4.29, SD = 1.61) more complex than the scene with simple color scheme (M = 2.91, SD = 1.65). A significant two-way interaction was obtained (F (1, 119) = 4.03, $p < .05$). As illustrated in Figure 4-7, the scene with Complex/Coherent color combination was perceived as the most complex scene (M = 4.72, SD = 1.27), and the scene with Simple/Coherent color combination was perceived as the least complex (the simplest) scene (M = 2.59, SD = 1.54).

Table 4-16. Mean and standard deviation (SD) scores for participants' evaluation of complexity for the irregular pattern set

Source	n	Mean*	SD	p-value
Complexity				.001
Simple	33	2.91	1.65	
Complex	34	4.29	1.61	
Coherence				.752
Coherent	35	3.69	1.76	
Incoherent	32	3.53	1.78	
Complexity by Coherence				.049
Simple x Coherent	17	2.59	1.54	
Simple x Incoherent	16	3.25	1.73	
Complex x Coherent	18	4.72	1.27	
Complex x Incoherent	16	3.81	1.83	

*7-point Bipolar Semantic Scale: 1 = Simple; 7 = Complex

Table 4-17. ANOVA summary table for participants' evaluation of complexity for the irregular pattern set

Source	df	SS	MS	F	p-value	
Complexity	1	30.38	30.38	11.87	.001	**
Coherence	1	.26	.26	.10	.752	
Complexity x Coherence	1	10.32	10.32	4.03	.049	*
Erro	63	161.17	2.56			
Total	67	1078.00				

***p** < .05; ****p** < .01; *****p** < .001

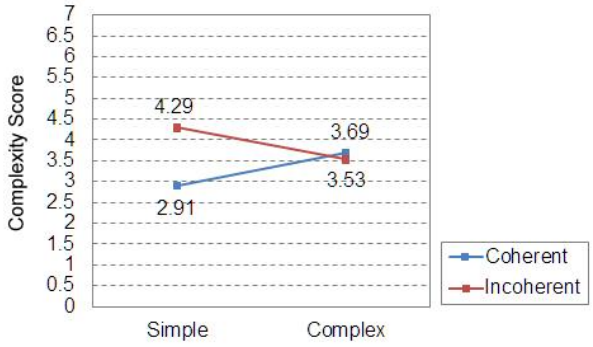


Figure 4-7. Interaction effect for complexity by coherence on participants' evaluations of complexity for the irregular pattern set.

Perception of Coherence

A between-subjects analysis of variance (ANOVA) was used for participants' evaluation of coherence involving the basic design independent variables (2 levels of

complexity x 2 levels of coherence). The analysis was employed for both the regular pattern set and irregular pattern set in a boutique store.

Regular Pattern

Coherence was measure by six 7-point bipolar semantic scales including incoherent/ coherent/, disharmonious/ harmonious, separated/ unified, disorderly/orderly, unbalanced/ balanced, and dissimilar/similar. Table 4-18 shows the mean and standard deviation scores for participants' evaluations of coherence for the regular pattern set. As can been seen in Table 4-19, the results of ANOVA test shows no significant differences along any of the dimensions was obtained within the evaluations of coherence on each bipolar semantic scale.

Table 4-18. Mean and standard deviation (SD) scores for participants' evaluation of coherence for the regular pattern set

Measure	Source	n	Mean*	SD	p-value
Incoherent/Coherent	Complexity				.448
	Simple	35	4.03	1.47	
	Complex	32	3.72	1.78	
	Coherence				.135
	Coherent	33	3.58	1.56	
	Incoherent	34	4.18	1.64	
	Complexity by Coherence				.827
	Simple x Coherent	17	3.76	1.39	
	Simple x Incoherent	18	4.28	1.53	
	Complex x Coherent	16	3.38	1.75	
	Complex x Incoherent	16	4.06	1.81	
Disharmonious/Harmonious	Complexity				.459
	Simple	35	3.49	1.76	
	Complex	32	3.12	2.08	
	Coherence				.718
	Coherent	33	3.21	1.88	
	Incoherent	34	3.41	1.96	
	Complexity by Coherence				.250
	Simple x Coherent	17	3.12	1.65	
	Simple x Incoherent	18	3.83	1.82	
	Complex x Coherent	16	3.31	2.15	
	Complex x Incoherent	16	2.94	2.05	

Table 4-18. Continued

Measure	Source	n	Mean*	SD	p-value
Separated/Unified	Complexity				.581
	Simple	35	3.57	1.67	
	Complex	32	3.00	1.65	
	Coherence				.651
	Coherent	33	3.30	1.72	
	Incoherent	34	3.29	1.64	
	Complexity by Coherence				.290
	Simple x Coherent	17	3.29	1.76	
	Simple x Incoherent	18	3.83	1.58	
	Complex x Coherent	16	3.31	1.74	
Disorderly/Orderly	Complexity				.156
	Simple	35	5.20	1.64	
	Complex	32	4.59	1.78	
	Coherence				.624
	Coherent	33	5.00	1.46	
	Incoherent	34	4.82	1.96	
	Complexity by Coherence				.243
	Simple x Coherent	17	5.06	1.52	
	Simple x Incoherent	18	5.33	1.78	
	Complex x Coherent	16	4.94	1.44	
	Complex x Incoherent	16	4.25	2.05	
Unbalanced/Balanced	Complexity				.082
	Simple	35	4.14	2.03	
	Complex	32	3.28	1.89	
	Coherence				.954
	Coherent	33	3.73	2.00	
	Incoherent	34	3.74	2.02	
	Complexity by Coherence				.273
	Simple x Coherent	17	3.88	2.18	
	Simple x Incoherent	18	4.39	1.91	
	Complex x Coherent	16	3.56	1.86	
	Complex x Incoherent	16	3.00	1.93	
Dissimilar/Similar	Complexity				.302
	Simple	35	3.94	1.81	
	Complex	32	3.47	1.83	
	Coherence				.979
	Coherent	33	3.70	1.88	
	Incoherent	34	3.74	1.80	
	Complexity by Coherence				.321
	Simple x Coherent	17	3.71	1.76	
	Simple x Incoherent	18	4.17	1.89	
	Complex x Coherent	16	3.69	2.06	
	Complex x Incoherent	16	3.25	1.61	

*7 point Bipolar Semantic Scale: 1 = Incoherent, Disharmonious, Separated, Disorderly, Unbalanced, Dissimilar ; 7 = Coherent, Harmonious, Unified, Orderly, Balanced, Similar

Table 4-19. ANOVA summary table for participants' evaluation of coherence for the regular pattern set

Measure	Source	df	SS	MS	F	p-value
Incoherent/Coherent	Complexity	1	1.53	1.53	.58	.448
	Coherence	1	6.02	6.02	2.29	.135
	Complexity x Coherence	1	.13	.13	.05	.827
	Error	63	165.36	165.36		
	Total	67	1182.00	2.63		
Disharmonious/Harmonious	Complexity	1	2.05	2.05	.56	.459
	Coherence	1	.49	.49	.13	.718
	Complexity x Coherence	1	1.97	1.97	1.35	.250
	Error	63	232.64	3.69		
	Total	67	976.00			
Separated/Unified	Complexity	1	5.31	5.31	1.94	.169
	Coherence	1	.03	.03	.01	.916
	Complexity x Coherence	1	5.66	5.66	2.06	.156
	Error	63	172.90	2.75		
	Total	67	913.00			
Disorderly/Orderly	Complexity	1	6.06	6.06	2.07	.156
	Coherence	1	.71	.71	.24	.624
	Complexity x Coherence	1	3.87	3.87	1.32	255
	Error	63	184.88	2.94		
	Total	67	1811.00			
Unbalanced/Balanced	Complexity	1	12.20	12.20	3.12	.082
	Coherence	1	.01	.01	.00	.954
	Complexity x Coherence	1	4.77	4.77	1.22	.273
	Error	63	245.98	3.90		
	Total	67	1196.00			
Dissimilar/Similar	Complexity	1	3.65	3.65	1.08	.302
	Coherence	1	.00	.00	.00	.979
	Complexity x Coherence	1	3.37	3.37	1.00	.321
	Error	63	212.47	3.37		
	Total	67	1145.00			

*p < .05; **p < .01; ***p < .001

Irregular Pattern

Table 4-20 shows the mean and standard deviation scores for participants' evaluations of coherence. Each item within the evaluation of coherence exhibited a significant statistical differences between the complexity levels including

incoherent/coherent (F (1, 63) = 13.17, $p < .01$), disharmonious/ harmonious (F (1, 63) = 21.21, $p < .001$), separated/ unified (F (1, 63) = 6.20, $p < .05$), disorderly/orderly (F (1, 63) = 6.13, $p < .05$), unbalanced/balanced (F (1, 63) = 12.76, $p < .01$), and dissimilar/ similar (F (1, 63) = 14.84, $p < .001$) in Table 4-21. All participants perceived the scene with simple color scheme (incoherent/coherent : M = 5.12, SD = 1.50; disharmonious/ harmonious; M = 4.88, SD = 1.47; separated/ unified: M = 4.33, SD = 1.92; disorderly/ orderly: M = 5.61, SD = 1.66; unbalanced/ balanced: M = 5.15, SD = 1.64; dissimilar/ similar: M = 5.00, SD = 1.56) as more coherent, harmonious, unified, orderly, balanced and similar than the scene with complex color scheme (incoherent/coherent : M = 3.60, SD = 1.80; disharmonious/ harmonious; M = 3.03, SD = 1.67; separated/ unified: M = 3.21, SD = 1.75; disorderly/ orderly: M = 4.41, SD = 2.15; unbalanced/ balanced: M = 4.34, SD = 1.96; dissimilar/ similar: M = 3.41, SD = 1.74).

Table 4-20. Mean and standard deviation (SD) scores for participants' evaluation of coherence for the irregular pattern set

Measure	Source	n	Mean*	SD	p-value
Incoherent/Coherent	Complexity				.001
	Simple	33	5.12	1.50	
	Complex	34	3.60	1.80	
	Coherence				.908
	Coherent	35	4.37	1.75	
	Incoherent	32	4.3	1.93	
	Complexity by Coherence				.894
	Simple x Coherent	17	5.12	1.41	
	Simple x Incoherent	16	5.13	1.63	
	Complex x Coherent	18	3.67	1.78	
	Complex x Incoherent	16	3.53	1.93	
Disharmonious/Harmonious	Complexity				.000
	Simple	33	4.88	1.47	
	Complex	34	3.03	1.67	
	Coherence				.768
	Coherent	35	3.89	1.92	
	Incoherent	32	4.03	1.73	
	Complexity by Coherence				.535
	Simple x Coherent	17	4.94	1.52	
	Simple x Incoherent	16	4.81	1.47	
	Complex x Coherent	18	2.89	1.75	
	Complex x Incoherent	16	3.25	1.65	

Table 4-20. Continued

Measure	Source	n	Mean*	SD	p-value
Separated/Unified	Complexity				.015
	Simple	33	4.33	1.92	
	Complex	34	3.21	1.75	
	Coherence				.331
	Coherent	35	3.54	1.87	
	Incoherent	32	4.00	1.95	
	Complexity by Coherence				.786
	Simple x Coherent	17	4.06	2.08	
	Simple x Incoherent	16	4.63	1.75	
	Complex x Coherent	18	3.06	1.55	
	Complex x Incoherent	16	3.38	2.00	
Disorderly/Orderly	Complexity				.016
	Simple	33	5.61	1.66	
	Complex	34	4.41	2.15	
	Coherence				.741
	Coherent	35	4.91	2.09	
	Incoherent	32	5.09	1.92	
	Complexity by Coherence				.447
	Simple x Coherent	17	5.71	1.61	
	Simple x Incoherent	16	5.50	1.75	
	Complex x Coherent	18	4.17	2.26	
	Complex x Incoherent	16	4.69	2.06	
Unbalanced/Balanced	Complexity				.001
	Simple	33	5.15	1.64	
	Complex	34	4.34	1.96	
	Coherence				.939
	Coherent	35	4.34	1.96	
	Incoherent	32	4.41	1.83	
	Complexity by Coherence				.106
	Simple x Coherent	17	5.47	1.63	
	Simple x Incoherent	16	4.81	1.64	
	Complex x Coherent	18	3.28	1.64	
	Complex x Incoherent	16	4.00	1.97	
Dissimilar/Similar	Complexity				.000
	Simple	33	5.00	1.56	
	Complex	34	3.41	1.74	
	Coherence				.623
	Coherent	35	4.09	1.81	
	Incoherent	32	4.31	1.87	
	Complexity by Coherence				.843
	Simple x Coherent	17	4.94	1.71	
	Simple x Incoherent	16	5.06	1.44	
	Complex x Coherent	18	3.28	1.53	
	Complex x Incoherent	16	3.56	2.00	

*7 point Bipolar Semantic Scale: 1 = Incoherent, Disharmonious, Separated, Disorderly, Unbalanced, Dissimilar ; 7 = Coherent, Harmonious, Unified, Orderly, Balanced, Similar

Table 4-21. ANOVA summary table for participants' evaluation of coherence for the irregular pattern set

Measure	Source	df	SS	MS	F	p-value	
Incoherent/ Coherent	Complexity	1	37.94	37.94	13.17	.001	**
	Coherence	1	.04	.04	.01	.908	
	Complexity x Coherence	1	.05	.05	.02	.894	
	Error	63	181.45	2.88			
	Total	67	1492.00				
Disharmonious/ Harmonious	Complexity	1	54.59	54.59	21.21	.000	***
	Coherence	1	.23	.23	.09	.768	
	Complexity x Coherence	1	1.00	1.00	.39	.535	
	Error	63	162.16	2.57			
	Total	67	1267.00				
Separated/ Unified	Complexity	1	21.21	21.21	6.20	.015	*
	Coherence	1	3.28	3.28	.96	.331	
	Complexity x Coherence	1	.25	.25	.07	.786	
	Error	63	215.39	3.42			
	Total	67	1188.00				
Disorderly/ Orderly	Complexity	1	23.10	23.10	6.13	.016	*
	Coherence	1	.41	.41	.11	.741	
	Complexity x Coherence	1	2.21	2.21	.59	.447	
	Error	63	237.47	3.77			
	Total	67	1939.00				
Unbalanced/ Balanced	Complexity	1	37.73	37.73	12.76	.001	**
	Coherence	1	.017	.017	.006	.939	
	Complexity x Coherence	1	7.96	7.96	2.69	.106	
	Error	63	186.28	2.96			
	Total	67	1515.00				
Dissimilar/ Similar	Complexity	1	41.80	41.80	14.84	.000	***
	Coherence	1	.69	.69	.25	.623	
	Complexity x Coherence	1	.11	.11	.04	.843	
	Error	63	177.43	2.82			
	Total	67	1399.00				

*p < .05; **p < .01; ***p < .001

Perception of Color Emotion

A between-subjects analysis of variance (ANOVA) was used for participants' evaluation of color emotions involving the basic design independent variables (2 levels of complexity x 2 levels of coherence). The analysis was employed for both the regular pattern set and irregular pattern set in a boutique store. Color emotions were measured through six 7-point bipolar semantic scales including static/dynamic, still/vibrant, lifeless/ lively, passive/active, light/heavy, and youth/mature.

Regular Pattern

Table 4-22 shows the mean and standard deviation scores for participants' evaluations of color emotions for the regular pattern set. As can been seen in Table 4-23, there was a significant difference on evaluations of the light/heavy color emotion between complexity levels (F (1, 63) = 6.29, $p < .05$) and between coherence levels (F (1, 63) = 4.23, $p < .05$). The store scene with complex color scheme (M = 4.47, SD = 1.69) was perceived heavier than the store scene with simple color scheme (M = 3.46, SD = 1.63), and the store scene with coherent color scheme (M = 4.36, SD = 1.77) was perceived heavier than the store scene with incoherent color scheme (M = 3.53, SD = 1.60).

Table 4-22. Mean and standard deviation (SD) scores for participants' evaluation of color emotions for the regular pattern set

Measure	Source	n	Mean*	SD	p-value
Static/Dynamic	Complexity				.597
	Simple	35	4.91	1.38	
	Complex	32	4.72	1.51	
	Coherence				.245
	Coherent	33	4.61	1.60	
	Incoherent	34	5.03	1.24	
	Complexity by Coherence				.771
	Simple x Coherent	17	4.65	1.46	
	Simple x Incoherent	18	5.17	1.30	
	Complex x Coherent	16	4.56	1.79	
	Complex x Incoherent	16	4.88	1.20	
Still/Vibrant	Complexity				.162
	Simple	35	4.91	1.63	
	Complex	32	5.44	1.44	
	Coherence				.532
	Coherent	33	5.27	1.61	
	Incoherent	34	5.06	1.52	
	Complexity by Coherence				.092
	Simple x Coherent	17	4.71	1.69	
	Simple x Incoherent	18	5.11	1.61	
	Complex x Coherent	16	5.88	1.31	
	Complex x Incoherent	16	5.00	1.46	

Table 4-22. Continued

Measure	Source	n	Mean*	SD	p-value
Lifeless/Lively	Complexity				.765
	Simple	35	5.34	1.28	
	Complex	32	5.44	1.39	
	Coherence				.408
	Coherent	33	5.52	1.28	
	Incoherent	34	5.26	1.38	
	Complexity by Coherence				.144
	Simple x Coherent	17	5.24	1.35	
	Simple x Incoherent	18	5.44	1.25	
	Complex x Coherent	16	5.81	1.17	
	Complex x Incoherent	16	5.06	1.53	
Passive/Active	Complexity				.627
	Simple	35	4.94	1.61	
	Complex	32	5.12	1.29	
	Coherence				.254
	Coherent	33	5.24	1.58	
	Incoherent	34	4.82	1.31	
	Complexity by Coherence				.913
	Simple x Coherent	17	5.18	1.78	
	Simple x Incoherent	18	4.72	1.45	
	Complex x Coherent	16	5.31	1.40	
	Complex x Incoherent	16	4.94	1.18	
Light/Heavy	Complexity				.015
	Simple	35	3.46	1.63	
	Complex	32	4.47	1.69	
	Coherence				.044
	Coherent	33	4.36	1.77	
	Incoherent	34	3.53	1.60	
	Complexity by Coherence				.986
	Simple x Coherent	17	3.88	1.87	
	Simple x Incoherent	18	3.06	1.31	
	Complex x Coherent	16	4.87	1.54	
	Complex x Incoherent	16	4.06	1.77	
Youth/Mature	Complexity				.146
	Simple	35	3.60	1.88	
	Complex	32	2.97	1.53	
	Coherence				.227
	Coherent	33	3.03	1.67	
	Incoherent	34	3.56	1.80	
	Complexity by Coherence				.853
	Simple x Coherent	17	3.29	1.76	
	Simple x Incoherent	18	3.89	2.00	
	Complex x Coherent	16	2.75	1.57	
	Complex x Incoherent	16	3.19	1.52	

*7 point Bipolar Semantic Scale: 1 = Static, Still, Lifeless, Passive, Light, Youth ; 7 = Dynamic, Vibrant, Lively, Active, Heavy, Mature

Table 4-23. ANOVA summary table for participants' evaluation of color emotions for the regular pattern set

Measure	Source	df	SS	MS	F	p-value	
Static/Dynamic	Complexity	1	.59	.59	.28	.597	
	Coherence	1	2.89	2.89	1.38	.245	
	Complexity x Coherence	1	.18	.18	.09	.771	
	Error	63	132.07	2.10			
	Total	67	1693.00				
Still/Vibrant	Complexity	1	4.68	4.68	2.00	.162	
	Coherence	1	.92	.92	.40	.532	
	Complexity x Coherence	1	6.85	6.85	2.93	.092	
	Error	63	147.06	2.33			
	Total	67	1946.00				
Lifeless/Lively	Complexity	1	.16	.16	.09	.765	
	Coherence	1	1.22	1.22	.69	.408	
	Complexity x Coherence	1	3.84	3.84	2.18	.144	
	Error	63	110.88	1.76			
	Total	67	2061.00				
Passive/Active	Complexity	1	.52	.52	.24	.627	
	Coherence	1	2.87	2.87	1.33	.254	
	Complexity x Coherence	1	.03	.03	.01	.913	
	Error	63	134.46	2.17			
	Total	67	1835.00				
Light/Heavy	Complexity	1	16.70	16.70	6.29	.015	*
	Coherence	1	11.23	11.23	4.23	.044	*
	Complexity x Coherence	1	.00	.00	.00	.986	
	Error	63	167.40	2.66			
	Total	67	1236.00				
Youth/Mature	Complexity	1	6.48	6.48	2.16	.146	
	Coherence	1	4.45	4.45	1.49	.227	
	Complexity x Coherence	1	.10	.10	.03	.853	
	Error	63	188.75	3.00			
	Total	67	929.00				

*****p < .05; ******p < .01; *******p < .001

Irregular Pattern

Table 4-24 shows the mean and standard deviation scores for participants' evaluations of color emotions for the irregular pattern set. As can been seen in Table 4-25, the still/vibrant (F (1, 63) = 13.55, p < .001), passive/active (F (1, 63) = 11.42, p < .01), and light/heavy (F (1, 63) = 8.86, p < .01) scale within the evaluation of color emotions exhibited a significant statistical differences between the complexity levels. The scene with complex color scheme (M = 5.50, SD = 1.58) was perceived more

vibrant than the scene with simple color scheme (*M* = 3.97, *SD* = 1.76). The scene with complex color scheme (*M* = 5.21, *SD* = 1.41) was perceived more active than the scene with simple color scheme (*M* = 4.00, *SD* = 1.48). The scene with complex color scheme (*M* = 3.79, *SD* = 1.65) was perceived heavier than the scene with simple color scheme (*M* = 2.70, *SD* = 1.47). A significant two-way interaction was obtained (F (1, 63) = 15.03, $p < .001$) in the light/heavy scale. As illustrated in Figure 4-8, the scene with Complex/Coherent (CC) color combination was perceived as the heaviest scene (*M* = 4.56, *SD* = 1.29), and the scene with Simple/Coherent (SC) color combination was perceived as the lightest scene (*M* = 2.18, *SD* = 1.24).

Table 4-24. Mean and standard deviation (SD) scores for participants' evaluation of color emotions for the irregular pattern set

Measure	Source	n	Mean*	SD	p-value
Static/Dynamic	Complexity				.447
	Simple	33	4.58	1.09	
	Complex	34	4.85	1.64	
	Coherence				.628
	Coherent	35	4.80	1.37	
	Incoherent	32	4.63	1.43	
	Complexity by Coherence				.447
	Simple x Coherent	17	4.53	1.13	
	Simple x Incoherent	16	4.63	1.09	
	Complex x Coherent	18	5.06	1.55	
	Complex x Incoherent	16	4.63	1.75	
Still/Vibrant	Complexity				.000
	Simple	33	3.97	1.76	
	Complex	34	5.50	1.58	
	Coherence				.828
	Coherent	35	4.80	1.88	
	Incoherent	32	4.69	1.80	
	Complexity by Coherence				.947
	Simple x Coherent	17	4.00	2.03	
	Simple x Incoherent	16	3.94	1.48	
	Complex x Coherent	18	5.56	1.38	
	Complex x Incoherent	16	5.44	1.83	

Table 4-24. Continued

Measure	Source	n	Mean*	SD	p-value
Lifeless/Lively	Complexity				.262
	Simple	33	4.85	1.37	
	Complex	34	5.24	1.39	
	Coherence				.644
	Coherent	35	4.97	1.47	
	Incoherent	32	5.12	1.31	
	Complexity by Coherence				.969
	Simple x Coherent	17	4.76	1.25	
	Simple x Incoherent	16	4.94	1.53	
	Complex x Coherent	18	5.17	1.65	
	Complex x Incoherent	16	5.31	1.08	
Passive/Active	Complexity				.001
	Simple	33	4.00	1.48	
	Complex	34	5.21	1.41	
	Coherence				.222
	Coherent	35	4.83	1.65	
	Incoherent	32	4.38	1.43	
	Complexity by Coherence				.119
	Simple x Coherent	17	3.94	1.60	
	Simple x Incoherent	16	4.06	1.39	
	Complex x Coherent	18	5.67	1.24	
	Complex x Incoherent	16	4.69	1.45	
Light/Heavy	Complexity				.004
	Simple	33	2.70	1.47	
	Complex	34	3.79	1.65	
	Coherence				.436
	Coherent	35	3.40	1.74	
	Incoherent	32	3.09	1.55	
	Complexity by Coherence				.000
	Simple x Coherent	17	2.18	1.24	
	Simple x Incoherent	16	3.25	1.53	
	Complex x Coherent	18	4.56	1.29	
	Complex x Incoherent	16	2.94	1.61	
Youth/Mature	Complexity				.092
	Simple	33	3.61	1.75	
	Complex	34	2.88	1.63	
	Coherence				.554
	Coherent	35	3.11	1.75	
	Incoherent	32	3.38	1.70	
	Complexity by Coherence				.828
	Simple x Coherent	17	3.53	1.66	
	Simple x Incoherent	16	3.69	1.89	
	Complex x Coherent	18	2.72	1.78	
	Complex x Incoherent	16	3.06	1.48	

*7 point Bipolar Semantic Scale: 1 = Static, Still, Lifeless, Passive, Light, Youth ; 7 = Dynamic, Vibrant, Lively, Active, Heavy, Mature

Table 4-25. ANOVA summary table for participants' evaluation of coherence for the irregular pattern set

Measure	Source	df	SS	MS	F	p-value	
Static/Dynamic	Complexity	1	1.16	1.16	.58	.447	
	Coherence	1	.47	.47	.24	.628	
	Complexity x Coherence	1	1.16	1.16	.58	.447	
	Error	63	124.68	1.98			
	Total	67	1618.00				
Still/Vibrant	Complexity	1	39.00	39.00	13.55	.000	***
	Coherence	1	.14	.14	.05	.828	
	Complexity x Coherence	1	.01	.01	.00	.947	
	Error	63	181.32	2.88			
	Total	67	1730.00				
Lifeless/Lively	Complexity	1	2.52	2.52	1.28	.262	
	Coherence	1	.42	.42	.22	.644	
	Complexity x Coherence	1	.00	.00	.00	.969	
	Error	63	123.93	1.97			
	Total	67	1832.00				
Passive/Active	Complexity	1	23.08	23.08	11.42	.001	**
	Coherence	1	3.07	3.07	1.52	.222	
	Complexity x Coherence	1	5.06	5.06	2.50	.119	
	Error	63	127.32	2.02			
	Total	67	1585.00				
Light/Heavy	Complexity	1	17.84	17.84	8.86	.004	**
	Coherence	1	1.24	1.24	.62	.436	
	Complexity x Coherence	1	30.26	30.26	15.03	.000	***
	Error	63	126.85	2.01			
	Total	67	888.00				
Youth/Mature	Complexity	1	8.57	8.57	2.93	.092	
	Coherence	1	1.04	1.04	.36	.554	
	Complexity x Coherence	1	.14	.14	.05	.828	
	Error	63	184.22	2.92			
	Total	67	897.00				

*p < .05; **p < .01; ***p < .001

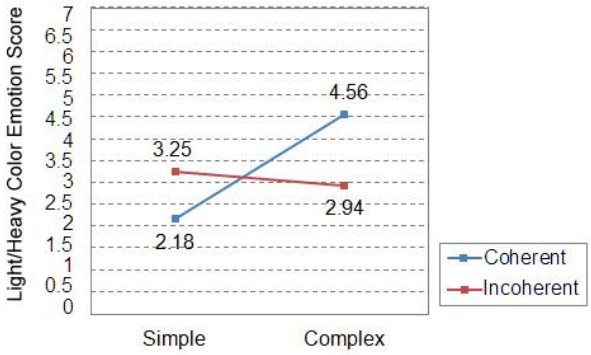


Figure 4-8. Interaction effect for complexity by coherence on participants' evaluations of the light/heavy store image for the irregular pattern set.

Perception of Store Image

A between-subjects analysis of variance (ANOVA) was used for participants' evaluation of store image involving the basic design independent variables (2 levels of complexity x 2 levels of coherence). The analysis was employed for both the regular pattern set and irregular pattern set in the experimental boutique store scene. The "high-end" store image was measure by "sophisticated" and "upper class" adjectives on 7-point Likert scales ranging from 1 as being "Strongly disagree to 7 as being "Strongly agree"

Regular Pattern

Table 4-26 shows the mean and standard deviation scores for participants' evaluations of store image for the regular pattern set. As can been seen in Table 4-27, both evaluations of sophisticated (F (1, 63) = 4.82, $p < .05$) and upper class (F (1, 63) = 7.68, $p < .01$) store image exhibited a significant statistical differences between the two different complexity levels. The store scene with simple color scheme (sophisticated: M = 5.14, SD = 1.50; upper class: M = 5.54, SD = 1.42) was perceived as the one with more sophisticated and upper class store image than the store scene with complex color scheme (sophisticated: M = 4.22, SD = 1.88; upper class: M = 4.47, SD = 1.70).

Table 4-26. Mean and standard deviation (SD) scores for participants' evaluation of store image for the regular pattern set

Measure	Source	n	Mean*	SD	p-value
Sophisticated	Complexity				.032
	Simple	35	5.14	1.50	
	Complex	32	4.22	1.88	
	Coherence				.498
	Coherent	33	4.55	1.75	
	Incoherent	34	4.85	1.74	
	Complexity by Coherence				.597
	Simple x Coherent	17	4.88	1.45	
	Simple x Incoherent	18	5.39	1.54	

Table 4-26. Continued

Measure	Source	n	Mean*	SD	p-value
	Complex x Coherent	16	4.19	2.01	
	Complex x Incoherent	16	4.25	1.81	
Upper Class	Complexity				.007
	Simple	35	5.54	1.42	
	Complex	32	4.47	1.70	
	Coherence				.942
	Coherent	33	5.00	1.56	
	Incoherent	34	5.06	1.74	
	Complexity by Coherence				.380
	Simple x Coherent	17	5.35	1.46	
	Simple x Incoherent	18	5.72	1.41	
	Complex x Coherent	16	4.63	1.63	
	Complex x Incoherent	16	4.31	1.82	

*7-point Likert-type scale: 1 = Strongly Disagree; 9 = Strongly Agree

Table 4-27. ANOVA summary table for participants' evaluation of store image for the regular pattern set

Measure	Source	df	SS	MS	F	p-value	
Sophisticated	Complexity	1	14.04	14.04	4.82	.032	*
	Coherence	1	1.35	1.35	.46	.498	
	Complexity x Coherence	1	.82	.82	.28	.597	
	Error	63	183.48	2.91			
	Total	67	200.03				
Upper Class	Complexity	1	19.09	19.09	7.68	.007	**
	Coherence	1	.01	.01	.01	.942	
	Complexity x Coherence	1	1.94	1.94	.78	.380	
	Error	63	156.68	2.49			
	Total	67	1873.00				

*p < .05. **p < .01. ***p < .001

Irregular Pattern

Table 4-28 shows the mean and standard deviation scores for participants' evaluations of store image for the irregular pattern set. As can been seen in Table 4-29, both evaluations of sophisticated (F (1, 63) = 19.9, p < .001) and upper class (F (1, 63) = 9.46, p < .01) store image exhibited a significant statistical differences between the complexity levels. All participants perceived the scene with simple color scheme (sophisticated: M = 5.73, SD = 1.10; upper class: M = 5.79, SD = 1.36) as the one with more sophisticated and upper class store image than the scene with complex color scheme (sophisticated: M = 4.03, SD = 1.90; upper class: M = 4.62, SD = 1.67).

Table 4-28. Mean and standard deviation (SD) scores for participants' evaluation of store image for the irregular pattern set

Measure	Source	n	Mean*	SD	p-value
Sophisticated	Complexity				.000
	Simple	33	5.73	1.10	
	Complex	34	4.03	1.90	
	Coherence				.552
	Coherent	35	4.74	1.77	
	Incoherent	32	5.00	1.78	
	Complexity by Coherence				.630
	Simple x Coherent	17	5.71	0.85	
	Simple x Incoherent	16	5.75	1.34	
	Complex x Coherent	18	3.83	1.95	
	Complex x Incoherent	16	4.25	1.88	
Upper Class	Complexity				.003
	Simple	33	5.79	1.36	
	Complex	34	4.62	1.67	
	Coherence				.388
	Coherent	35	5.03	1.65	
	Incoherent	32	5.38	1.60	
	Complexity by Coherence				.675
	Simple x Coherent	17	5.71	1.45	
	Simple x Incoherent	16	5.88	1.31	
	Complex x Coherent	18	4.39	1.61	
	Complex x Incoherent	16	4.88	1.75	

*7 point Bipolar Semantic Scale: 1 = Incoherent, Disharmonious, Separated, Unbalanced, Dissimilar ; 7 = Coherent, Harmonious, Unified, Balanced, Similar

Table 4-29. ANOVA summary table for participants' evaluation of store image for the irregular pattern set

Measure	Source	df	SS	MS	F	p-value	
Sophisticated	Complexity	1	47.52	47.52	19.19	.000	***
	Coherence	1	.89	.89	.36	.552	
	Complexity x Coherence	1	.58	.58	.23	.630	
	Error	63	156.03	2.48			
	Total	67	1792.00				
Upper Class	Complexity	1	22.43	22.43	9.46	.003	**
	Coherence	1	1.79	1.79	.76	.388	
	Complexity x Coherence	1	.42	.42	.18	.675	
	Error	63	149.31	2.37			
	Total	67	1982.00				

*p < .05. **p < .01. ***p < .001

Arousal States

A between-subjects analysis of variance (ANOVA) was used for participants' evaluation of arousal states involving the basic design independent variables (2 levels

of complexity x 2 levels of coherence). The analysis was employed for both the regular pattern set and irregular pattern set in a boutique store.

Regular Pattern

Table 4-30 shows the mean and standard deviation scores. As can been seen in Table 4-31, the results of ANOVA test shows no significant interaction effect. A significant main effect on arousal states was complexity levels (F (1, 63) = 4.82, p < .05). All participants perceived the scene with complex color scheme (M = 4.91, SD = 1.24) as the more arousing one than the scene with simple color scheme (M = 4.19, SD = 1.39).

Table 4-30. Mean and standard deviation (SD) scores for participants' evaluation of arousal states for the regular pattern set

Source	n	Mean*	SD	p-value
Complexity				.032
Simple	35	4.19	1.39	
Complex	32	4.91	1.24	
Coherence				.877
Coherent	33	4.56	1.36	
Incoherent	34	4.50	1.38	
Complexity by Coherence				.276
Simple x Coherent	17	4.21	1.43	
Simple x Incoherent	18	4.17	1.39	
Complex x Coherent	16	4.94	1.21	
Complex x Incoherent	16	4.88	1.31	

*7-point Bipolar Semantic Scale: 1 = Not Arousing; 7 = Arousing

Table 4-31. ANOVA summary table for participants' evaluation of arousal states for the regular pattern set

Source	df	SS	MS	F	p-value	
Complexity	1	8.66	8.66	4.82	.032	*
Coherence	1	.04	.04	.02	.877	
Complexity x Coherence	1	.00	.00	.00	.972	
Error	63	113.22	1.80			
Total	67	1486.75				

*p < .05; **p < .01; ***p < .001

Irregular Pattern

Table 4-32 shows the mean and standard deviation scores. As can been seen in Table 4-33, a significant main effect on arousal states was complexity levels (F (1, 63) =

22.76, $p < .001$). All participants perceived the scene with complex color scheme (M = 4.91, SD = 1.00) as the more arousing one than the scene with simple color scheme (M = 3.58, SD = 1.31). A significant two-way interaction was obtained (F (1, 119) = 4.21, $p < .05$). As illustrated in Figure 4-9, the scene with Complex/Coherent color combination was perceived as the most arousing scene (M = 5.00, SD = .89), and the scene with Simple/Coherent color combination was perceived as the least arousing scene (M = 3.12, SD = 1.35).

Table 4-32. Mean and standard deviation (SD) scores for participants' evaluation of arousal states for the irregular pattern set

Source	n	Mean*	SD	p-value
Complexity				.000
Simple	33	3.58	1.31	
Complex	34	4.91	1.00	
Coherence				.175
Coherent	35	4.09	1.47	
Incoherent	32	4.44	1.16	
Complexity by Coherence				.044
Simple x Coherent	17	3.12	1.35	
Simple x Incoherent	16	4.06	1.11	
Complex x Coherent	18	5.00	.89	
Complex x Incoherent	16	4.81	1.12	

*7-point Bipolar Semantic Scale: 1 = Not Arousing; 7 = Arousing

Table 4-33. ANOVA summary table for participants' evaluation of arousal states for the irregular pattern set

Source	df	SS	MS	F	p-value	
Complexity	1	28.95	28.95	22.76	.000	***
Coherence	1	2.40	2.40	1.88	.175	
Complexity x Coherence	1	5.46	5.46	4.21	.044	*
Error	63	80.14	1.27			
Total	67	1330.00				

*p < .05; **p < .01; ***p < .001

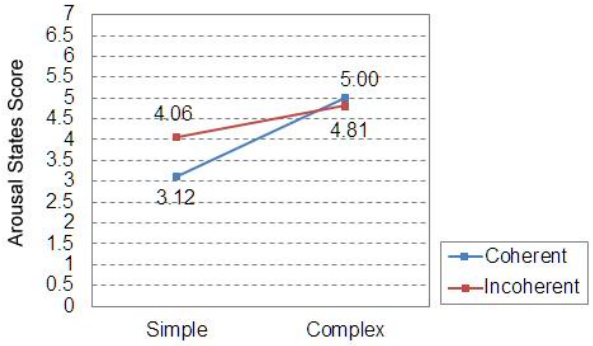


Figure 4-9. Interaction effect for complexity by coherence on participants' evaluations of arousal states for the irregular pattern set.

Pleasure States

A between-subjects analysis of variance (ANOVA) was used for participants' evaluation of pleasure states involving the basic design independent variables (2 levels of complexity x 2 levels of coherence). The analysis was employed for both the regular pattern set and irregular pattern set in a boutique store.

Regular Pattern

Table 4-34 shows the mean and standard deviation scores. As can been seen in Table 4-35, the results of ANOVA test shows no significant interaction was obtained. A significant main effect on pleasure states was complexity levels (F (1, 63) = 8.35, p < .01). The scene with simple color scheme (M = 4.87, SD = 1.38) was perceived as the more pleasing one than the scene with complex color scheme (M = 3.80, SD = 1.59).

Table 4-34. Mean and standard deviation (SD) scores for participants' evaluation of pleasure states for the regular pattern set

Source	n	Mean*	SD	p-value
Complexity				.005
Simple	35	4.87	1.38	
Complex	32	3.80	1.59	
Coherence				.410
Coherent	33	4.19	1.46	
Incoherent	34	4.52	1.67	

Table 4-34. Continued

Source	n	Mean*	SD	p-value
Complexity by Coherence				.276
Simple x Coherent	17	4.61	1.36	
Simple x Incoherent	18	5.11	1.39	
Complex x Coherent	16	3.75	1.48	
Complex x Incoherent	16	3.85	1.74	

*7-point Bipolar Semantic Scale: 1 = Not Pleasing; 7 = Pleasing

Table 4-35. ANOVA summary table for participants' evaluation of pleasure states for the regular pattern set

Source	df	SS	MS	F	p-value	
Complexity	1	18.68	18.68	8.35	.005	**
Coherence	1	1.54	1.54	.69	.410	
Complexity x Coherence	1	.67	.67	.30	.588	
Error	63	141.05	2.24			
Total	67	1434.89				

*p < .05; **p < .01; ***p < .001

Irregular Pattern

Table 4-36 shows the mean and standard deviation scores. As can been seen in Table 4-37, a significant main effect on pleasure states was complexity levels (F (1, 63) = 16.08, p < .001). All participants perceived the scene with simple color scheme (M = 5.35, SD = 1.13) as the more pleasing one than the scene with complex color scheme (M = 4.22, SD = 1.18). Yet, a two-way interaction between complexity and coherence levels approached significance (F (1, 63) = 16.08, p = .052). As illustrated in Figure 4-10, the scene with Simple/Coherent color combination was slightly perceived as the most pleasing scene (M = 5.53, SD = .97), and the scene with Complex/Coherent color combination was slightly perceived as the least pleasing scene (M = 3.87, SD = 1.19).

Table 4-36. Mean and standard deviation (SD) scores for participants' evaluation of pleasure states for the irregular pattern set

Source	n	Mean*	SD	p-value
Complexity				.000
Simple	33	5.35	1.13	
Complex	34	4.22	1.18	
Coherence				.505
Coherent	35	4.68	1.36	
Incoherent	32	4.89	1.19	

Table 4-36. Continued

Source	n	Mean*	SD	p-value
Complexity by Coherence				.052
Simple x Coherent	17	5.53	.97	
Simple x Incoherent	16	5.17	1.28	
Complex x Coherent	18	3.87	1.19	
Complex x Incoherent	16	4.60	1.06	

*7-point Bipolar Semantic Scale: 1 = Not Pleasing; 7 = Pleasing

Table 4-37. ANOVA summary table for participants' evaluation of pleasure states for the irregular pattern set

Source	df	SS	MS	F	p-value	
Complexity	1	20.62	20.62	16.08	.000	***
Coherence	1	.58	.58	.45	.505	
Complexity x Coherence	1	5.02	5.02	3.92	.052	
Error	63	80.76	1.28			
Total	67	1636.44				

*p < .05; **p < .01; ***p < .001

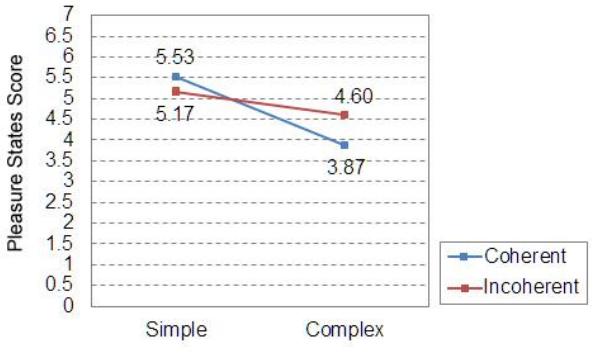


Figure 4-10. Interaction effect for complexity by coherence on participants' evaluations of pleasure states for the irregular pattern set

Two-Color Combination Preferences

In this section, two different statistical analyses were conducted based on the types of questions for studying individual two-color combination preferences in a boutique store. A between-subjects analysis of variance (ANOVA) was used for participants' evaluation of two-color combination preference involving the basic design independent variables (2 levels of complexity x 2 levels of coherence). The analysis was employed for both the regular pattern set and irregular pattern set in a boutique store.

Regular Pattern

Table 4-38 shows the mean and standard deviation scores. As can been seen in Table 4-39, the results of ANOVA test shows no significant interaction. A significant main effect on color combination preference was complexity levels (F (1, 63) = 8.25, p < .01). Regardless coherence levels, all participants evaluated simple color scheme (M = 6.26, SD = 1.96) as their most preferred color combination than the complex color scheme (M = 4.72, SD = 2.43).

Table 4-38. Mean and standard deviation (SD) scores for participants' evaluation of color combination preference for the regular pattern set

Source	n	Mean*	SD	p-value
Complexity				.006
Simple	35	6.26	1.96	
Complex	32	4.72	2.43	
Coherence				.085
Coherent	33	5.03	2.10	
Incoherent	34	6.00	2.44	
Complexity by Coherence				.359
Simple x Coherent	17	5.53	1.74	
Simple x Incoherent	18	6.94	1.96	
Complex x Coherent	16	4.50	2.37	
Complex x Incoherent	16	4.94	2.54	

*9-point Likert-type scale: 1 = Dislike Extremely; 9 = Like Extremely

Table 4-39. ANOVA summary table for participants' evaluation of color combination preference for the regular pattern set

Source	df	SS	MS	F	p-value	
Complexity	1	38.51	38.51	8.25	.006	**
Coherence	1	14.34	14.34	3.07	.085	
Complexity x Coherence	1	3.99	3.99	.86	.359	
Error	63	294.12	4.67			
Total	67	2396.00				

*p < .05; **p < .01; ***p < .001

Irregular Pattern

Table 4-40 shows the mean and standard deviation scores. As can been seen in Table 4-41, the results of ANOVA test shows no significant interaction was obtained. A significant main effect on color combination preference was complexity levels (F (1, 63) = 4.40, p < .05). Regardless coherence levels, all participants evaluated simple color

scheme (*M* = 6.70, *SD* = 1.92) as their most preferred color combination than the complex color scheme (*M* = 5.62, *SD* = 2.10).

Table 4-40. Mean and standard deviation (SD) scores for participants' evaluation of color combination preference for the irregular pattern set

Source	n	Mean*	SD	p-value
Complexity				.040
Simple	33	6.70	1.92	
Complex	34	5.62	2.10	
Coherence				.416
Coherent	35	5.94	2.27	
Incoherent	32	6.38	1.90	
Complexity by Coherence				.276
Simple x Coherent	17	6.76	1.92	
Simple x Incoherent	16	6.63	2.09	
Complex x Coherent	18	5.17	2.36	
Complex x Incoherent	16	6.12	1.71	

*9-point Likert-type scale: 1 = Dislike Extremely; 9 = Like Extremely

Table 4-41. ANOVA summary table for participants' evaluation of color combination preference for the irregular pattern set

Source	df	SS	MS	F	p-value	
Complexity	1	18.39	18.39	4.40	.040	*
Coherence	1	2.80	2.80	.67	.416	
Complexity x Coherence	1	5.04	5.04	1.21	.276	
Error	63	263.06	4.18			
Total	67	2824.00				

*****p < .05; ******p < .01; *******p < .001

In addition to evaluating the two-color combination preferences on the 9-point Likert scale, participants were asked to rank the four store scenes of two-color combinations for two pattern sets from the most preferred to least preferred one in order to investigate participants' two-color combination preference among different sets of four store scenes. Table 4-42 and Table 4-43 show the descriptive statistic of participants' color combination preferences for the regular and irregular pattern sets. In the regular pattern set, the Scene B (SI) (47.7%) was ranked as the most preferred one, and the Scene A (SC) (44.4%) was ranked as the second most preferred one. The Scene D (CI) (50.0%) was ranked as the least preferred one, and the Scene C (CC) (41.8%) was ranked as the second least preferred one. In the irregular pattern set, the

Scene B (SI) (52.9%) was ranked as the most preferred one, and the Scene A (SC) (35.3%) was ranked as the second most preferred one. The Scene D (CI) (58.2%) was ranked as the least preferred one, and the Scene C (CC) (34.0%) was ranked as the second least preferred one.

Table 4-42. Descriptive statistic of participants' color combination preferences among the regular pattern set

	Regular Pattern Set				
	Scene A (SC)	Scene B (SI)	Scene C (CC)	Scene D (CI)	Total
The Most Preferred Scene	68(44.4%)	73(47.7%)	9(5.9%)	3(2.0%)	153(100%)
The Least Preferred Scene	8(5.2%)	4(2.6%)	64(41.8%)	77(50.0%)	153(100%)

Table 4-43. Descriptive statistic of participants' color combination preferences among the irregular pattern set

	Irregular Pattern Set				
	Scene A (SC)	Scene B (SI)	Scene C (CC)	Scene D (CI)	Total
The Most Preferred Scene	54(35.3%)	81(52.9%)	16(10.5%)	2(1.3%)	153(100%)
The Least Preferred Scene	8(5.2%)	4(2.6%)	52(34.0%)	89(58.2%)	153(100%)

Qualitative Findings

In order to elaborate on reasons behind two-color combination preferences on the quantitative measures, participants were asked two questions as follow: 1) "Please explain what you like about this boutique store"; 2) "Please explain what you dislike about this boutique store". A content analysis was conducted that started with the following coding processes. First, the main "themes" emerging from the written comments were identified. Second, all the comments obtained from this study were classified under different identified themes. Later, the frequencies of the comments under each theme were counted for comparisons (Kumar, 2005). Regarding the "liking" and disliking", all responses from the total of eight boutique store scenes including four scenes in the regular pattern set and four scenes in the irregular pattern set were

categorized into different themes. For instance, if a participant said, “I like the color design on the ceiling”, it was categorized under the “color” theme. The frequency of comments under each different theme was calculated. Besides, the comments from eight different scenes were coded with different colors (Appendix F).

In the “what you like about” question, a total of 214 comments among the eight different store scenes were made by participants. One hundred and six comments were made regarding the four color combinations in the regular pattern set; One hundred and eight comments were made regarding the four color combinations in the irregular pattern set. As can be seen in Table 4-44, the distributions of frequency under each theme in the regular and irregular pattern sets were very similar.

Table 4-44. Descriptive distributions of themes emerging from written comments in the “what you like about” question

	Theme								
Scene	Composition of the space	Store Image	Color	Shopping Orientation	Emotion	Lighting	Color Pattern	Total n	%
Regular Pattern Set									
Scene A (SC)	16	8	4	2	1	1	0	32	(30.1%)
Scene B (SI)	15	6	1	3	3	1	0	29	(27.4%)
Scene C (CC)	9	3	5	1	0	1	1	20	(18.9%)
Scene D (CI)	5	7	8	1	1	2	1	25	(23.6%)
Total n	45	24	18	7	5	5	2	106	(100%)
%	(42.5%)	(22.6%)	(17.0%)	(6.6%)	(4.7%)	(4.7%)	(1.9%)		
Irregular Pattern Set									
Scene A (SC)	18	6	7	2	2	0	0	35	(32.4%)
Scene B (SI)	9	11	3	0	2	1	0	26	(24.6%)
Scene C (CC)	13	3	1	1	1	1	0	20	(18.5%)
Scene D (CI)	10	10	3	2	0	2	0	27	(25.0%)
Total n	50	30	14	5	5	4	0	108	(100%)
%	(46.3%)	(27.8%)	(13.0%)	(4.6%)	(4.6%)	(3.7%)	(0.0%)		

There were two themes emerging with the frequency over 10% in both the regular and irregular pattern set. The highest theme (Regular: 42.5%; Irregular: 46.3%) was related to the “composition of the space”, such as the spaciousness and organization of store. The second highest theme (Regular: 22.6%; Irregular: 27.8%) was related to “store image” especially the contemporary quality of the space. The third highest theme (Regular: 17.0%; Irregular: 13.0%) was related to “color”, such as the color applications on the ceiling and white shelving millwork.

Although the frequency of the comments related to perceptions of color was relatively higher than the other themes with frequency under 10%, participants’ perspectives regarding the perception of color were varied among eight scenes especially in the scenes with complex color scheme (CC and CI). Among a total of 32 (Regular: 17.0%; Irregular: 13.0%) comments under the "color” theme, some (40.7%) of them shared a similar perspective indicating their liking of the color combination applications on the ceiling:1) “I like the colors”; 2) “I like the colorful ceiling”; 3) “I like the color design on the ceiling”. However, the others (53.1%) shared another perspective indicating their liking of the achromatic color scheme within the store environment: 1) “I like the white walls and shelving”; 2) “everything is white makes it appealing to the eye”. Few (6.2%) of them indicated their liking of overall color scheme within the store: 1) “I like the color scheme”; 2) “I like the contrast of the ceiling with the white look of the store”. In addition, only two (1.9%) comments were made about “color pattern” in the regular pattern set; none of participants mentioned about “color pattern in the irregular pattern set. The qualitative data aligned with prior quantitative findings that there was no impact of pattern on individual preferences.

In the “what you dislike about” question, a total of 165 comments among the eight different store scenes were made by participants. Ninety-four comments were made regarding the four color combinations in the regular pattern set; seventy-one comments were made regarding the four color combinations in the irregular pattern set. As can be seen in Table 4-45, the “color” theme was the highest theme in both regular (45.7%) and irregular (40.8%) pattern set regarding disliking issue.

Table 4-45. Descriptive distributions of themes emerging from written comments in the “what you dislike about” question

	Theme								
Scene	Composition of the space	Store Image	Color	Shopping Orientation	Emotion	Lighting	Color Pattern	Total n	%
Regular Pattern Set									
Scene A (SC)	2	2	8	5	2	1	4	24	(25.6%)
Scene B (SI)	6	5	8	4	2	0	1	26	(24.5%)
Scene C (CC)	1	5	14	2	0	0	1	23	(24.5%)
Scene D (CI)	3	1	13	0	1	0	3	21	(22.4%)
Total n	12	13	43	11	5	1	9	94	(100%)
%	(12.8%)	(13.8%)	(45.7%)	(11.7%)	(5.3%)	(1.1%)	(9.6%)		
Irregular Pattern Set									
Scene A (SC)	1	1	4	4	1	0	0	11	(15.5%)
Scene B (SI)	6	1	3	3	0	2	0	15	(14.1%)
Scene C (CC)	6	3	13	2	3	0	2	29	(40.9%)
Scene D (CI)	1	3	9	3	0	0	0	16	(22.5%)
Total n	14	8	29	12	4	2	2	71	(100%)
%	(19.7%)	(11.3%)	(40.8%)	(16.9%)	(5.6%)	(2.8%)	(2.8%)		

Unlike the differences between the comments in the “what you like about” question, all the comments regarding disliking issue shared a similar perspective indicating their disliking of the colors on the ceiling. In addition, these comments further

indicated the contradictions between the colors on the ceiling and the perceptions of overall store environment. The results showed the applications of color combinations had somewhat negative effects on participants' liking among the all eight store scene.

Examples of these comments under the "color" theme in the "what you dislike about" question included in the following:

> The colors in the ceiling are distracting and do not fit with the style of the store.
> The purple and yellow roof is too flashy and lowers the elegance of the store.
> The colors don't really match the rest of the setup.
> The contrasting colors are unpleasant and distracting from the clothes.
> The colors on the ceiling seems to clash with the other colors in the room and aren't a pleasant combination.

Regarding to the disliking issue under the "color" theme, the scenes with complex color scheme (CC and CI) had higher frequency than the scenes with simple color scheme (SC an SI) in both the regular and irregular pattern set. As can be seen in Table 4-45, there were 43 comments made under the "color" theme in the regular pattern set. Twenty-seven (62.8 %) comments were made within the scenes with complex color scheme. Sixteen (37.2%) comments were made within the scenes with simple color scheme. In the irregular pattern, Twenty-two (75.9%) comments were made within the scenes with complex color scheme. Only seven (24.1%) comments were made within the scenes with simple color scheme. The results provided insights into prior quantitative analyses. The simple color scheme (SC and SI) were more preferred than the complex color scheme (CC and CI) in the regular and irregular set, since the complex color scheme (CC and CI) contradicted with the perception of overall store environment more than the simple color scheme (SC and SI) in a boutique store scene.

In previous findings regarding the liking issue, few comments (*n*=2, 0.9%) were made about “color pattern” among all the eight scenes. However, some participants (*n*= 11, 6.6%) indicated their disliking of “color pattern” especially in the regular pattern set (*n*=9, 5.5%). Most of the comments under the “color pattern” theme didn’t further address why people disliked the regular pattern. Only one person mentioned that “I dislike the pattern, because the checkered ceiling is sort of distracting”. The results suggested that the applications of color combinations in the regular pattern had greater effects on participants’ disliking than the irregular pattern.

In addition to prior qualitative findings regarding liking and disliking, participants were asked two questions in the two-color combination preference ranking section as follow: 1) “Please indicate your reasons for the most preferred one; 2) Please indicate your reasons for the least preferred one. A content analysis was conducted respectively for the qualitative data in the regular and irregular pattern set.

In the regular pattern set, the only difference between the four store scenes was the two-color combination application on the ceiling. As expected, all of 359 comments made by participants were related to perceptions of color regarding their most and least preferred scene in the regular pattern set, and all the responses related to perceptions of color were further categorized into different themes. For instance, if a participant said, “I like the color combination”, it was categorized under the “color combination” theme. The frequency of comments under each different theme was calculated. Besides, the comments from four different store scenes in the regular pattern set were coded with different colors (Appendix G).

According to prior quantitative analyses, the Scene B (SI) was ranked as the most preferred scene in the regular pattern set (*n*=73, 47.7%). As can be seen in Table 4-46, among the eighty-nine (52%) comments in the Scene B (SI), thirty-one (47.5%) comments made about the perceptions of “arousal” reflected that participants evaluated the Scene B (SI) as the least over stimulating and the calmest one. Some examples of comments under the arousal theme included the following: 1) “I feel calm and relaxed” 2) “the colors are less harsh on the eyes” 3) “the colors are not overwhelming”.

Table 4-46. Descriptive distributions of themes emerging from written comments regarding the most preferred scene in the regular pattern set

	Most preferred					
Theme	Scene A (SC)	Scene B (SI)	Scene C (CC)	Scene D (CI)	Total n	Total %
Color Combination	12	17	2	0	31	(18.1%)
Brightness	4	1	4	1	10	(5.8%)
Saturation	0	1	0	0	1	(0.6%)
Color emotion	12	7	2	0	21	(18.1%)
Arousal	22	31	1	1	55	(32.2%)
Pleasure	9	5	2	0	16	(9.4%)
Store image	1	0	1	0	2	(1.2%)
Overall Store Setting	8	17	0	0	25	(14.6%)
Total n (%)	68 (39.8%)	89 (52.0%)	12 (7.0%)	2 (1.2%)	171	(100%)

Seventeen (19.1%) comments were made about liking the “color combination”. The Simple/Incoherent color combination in the Scene B (SI) was perceived as the most preferred color combination which went well together. Seventeen (19.1%) comments were made about the perception of overall store settings. Participants reported that the Simple/Incoherent color combination in the Scene B (SI) matched the rest of the store

and also went with the color scheme of store when comparing to other three color combinations. Some examples of comments included the following: 1) “It seems to blend in more without taking the attention off the setting”; 2) “Colors fit the scene the most, without disturbing the entire setup of the store”; 3) “the colors fits the closest with the store's color scheme”. A conclusion can be drawn from these findings to verify why the Scene B (SI) was most preferred, that is, the “high level of liking toward the simple/incoherent two-color combination”, the “high level of consistency between the simple/incoherent two-color combination and the perceptions of overall store settings within the store scene”, and the “optimal level of arousal” were the main reasons contributing to participants’ color combination preferences. The scene A (SC) was ranked as the second preferred scene in the regular pattern set (n=68, 44.4%). As can be seen in Table 4-46, the eight-nine (39.8%) comments in the Scene A (SC) shared very similar perspectives with prior findings in the Scene B (SI) regarding the perceptions of arousal, the liking of color combination, and perception of overall store settings.

According to prior quantitative analyses, the Scene D (CI) was ranked as the least preferred scene in the regular pattern set (*n*=77, 50.0%). As can be seen in Table 4-47, among the eighty-four (44.7%) comments in the Scene D (CI), twenty-three (27.4%) comments were made about disliking the “color combination”. Some examples of comments included the following: 1) “It has the worst color combination” 2) “color don’t go very well on a ceiling” 3) “colors don't go together at all and are very uncomplimentary”. Twenty-two (26.2%) commends were made about the perceptions of “brightness”. Participants indicated that the color combination in the Scene D (CI) was

too dark. Fifteen comments (17.6%) were made about the perceptions of “arousal”. However, the perceptions of arousal were very different. Some participants reported that the color combination in the Scene D (CI) was boring and not exciting. Some people reported that the color combination was too loud and overwhelming. The contradiction among comments reveals that the perception of color may result from individual sensitivity or preference.

Table 4-47. Descriptive distributions of themes emerging from written comments regarding the least preferred scene in the regular pattern set

	Least preferred					
Theme	Scene A (SC)	Scene B (SI)	Scene C (CC)	Scene D (CI)	Total n	Total %
Color Combination	0	2	4	23	29	(15.4%)
Brightness	2	0	30	22	54	(28.8%)
Color Pattern	1	0	0	0	1	(0.5%)
Color emotion	2	0	7	4	13	(6.9%)
Arousal	3	0	25	15	43	(22.9%)
Pleasure	1	2	12	13	28	(14.9%)
Store image	0	0	1	2	3	(1.6%)
Overall Store Setting	0	0	12	5	17	(9.0%)
Total n (%)	9 (4.8%)	4 (2.1%)	91 (48.4%)	84 (44.7%)	188	(100%)

The Scene C (CC) was ranked as the least preferred scene in the regular pattern set (*n*=64, 41.8%). As can be seen in Table 4-47, the comments in Scene C (CC) shared very similar perspectives with prior findings in the Scene D (CI). No variations appeared in the participants who least preferred the Scene C; uniformly their respondents saw the space as too distracting and overly stimulating.

In the irregular pattern set, the only difference between the four store scenes was the two-color combination application on the ceiling. As expected, the majority (97.3%) of the total 370 comments related to the perception of color in the most and least preferred scene. Only 10 (2.7%) comments were made about the color pattern scattering in each store scene. According to prior quantitative analyses, no statistical pattern effect on participants' color combination preference was obtained. Therefore, a content analysis was conducted for the color-related comments. All the responses related to perceptions of color were further categorized into different themes. The frequency of comments under each different theme was calculated. Besides, the comments from four different store scenes in the irregular pattern set were coded with different colors (Appendix H).

According to the quantitative analyses, the results of preference ranking in the regular and irregular pattern set were identical. The Scene B (SI) (*n*=81, 58.2%) was ranked as the most preferred scene, and the Scene A (SC) (*n*=54, 35.3%) was ranked as the second preferred scene; the Scene D (CI) (*n*=89, 58.2%) was ranked as the least preferred scene, and the Scene C (CC) (*n*=52, 24%) was ranked as the second least preferred scene in the irregular pattern set. Interesting enough, the comments made by participants who most preferred the Scene B (SI) and Scene A (SC) were found very similar to each other and the reasons and examples of comments presented earlier in the regular pattern set.

As can be seen in Table 4-48, among the 104 (55.3%) comments in the Scene B (SI), twenty-nine (27.9%) were made about liking the "color combination". The comments reflected that the color combination in the Scene B (SI) mixed colors nicely

and looked the best together. Twenty-eight (26.9%) comments were made about the perception of “overall store settings”. Participants reported that the Simple/Incoherent color combination in the Scene B (SI) matched the rest of the store and went well with the color scheme of store when comparing to other three color combinations. Twenty-five (24.0%) comments made about the perceptions of “arousal” reflected that participants evaluated the Scene B (SI) as the least over stimulating and the calmest one. Most comments in Scene A (SC) were similar to the comments made about the perceptions of arousal in the Scene B (SI).

Table 4-48. Descriptive distributions of themes emerging from written comments regarding the most preferred scene in the irregular pattern set

	Most preferred					
Theme	Scene A (SC)	Scene B (SI)	Scene C (CC)	Scene D (CI)	Total n	Total %
Color Combination	6	29	2	0	37	(19.7%)
Brightness	1	4	3	0	8	(4.3%)
Color Pattern	0	5	4	0	9	(4.8%)
Color emotion	10	2	5	1	18	(9.6%)
Arousal	24	25	5	0	54	(28.7%)
Pleasure	9	7	2	1	19	(10.1%)
Store image	2	4	0	0	6	(3.2%)
Overall Store Settings	9	28	0	0	37	(19.6%)
Total n (%)	61 (32.4%)	104 (55.3%)	21 (11.2%)	2 (1.1%)	188	(100%)

As can be seen in Table 4-49, there was a total of ninety-eight (53.8%) comments made in the Scene D (CI). These comments were found very similar to some reasons presented earlier in the regular pattern set including disliking the “color combination” (20.4%) and the perceptions of “brightness” (14.3%).

In addition, thirty-six comments were made about perceptions of “pleasure”. Participants reported that the Complex/Incoherent color combination in the Scene D (CI) was ugly, unpleasant and less appeasing when comparing to the other three color combinations. Seventeen (17.3%) comments were made about the perception of “overall store settings”. Participants reported that the Scene D (CI) failed to match the rest of the store. Some examples of comments included the following: 1) “the colors do not blend well with the color scheme of store”; 2) “the color doesn't look right with the rest of the décor”; 3) “the colors on the ceiling do not blend well with the rest of the atmosphere of the store”. The comments made by people who least preferred the Scene C (CC) about the “overall store settings” were similar to the comments in the Scene D (CI). Moreover, participants who least preferred the Scene C (CC) indicated that it was too distracting and overly stimulating.

Table 4-49. Descriptive distributions of themes emerging from written comments regarding the least preferred scene in the irregular pattern set

	Least preferred					
Theme	Scene A (SC)	Scene B (SI)	Scene C (CC)	Scene D (CI)	Total n	Total %
Color Combination	1	0	0	20	21	(11.5%)
Brightness	0	3	24	14	41	(22.5%)
Saturation	0	0	0	3	3	(1.6%)
Color emotion	3	0	3	2	8	(4.5%)
Arousal	4	0	22	6	32	(17.7%)
Pleasure	1	1	5	36	43	(23.6%)
Store image	0	0	1	0	1	(0.5%)
Overall Store Settings	1	0	15	17	33	(18.1%)
Total n	10	4	70	98	182	(100%)
(%)	(5.5%)	(2.2%)	(38.5%)	(53.8%)		

In sum, the findings of qualitative analyses aligned with the quantitative analysis that participants' preferences regarding the four different two-color combination applications were consistent among the two different pattern set. In other words, no statistical pattern effect on the color combination preferences was found in the current study. In addition, the results of quantitative and qualitative analysis are discussed further in the Chapter 5 in order to answer the research questions posed in Chapter 1.

CHAPTER 5
DISCUSSION

The main purpose of this study was to understand the effects of two-color combination applications in a boutique store on individual perception of complexity and coherence, color emotions, and store images, emotional states of arousal and pleasure, and color preferences. Therefore, these variables and the research questions posed in Chapter 1 are reviewed with the previous theory in Chapter 2 and the findings in Chapter 4. Later, limitations, future research recommendations, implications and conclusion are presented.

Perception of Complexity

According to classic color literatures (Acking & Küller, 1972; Valdez & Mehrabian, 1994), color saturation (chroma) influenced the perception of complexity; colors with higher saturation were perceived more complex. Therefore, saturation was manipulated for distinguishing two different complex levels of two-color combination used as the environmental stimuli in the study framework. In the pilot study, the manipulations of saturation were shown to contribute to different complexity levels of two-color combinations on color swatches. The results showed that all participants perceived the complex color scheme (CC and CI) as the more complex combination in comparison with the simple color scheme (SC and SI) on color swatches (Appendix I). The results supported prior research (Acking & Küller, 1972; Valdez & Mehrabian, 1994) indicating that saturation was associated with individual perceptions of complexity.

Interestingly, the findings of the pilot study revealed that individual perceptions of complexity toward the four two-color combinations on color swatches were also significantly affected by different coherence levels. All participants evaluated the

coherent color scheme (SC and CC) as the more complex combination, rather than the incoherent color scheme (SI and CI). The levels of coherence (coherent versus incoherent) were distinguished by color value based on the color harmony research (Marshall, 1980; Ou & Luo, 2006). The findings of the pilot study suggested that value may influence the perception of complexity on color swatches, that it, the color combinations with higher and equal value (Yellow: 100% Purple: 100%) were perceived as more complex than the color combinations with lower and unequal value (Yellow: 50%; Purple: 100%). The results supported the findings of Hogg et al. (1979) color emotions studies indicating that value was associated with the complexity factor of environmental stimuli on the simple/complex emotion scale.

Additionally, the results of the pilot study showed individual perceptions of complexity toward the four different two-color combinations on color swatches were significantly influenced by the interaction of complexity (simple versus complex) and coherence (coherent versus incoherent) levels. Participants perceived the Swatch 3 (Complexity/Coherent) as the most complex color combination and the Swatch 1(Simple/Coherent) as the least complex color combination. Moreover, when applying the four two-color combinations into the experimental achromatic boutique store scene, the results aligned with the findings in the pilot study that showed the Complex/Coherent (CC) color combination was perceived as the most complex one and the Simple/Coherent (SC) color combination was perceived as the least complex one in the irregular pattern set. The findings suggested a positive relationship between individual perceptions of complexity and individual states of arousal toward the four two-color combinations in the current high-end retail environment, since the results of the

perceptions of complexity and the evaluations of arousal states toward different two-color combinations remain constant. The result aligned with previous studies (Giboa & Rafaeli, 2003; Kaltcheva & Weitz, 2006) indicating a positive linear relationship between states of arousal and complexity in retail environments.

Although the Complex/Coherent (CC) and Complex/Incoherent (CI) color combination shared the same higher saturation (100%) when compared to the simple (25%) color combinations (SC and SI), participants perceived the Complex/Coherent (CC) color combination as more complex than the Complex/Incoherent (CI) color combination. On the other hand, though the Simple/Coherent (SC) and Simple/Incoherent (SI) color combination shared the same lower saturation (25%) when compared with the Complex (100%) color combinations (SC and SI), participants perceived the Simple/Coherent (SC) color combination as less complex than the Simple/Incoherent (SI) color combination. The results suggested that the manipulation of color saturation was not the only factor associated with individual perceptions of complexity.

The instability of yellow hue and the simultaneous contrast effect of complementary color combinations may provide possible explanations for the current study's findings. Josef Albers (1963, as cited in Portillo, 2009) elaborated on his stance that when two colors especially complementary colors were placed closely together, simultaneous contrast created an illusion in which the colors appear more saturated in hue. In the current study, the color combination was arranged closely together on the color swatches and the ceiling of the simulated boutique store scene. Although the complementary color hues defined by Munsell were consistently manipulated (yellow:

60°; purple: 270°) among all the four color combinations in the HSV color space, the complementary hues in the Complex/Coherent (CC) color combination manipulated with full saturation (100%) and full value (100%) appeared as a the most contrasting one among all the four color combinations. Yellow was noted as an unstable hue which shifted readily when changing in value (lightness) (Albers, 1969). Therefore, lowering the value (50%) of the yellow hue in the Complex/Incoherent (CI) color combination made the yellow hue shift to green, so the Complex/Incoherent (CI) (green and bright purple) color combination appeared as a less contrasting one than the Complex/Coherent (CC) (bright yellow and bright purple) color combination (Appendix I). Due to the effect of simultaneous contrast, the Complex/Coherent (CC) color combination was perceived to be more saturated, so it was perceived as the most complex color combination

On the other hand, the complementary hues in the Simple/Coherent (SC) color combination manipulated with low saturation (25%) but full value (100%) appeared as a less contrasting pair. Besides, lowering the value (50%) with a decreased saturation (25%) of the yellow hue in the Simple/Incoherent (SI) color combination made the yellow hue shift to achromatic grey, so the Simple/Coherent (SC) (pastel yellow and pastel purple) color combination appeared as a less contrasting one than the Simple/Incoherent (SI) (grey and pastel purple) color combination. Due to the effect of simultaneous contrast, the Simple/Coherent (SC) color combination may be perceived as the least complex color combination.

Pattern has been identified as one information characteristic affecting the perception of complexity in a design (Donderi, 2006; Pieters, 2010). The objects

arranged in an irregular pattern were perceived as more complex than the objects arranged in a regular pattern (Donderi, 2006; Pieters, 2010). In the present study, although two levels of two independent variables were manipulated in the irregular pattern set, no statistical significance was found for the perception of complexity in the regular pattern set. When comparing the mean scores of the independent variables in the regular and irregular pattern set, the findings suggested the regular pattern set was perceived as more complex than the irregular pattern set which seems to contradict the expectation. This may be due to the relationship between color arrangements and the contrast effect in the present study. When two colors especially complementary colors were placed closely together, simultaneous contrast created an illusion where in the colors appeared more saturated in hue (Munsell, 1905). In the current study, the color combination was arranged repetitively and side by side on the ceiling of the boutique store scene in the regular pattern set. Therefore, overall the color combinations in the regular pattern set may look more saturated than in the irregular pattern set, so the regular pattern set was perceived as more complex.

Additionally, according to Donderi (2006), complexity is greater when the objects in the design form an irregular rather than a regular pattern, with the extreme being a random distribution of objects across space. Though the irregular pattern was formed by randomly assigned square shapes, it was not dramatically different from the regular pattern. The square shapes were still arranged following certain rules for the irregular pattern rather than in an extremely random arrangement by overlapping the color shapes or varying the spacing between color shape placements. The similarity between

regular and irregular patterns may weaken the impact of color pattern difference on perceptions of complexity.

However, it was beyond the scope of the study to examine the effect of color pattern on perceptions of complexity. Beside, due to the study design, each participant only responded to one of the eight boutique store scene for evaluations of each dependent variable. Therefore, it was unclear how color pattern difference affects perception of complexity in this high-end retail environment without comparisons for reference. It was suggested that further studies can replicate and expand the current study framework to investigate the interaction effects of color combinations and pattern differences (regular versus irregular) on perceptions of complexity in a high-end retail environment. Moreover, the impact of dissimilarity of color combination arrangements (regular versus extremely random arrangement) or irregularity of color shapes (e. g. a mix of square, triangular and round shapes) on perception of complexity in a design (Donderi, 2006; Pieters, 2010) can be further assessed in future studies.

Perception of Coherence

Coherence, referring to the “similarity”, “balance” and “symmetry” (Wertheimer, 1924), “coherence” (Koffka, 1935), “congruity” (Lauer, 1979), “unity” (Veryzer & Hutchinson, 1998), “order” (Nasar, 2000), is similar to the “color harmony” principles. According to the literature (Marshall, 1980; Ou & Luo, 2006), color value plays an important role in perceptions of coherence. Marshall (1980) elaborated the qualitative rule that colors with unequal value (lighted or darkened) combined as a combination will be perceived as discordant (incoherent). Ou and Luo (2006) investigated harmony in two-color combinations using color swatches selected from CIELab color space for deriving a quantitative model. They found the color combination with a higher value was

more likely to be perceived as harmonious (coherent) (Ou & Luo, 2006). Therefore, value was manipulated for distinguishing two different coherence levels of a two-color combination and used as the environmental stimuli in the study framework. The perception of coherence was measured by four bipolar semantic scales including incoherent/ coherent, disharmonious/ harmonious, unbalanced/ balanced, and dissimilar/similar. Although the reliability value of these scales for measuring coherence was good at 0.89, the present study didn't combine them into one dimension, because individual dimensions may show different findings. Additionally, color coherence/incoherence has not been studied much, so studying how each dimension works is worth attention.

In the pilot study, the manipulations of value on color swatches seemed to contribute to different coherence levels of two-color combinations on the disharmonious/ harmonious and dissimilar/similar scales but not for the incoherent/coherent and unbalanced/ balanced scales. All participants perceived the coherent color scheme (SC and CC) as the more harmonious (similar) color combination than the incoherent color scheme (SI and CI). However, when applying the four two-color combinations into the boutique store scene, no significant difference was found between coherence levels in both the regular and irregular pattern. The results suggested the color harmony principles (Marshall, 1980; Ou & Luo, 2006) may work for color swatches but fail to distinguish the coherence levels in an interior context.

Interestingly, the findings of the pilot study revealed that individual perceptions of coherence toward the four two-color combinations on color swatches were also significantly affected by different complexity levels on each scale. All participants

evaluated the simple color scheme as a more coherent combination than the complex color scheme on all the four scales. The results of the pilot study suggested a negative correlation between complexity and coherence. When the complexity level of the color combination increased, the perception of coherence decreased. The results confirmed Deng's assumption (2010) indicating that increasing complexity implies decreasing similarity and unity in most cases, and also aligned with Acking and Kuller's findings (1972) that the variation of chromaticity can determine viewers' evaluations of visual complexity and coherence. Specifically, the color combinations with the higher saturation were not only perceived as more complex but also perceived as less coherent.

Additionally, the results of pilot study showed individual perceptions of coherence toward the four different two-color combinations on color swatches were significantly influenced by the interaction of complexity (simple versus complex) and coherence (coherent versus incoherent) levels. Participants perceived the Swatch 1 (Simple/Coherent) as the most coherent color combination and the Swatch 3 (Complex/Coherent) as the least coherent color combination. Moreover, when applying the four two-color combinations into the boutique store scene, the results aligned the findings in the pilot study that participants perceived the store scenes with the simple color scheme (SC and SI) as more coherent than those with the complex color scheme (CC and CI) in the irregular pattern set. The findings reconfirmed the negative correlation between complexity and coherence.

In addition, the qualitative findings reflected that the relationship between color combination and the overall environment setting on perceptions of coherence. The store

scene with a simple color scheme (SC and SI) related to the rest of the store and went with the color scheme of store, whereas the store scene with a complex color scheme (CC and CI) was perceived as not connecting with the rest of the store. According to the Kaplan and Kaplan (1982), how well the pieces of visual information offered in the environment reinforced each other determines the perceptions of coherence of a scene. Hence, the store scene with a simple color scheme (SC and SI) was perceived as more coherent. The findings suggested that individuals tended to evaluate the coherence of the overall interior context. Therefore, it is not enough to only select colors without considering environmental preferences for the coherence chacterestics.

Regarding the perceptions of coherence, unlike the irregular pattern set, no significant difference was found for the independent variables in the regular pattern set. When comparing the mean scores of the independent variables in the regular and irregular pattern set, the result suggested the irregular pattern set was perceived as more coherent than the regular pattern set. The finding reinforced the negative correlation between complexity and coherence but seemed to oppose the Gestalt theories of figural goodness (Wertheimer, 1924) that a coherent (good) figure should be “similar”, “balanced” and ”symmetrical” to each other.

However, qualitative comments revealed that the irregular pattern was perceived as more coherent than the regular pattern, because the perceptions of coherence regarding color pattern were also associated with the overall interior context especially in terms of atmosphere (image). For instance, “the irregular pattern matches the store atmosphere”, “the irregular pattern isn't taking away from the clothing”, and “the regular pattern tiles on the ceiling clashes with the mood and the clothing. That is, the randomly

arranged irregular pattern affected perceptions of the overall store atmosphere, whereas the repetitive regular pattern did not. Hence, the irregular pattern was perceived as more coherent based on Kaplan and Kaplan (1982). However, these assumptions were lack of statistical support, since the present study didn't examine the effect of color pattern on perceptions of coherence. Therefore, further studies can replicate and expand the current study framework to study the interaction effects of color combinations and pattern differences (regular versus irregular) on perceptions of coherence in a high-end retail environment.

Color Emotions

The four two-color combinations with different complexity and coherence levels as the environmental stimuli in the study framework were also in terms of emotional associations (Hogg, 1969; Hogg et al., 1979; Ou & Luo, 2004; Kaya & Epps, 2004). Therefore, color emotions were measured to see how different color attributes of two-color combinations associated with individual perceptions of color emotions in the current high-end retail environment.

According to Ou and Luo (2004), value corresponds to a perception of visual weight (light/heavy response). The color combination with higher value should be perceived lighter, whereas the color combination with lower value should be perceived heavier. However, the current study's findings seemed to contradict the expectation that participants perceived the coherent color scheme (SC and CC) with higher value as heavier one than the incoherent color scheme (SI and CI) in the regular pattern set. This may be due to the different methodologies. Ou and Luo (2004) investigated the relationship between color attributes and perceptions of color emotions for single and two-color combinations through color swatches. However, the current study examined

how color attributes of two-color combinations affect individual perceptions of color emotions in a simulated boutique store scene. The findings suggested that perception of visual weight for color combinations in a space may be influenced by the overall context of a space and pattern, so the perceptions of visual weight on color swatches and interior context can be compared in the future studies. Moreover, Ou at al. (2010) indicated that context and circumstance play a significant role in emotional responses, because there are many other factors that are likely to be influential in the color emotion responses, such as lighting conditions and texture effect. These factors can also be considered in the future studies.

Additionally, perceptions of visual weight were significantly affected by the complexity levels in both the regular and irregular pattern set. The complex color scheme (CC and CI) was perceived as heavier, whereas the simple color scheme (SC and SI) was perceived as lighter. Moreover, an interaction effect between complexity and coherence was found in the irregular pattern set. The Complex/Coherent (CC) color scheme was perceived as the heaviest combination, whereas the Simple/Coherent (CI) color scheme was perceived as the lightest combination. The findings suggested a positive correlation between the perceptions of complexity and visual weight (light/heavy). This may be due to the interrelations of the three color dimensions. The tinted (value: 100%) and tonal (saturation: 25%) complementary color hues (yellow/purple) in Simple/Coherent (SC) combination appeared as the pastel (less contrasting) color scheme and associated with light emotion, whereas the tinted (value: 100%) and tonal (saturation: 100%) complementary color hues (yellow/purple) in Complex/Coherent (CC) combination appeared as the bright (highly contrasting) color

scheme and associated with heavy emotion. The results suggested that the three attributes work as an interrelated sensation influencing individual perceptions of complexity and visual weight in an interior context, so the three dimensions should not be fully isolated in future studies.

Although the present study didn't examine the interaction of color combinations and color patterns on perceptions of visual weight, when comparing the mean scores of the independent variables in the regular and irregular pattern set, it was found that the regular pattern set was perceived as heavier than the irregular pattern set. The findings reinforced the positive correlation between perceptions of complexity and visual weight and suggested that future study can replicate the current study framework to investigate the interaction effects of the complexity levels and coherence levels of color combination and color pattern differences on perceptions of visual weight in a high-end retail environment.

Regarding visual activity, the findings in the irregular pattern set showed the perceptions of still/vibrant and passive/active emotions appeared to be significantly affected by the complexity (saturation) levels. The results confirmed that saturation corresponds to the still/vibrant and passive/active response (Hogg, 1969 & 1979; Ou & Luo, 2004). Participants perceived the store scenes with the complex color scheme (CC and CI) as a more vibrant and active combination than the store scenes with simple color scheme (SC and SI) especially in the irregular pattern set. Berlyne (1974) suggested a positive relationship between complexity, arousal states and visual activity, because the arousal states denote the degree to which individuals feel "active which arises when increasing the complexity of stimuli in the environment. The current study

findings confirmed that the complex color scheme (CC and CI) was perceived as more complex, arousing, and vibrant/active combination than the simple color scheme (SC and SI).

Additionally, unlike the irregular pattern set, no significant difference was found for the independent variables in the regular pattern set regarding visual activity. When comparing the mean scores of the independent variables in the regular and irregular pattern set, the findings revealed that applying simple color combination (SC and SI) in a repetitive regular pattern may increase perception of visual activity than in a randomly arranged irregular pattern in the current study. This may be due to positive correlation between complexity and visual activity in the high-end retail environment. The regular color pattern was perceived as more complex than the irregular pattern set, so individuals perceived the simple color combination in the regular pattern more complex. The results suggested that the possible interaction effects between color combination and color pattern differences on perceptions of visual activity in an interior context can be examined in future studies.

Perception of Store Image

Color is often identified as contributing to store atmosphere by distinguishing retail brands (Bellizzi et al., 1983; Bellizzi & Hite, 1992; Baker, 1992; Crowley, 1993; Alawadhi, 2009). However, existing studies typically examine the impact of single colors in retail environments. Therefore, this study examined the effects of two-color combinations on individual perceptions of store image in a “high-end” retail environment.

First of all, the “high-end” store image of the experimental achromatic boutique store scene was confirmed in the pilot study. All participants agreed that the achromatic

store scene represents a “sophisticated” and “upper class” store image. The “high-end” store image was reconfirmed by asking the participants to list adjectives to describe their overall impression of the achromatic boutique store scene in an open-end question. The pilot study results supported the intended environmental image in the current study framework.

Later, when applying the four two-color combinations of different complexity and coherence levels to the achromatic boutique store scene, the results were confirmed with prior color research (Alawadhi, 2009; Bellizzi et al., 1983; Bellizzi & Hite, 1992; Baker, 1992; Crowley, 1993) and suggested color combinations influenced on the perceptions of store image (brand) in retail environments. The findings showed the levels of agreement on the “high-end” store image were significantly influenced by the complexity levels of color combination in both the regular and irregular pattern set regardless of the coherence difference. All participants agreed the store scenes with simple color scheme (SC and SI) were more sophisticated and upper class than the store scenes with complex color scheme (CC and CI). The qualitative data also reflected that the simple color scheme (SC and SI) reinforced the image of overall store setting, whereas the complex color scheme (CC and CI) distracted from it. The results suggested that perception of store images for color combinations in a space may be influenced by the overall context of a space and pattern. However, the present study didn’t examine the interaction of color combinations and color patterns on perceptions of store image. When comparing the mean scores of the independent variables in the regular and irregular pattern set, it was found that the irregular pattern set was perceived as more sophisticated and upper class one than the regular pattern set.

Therefore, it was suggested that future studies can investigate the interaction effects between color combinations and color patterns on perceptions of store image in a high-end retail environment.

Moreover, the results revealed that applying any of the four two-color combinations to the store scene decreased individuals' perception of a "high-end" image toward the store scene. The mean scores in both regular and irregular pattern sets were lower overall than the means scores in the achromatic store scene. According to Scott (2008), the environmental colors in a three-dimensional space interacted differently depending on the way they were placed and can further influence the perceptions of mood and atmosphere. Moreover, the color and form must be presented to the viewer in a manner that achieves visual unity (Portillo, 2009). The findings of the current study suggested that, regardless of the variations of value, saturation, and color patterns, applying the color combination dominantly on the one-dimensional surface (ceiling) in the interior context may weaken the perceptions of a "high-end" store image, because the color combination doesn't blend to the rest of color schemes in the store to achieve visual unity of the "high-end" store image. However, it was beyond the scope of the current study to examine the impact of color combination applications on perceptions of store image. Therefore, it was suggested that future studies can apply the color combinations to the space in different ways (e.g. blending the color combination three-dimensionally) and compare the results with the current study.

Arousal States

Arousal is a well-accepted measure to investigate the relationship between color stimuli and individual emotional states for the prediction of preference, store patronage and purchase intentions in retail environments (Bellizzi & Hite, 1992; Babin et al., 2003).

However, these previous studies only examined single colors as the environmental stimuli on the M-R model in retail environments. Therefore, this study examined the relationship between two-color combinations and individual emotional states in the high-end retail environments.

The states of arousal denote the degree to which individuals feel stimulated, excited, or active in the environment (Berlyne, 1974). The findings of this study suggested that individual arousal states toward the four different two-color combinations in the high-end retail environments were significantly affected by different complexity levels of the two-color combinations in both the regular and irregular pattern set. The results aligned with previous studies indicating that arousal levels can be influenced by color in retail environments (Babin et al., 2003; Bellizzi & Hite, 1992). Moreover, when the complexity level of two-color combination increased, the evaluations of arousal states increased in both the regular and irregular pattern set. In other words, all participants perceived the complex color scheme (CC and CI) as a more arousing combination than the simple color scheme (SC and SI). The results not only reinforced the positive linear relationship between arousal and complexity in retail environments (Giboa & Rafaeli, 2003), but also supported that individual states of arousal increased linearly with color saturation in retail environments (Kaltcheva & Weitz, 2006), since "saturation" was manipulated for different levels of complexity in the current study based on the prior color complexity research (Acking & Küller, 1972).

Additionally, in the irregular pattern set, the results showed that individual states of arousal toward the four different two-color combinations were significantly influenced by the interaction of complexity (simple versus complex) and coherence (coherent versus

incoherent) levels. The Complex/Coherent (CC) color scheme was perceived as the most arousing combination, whereas the Simple/Coherent (SC) color scheme was perceived as the least arousing combination. The findings reinforced the positive correlation between perceptions of complexity and arousal states and suggested that the “simultaneous contrast effect” of complementary color combinations may influence the perceptions of complexity and arousal states. The Complex/Coherent (CC) color appeared more saturated, so it was perceived as the most arousing (complex) color combination; conversely, the Simple/Coherent (SC) color appeared less saturated, so it was perceived as the least arousing (complex) color combination.

Moreover, the qualitative data reflected that the highly saturated Complex/Coherent (CC) color clashed with the overall neutral color theme in the boutique store scene. The color combination with less contrast created a “calm” color image (Kobayashi, 1990) which was associated with the arousal states scale (Calm/Excited) used in the current study. The findings suggested that the color image created by the Complex/Coherent scheme may contrast the most with the “calm” color image of the overall neutral color theme among the four color combinations, so it was perceived as the most arousing color combination. On the other hand, the Simple/Coherent (SC) color appeared as a lower contrasting (less saturated) pair. Therefore, the findings suggested that the color image created by the Simple/Coherent (SC) color combination was similar to the “calm” color image of the overall neutral color theme among the four color combinations, so it was perceived as the least arousing color combination.

Due to the positive linear relationship between arousal and complexity, the irregular pattern set was expected to be more arousing than the regular pattern set (Donderi, 2006; Pieters, 2010). However, when comparing the mean scores of the independent variables in the regular and irregular pattern set, the results aligned with the findings regarding perceptions of complexity in that the regular pattern set was perceived as more arousing than the irregular pattern set. Therefore, it was suggested that future studies can investigate the interaction effects between color combinations and color pattern differences on individual arousal states in a high-end retail environment.

Pleasure States

Emotional states indicated the amount of pleasure and arousal that individuals experienced within a retail environment. Pleasure denotes the degree to which individuals feels happy or satisfied in an environment (Donovan & Rossiter, 1982; Donovan et al., 1994; Kaltcheva & Weitz, 2006; Park et al. 2010). The findings of this study revealed that individual pleasure states toward the four different two-color combinations in the high-end retail environments were significantly affected by different complexity levels in both the regular and irregular pattern set. Participants perceived the simple (SC and SI) color as a more pleasing combination than the complex (CC and CI) color. The strong connection between the complexity levels of the two-color combination and individual' pleasure states in this study confirmed the connection between environmental dimensions and state of pleasure in the Mehrabian-Russell model. The results also aligned with previous studies indicating that pleasure levels can be influenced by color in retail environments (Bellizzi & Hite, 1992; Crowley, 1993; Babin et al., 2003).

Moreover, the findings aligned with Giboa and Rafaeli's studying (2003) suggesting a positive correlation between pleasure states and perceptions of coherence. Participants perceived the simple color scheme (SC and SI) as more coherent and pleasing; conversely, participants perceived the complex color scheme (CC and CI) as less coherent and pleasing. Furthermore, a positive relationship was also found between the pleasure states and two-color combination preference, since the evaluations of pleasure states and overall "liking" (preference) remained consistent. The results aligned with previous studies (Mehrabian & Russell, 1974; Donovan & Rossiter, 1982; Kaltcheva & Weitz, 2006; Park et al. 2010) and supported the role of pleasure for determining individual approach-avoidance behaviors (preference).

In addition, the interaction effect between complexity and coherence levels almost reach the significant level (p=0.52) in the irregular pattern set. The Simple/Coherent (SC) color scheme was perceived as the most pleasing combination, whereas the Complex/Coherent (CC) color scheme was perceived as the least pleasing combination. The results suggested a negative correlation between pleasure states and perceptions of complexity rather than the curvilinear relationship predicted by prior theory (Berlyne, 1974). A possible explanation may be found in the distribution of complexity rating in the irregular pattern set. Although the rating of the Simple/Coherent (SC) color scheme was relatively low at 2.59 on a 7-point bipolar scale when compared to the other three color combinations, it was not an extremely low at 0 or 1. The ratings of other color combinations were larger than 3. These ratings suggested the environmental stimuli were perceived as having moderate to high complexity belonging to the negative side of the invert "U" distribution. That is, the Simple/Coherent (SC) color may reach the

moderate complexity, so the states of pleasure decreased linearly when the complexity level of color combinations increased from SI, CI to CC.

Additionally, the distribution of arousal states ratings in the irregular pattern set revealed that the rating of the Simple/Coherent (SC) color was relatively low at 3.12 on a 7-point bipolar scale, and the ratings of the other color combinations were larger than 4. The Complex/Coherent (CC) color scheme had the highest rating at 5. According to Bellizi et al. (1983), too much excitement and attraction created by a color scheme within a retail environment may become uncomfortable and irritating. The findings aligned with Bellizi et al. (1983) suggesting the Complex/Coherent (CC) color scheme in a boutique store scene may be too arousing for viewers, so it became the most irritating and the least pleasing color combination. Giboa and Rafaeli (2003) found the interplay of complexity (moderate complex) and coherence (high coherent) in a retail design can lead to the highest pleasure and approach tendencies due to the way-finding issues. Complex designs may impede navigation, so the introducing of coherence chacterestics was needed to facilitate wayfinding within a retail environment. Though their study did not particularly focus on color issues, it gave an insight to the importance of controlling the complexity (arousing) and coherence levels to appeal to consumers within a retail environment, which was also reinforced by the current study's results.

According to Kaltcheva and Weitz (2006), a consumer's motivational orientation may moderate the effect of the arousal on the pleasantness of a retail environment (Kaltcheva & Weitz, 2006). When consumers have a recreational motivational orientation, high arousal has a positive effect on pleasure states; whereas when consumers have a task-oriented motivational orientation, high arousal decreases

pleasure states in retail environment. It was assumed that a boutique store may have predominantly recreational-oriented consumers who perceived the highly arousing boutique store scene as the more pleasing one. However, the results seemed to contradict the expectation. This may be due to the types of recreational shoppers in different market segments, since the findings of Kaltcheva and Weitz's study were developed using a simulated ordinary music store scene. Wirtz, Mattila, and Tan (2000) noted that people associated specific expectations with specific retail setting. Portillo (2009) also argued that though designing chromatic, highly stimulating physical environment was recommended for the recreational shoppers in some consumer research, such shoppers may differ depending on the market segment. For instance, one of her (Portillo, 2009) case studies in designing a Korean luxury shopping interior noted that, in general, the tonal, sophisticated interiors are more aesthetically pleasing (appealing) to the recreational shoppers especially in the luxury sector. Therefore, the recreational shopper in a high-end sector (boutique store) may differ from a recreational shopper in a low-end (ordinary music shop) sector, so their expectations and responses with the retail setting are different. The findings suggested that future studies can examine how shopping motivational orientations (task versus recreational) mediate emotional states toward the color combination stimuli in a high-end retail environment.

In addition, the current study's findings revealed a positive relationship between visual weight (light/heavy) and pleasure states in the irregular pattern set. The lightest Simple/Coherent (SC) color theme was perceived as the most pleasing one, whereas the heaviest Complex/Coherent (CC) color theme was perceived as the least pleasing one. The perceptions of visual weight in relations to the interrelation of color attributes

have been addressed in the prior discussion. The findings suggested the interrelation of color attributes should be considered for creating appropriated visual weight in interior context to increase individual pleasure states toward the high-end retail environment. A tinted and tonal complementary color hues (yellow/purple) associating with light emotion may be suggested as the color scheme for making a high-end retail environment.

In addition, classic color preference researcher found that females preferred pastel colors, pale and subdued color tones, whereas males preferred brilliant hue tints and full colors tones (Warner, 1949). Therefore, the pastel, pale and subdued tonal color scheme in the Simple/Coherent (SC) combination may be perceived as the more pleasing combination by female participants, whereas bright and full tonal color scheme in the Complex/Coherent (CC) combination may be perceived as the more pleasing combination by male participants. The distribution of demographic chacterestics showed the study sample was composed of more females (56.86 %) than males (43.14%). Therefore, gender difference may be involved in the current study's findings. However, it was beyond the study scope to examine the gender differences on each dependents variable, but future studies can further compare the gender effect by a replication of this study.

Though the present study didn't examine the interaction of color combinations and color patterns on states of pleasure, when comparing the mean scores of the independent variables in the regular and irregular pattern set, it was found that the irregular pattern set was perceived as more pleasing one than the regular pattern set. The findings revealed a positive correlation between perceptions of coherence and pleasure states that aligned with Kaplan and Kaplan (1987) indicating that the

coherence characteristic of a scene can predict preference (pleasure states). The qualitative data revealed that participants perceived the irregular pattern set as more coherent and pleasing due to the relationship between color patterns and the overall interior context especially in terms of atmosphere (image). The findings suggested the importance of selecting color patterns while giving consideration to environmental preferences for creating a more pleasing retail environment.

In addition, the asymmetry preference was found to be associated with a creative personality. “Asymmetry was thought to allow into the perceptual system to greatest possible richness of experience” (Runco & Pritzker, 1999, p. 363), so it was preferred by creative individuals. The young generation has been identified as the more creative group. Interestingly, the current study selected participants from ages 18 to 30 years to target young consumers. The results suggested that using the irregular color pattern should be perceived as more creative and pleasing to the young market segment. Future studies can replicate the current study to examine the interaction of color combination and color pattern difference on pleasure states and further compare the age effect by using older adult sample.

Two-Color Combination Preference

This study used complexity and coherence characteristics from the Kaplan and Kaplan environmental preference framework regarding two-color combinations as the predictors of color preference within a high-end retail environment. According to Kaplan and Kaplan (1987), the scene with the complexity characteristic that satisfies an immediate exploring motivation should be preferred, and the scene with coherence characteristics satisfying an immediate understanding motivation should be preferred. Therefore, it was expected that the complex (CC and CI) color scheme was preferred

over the simple (SC and SI) color scheme, and the coherent (SC and CC) color scheme was preferred over the incoherent (SI and CI) color scheme. Moreover, coherence can make the environment easier to comprehend and reduce the uncertainly posed by complexity (Kaplan & Kaplan, 1982). People's preference for a higher level of complexity depends upon whether the information is ordered or unordered, because the unordered complex setting are difficult to comprehend (Ulrich, 1977). Therefore, looking at color combinations regarding the Kaplan and Kaplan environmental preference, it was expected that the Complex/Coherent (CC) color combination would be perceived as the most preferred one, and the Complex/ Incoherent (CI) color combination would be perceived as the least preferred one among the four two-color combinations in the current study.

To investigate this assumption, each participant was asked to evaluate the level of overall liking (preference) toward one of the eight store scenes. Although it was expected that the complex (CC and CI) color scheme would be preferred over the simple (SC and SI) color scheme, the results showed that the store scenes with the simple (SC and SI) color scheme were preferred over the store scenes with the complex (CC and CI) color scheme in both the regular and irregular pattern set. The possible explanations for this result emerging from prior discussions are as follows: the complex (CC and CI) color scheme 1) may exceed the moderate level of complexity (arousal); 2) was perceived less coherent; 3) was perceived heavier in visual weight; 4) was perceived more active and vibrant in visual activity; 5) was less close to "high-end" store image of the retail environment than the simple color scheme (SC and SI).

First, according to Berlyne's theory of aesthetic response (1974), preference was associated with the arousal level of stimuli within the environment, and viewers' pleasure will increase with increased complexity, to an optimal level (Berlyne, 1974). When increasing the complexity of stimuli linearly, the responses will show an inverted U-shaped curve for pleasure. Pleasure plays a pivotal role in determining preference in the M-R model (Mehrabian & Russell, 1974). Hence, the possible reason explaining why the store scenes with simple (SC and SI) color schemes were preferred over the store scenes with complex (CC and CI) color schemes is that the level of complexity within the complex color-combination scenes may exceed the moderate level of arousal, so viewers' pleasure declined as the inverted U shape relationship between arousal and pleasure.

Second, though value failed to distinguish different coherence levels in the interior context, the perception of coherence was found significantly influenced by complexity levels due to the interrelation of three color attributes. The simple (SC and SI) color scheme was perceived as the more "coherent", aesthetically pleasing and preferred combination. The results aligned with Kaplan and Kaplan (1987) suggesting that the coherence characteristic of a scene can be used as a predictor for interior preference by future color researchers with the considerations of the coherence characteristic in the context of space. Berlyne (1971) suggested that order (coherence) has the above effect, in addition to that of complexity on the external environment. In the current study, the coherence characteristics seemed more powerful than the complex characteristics in relation to color combination preference. Therefore, it was important to consider the coherence environmental characteristics when planning colors

to a three-dimensional interior. Portillo (2009) and her case studies had revealed that color planning is a complex task involving lightning, materiality and dimensionality issues which may affect individual color perceptions and preference. Hence, it was suggested that future studies can replicated this study framework but apply the color schemes to different lighting conditions, materials, placement, and proportion in comparisons with the present study findings.

Prior discussion leads to a conclusion that color combination preference seemed strongly supported by both the Kaplan and Kaplan framework and the M-R model. Using two-color combinations as environmental stimuli can evoke emotional responses (arousal and pleasure) in mediating individual color combination preferences in the Mehrabian-Russell model. Though the current study didn't examine the relationship between the perceptions of complexity and coherence characteristics, emotional states and color preferences directly, several correlations observed in prior quantitative findings show a moderate complex (arousal) and high coherent (pleasure) of the simple (SC and SI) color scheme was more preferred, whereas a higher complex (arousal) and lower coherent (pleasure) of complex color scheme (CC and CI) was less preferred.

Third, a negative correlation was found between visual weight and color preference in both the regular and irregular pattern sets. The findings revealed that the highly saturated (100%) color scheme (complex color combination) was perceived as heavier and less preferred. A lighter color scheme is associated with a spacious atmosphere, whereas a heavier color scheme created an intimate space (Quinn, 1981). The results suggested that the lighter color scheme (SC and SI) was preferred, because it created the "spaciousness "of the boutique store. The qualitative data supported the

quantitative findings revealing that the liking of “spaciousness” was often cited, particularly toward the simple (SC and SI) color scheme in both regular and irregular pattern set (Appendix F). According to Dowling (1993), a successful retail design should “facilitate the creation of a clean, uncluttered, spacious and streamlined environment” (p. 307). Therefore, the lighter color scheme facilitating the creation of a spacious environment may be ideal for a boutique store. However, it was also noted that consumers may have specific expectations with specific retail settings (Wirtz et al., 2000). In other words, people looking for a more intimate and private atmosphere such as high-end jewelry shoppers may prefer the heavier color scheme in a retail environment. Hence, future studies can further examine the perceptions of visual weight on color preference toward different types of stores in comparison with the current study’s findings.

Fourth, the perceptions of visual activity (passive/ active, still/ vibrant) positively correlated with the perceptions of complexity and the states of arousal but negatively correlated with color preferences in the irregular pattern set. The ratings of visual activity on the 7-point semantic scales revealed that the simple color scheme (SC and SI) created the moderate active (*M:* 3.97) and vibrant (*M*: 4.00) emotions, whereas the complex color scheme (CC and CI) created the high active (*M:* 5.50) and vibrant (*M:* 5.21) emotion in a boutique store scene. The results aligned with Berlyne (1974) and Bellizzi et al. (1983) suggesting that too much excitement in the complex (CC and CI) color scheme may become uncomfortable and irritating, leading to customers’ avoidance behavior (less preferred) in a high-end retail environment. Though the highly saturated complex (CC and CI) color scheme seemed over-simulating for a boutique

store, it may be an ideal color palette for the other types of store. For instance, Kaltcheva and Weitz (2006) suggested a sporting-goods retail store should have a more complex layout and highly saturated colors throughout the store. Therefore, the complex (CC and CI) color scheme may be suitable for this type of retail store to create the active and vibrant emotions.

Fifth, the “high-end” store image was verified in the pilot study; however, when applying two-color combinations on the ceiling of the achromatic store scene, results showed that the simple (SC and SI) color scheme was perceived as a more sophisticated and upper class combination than the complex (CC and CI) color scheme in both the regular and irregular pattern set. In other words, the complex yellow-purple combination appeared to weaken the original “high-end” store image. According to Kincade and Moye (2003), Alawadhi (2009) and Portillo (2009), the more “sophisticated” of the store environment, the more it appeals to the up-scale customers. Therefore, simple (SC and SI) color scheme with the more “sophisticated “and “upper class” image was more preferred.

In addition to the evaluations of overall liking toward one of the eight store scenes, each participant was asked to rank the four two-color combinations store scenes in each regular and irregular pattern set from the most preferred to the least preferred one. The results of the preferences rankings aligned with prior evaluations of overall liking in that the store scenes with the simple color scheme (SC and SI) were preferred over the store scenes with the complex color scheme (CC and CI) in both the regular and irregular pattern sets. In addition, the Scene B (SI) was ranked as the most preferred one, and the Scene A (SC) was ranked as the second most preferred one. The Scene D

(CI) was ranked as the least preferred one, and the Scene C (CC) was ranked as the second least preferred one. Although it was expected that Scene C (CC) was the most preferred one base on Kaplan and Kaplan (1987), all participants preferred the Scene B (SI) the most in both the regular and irregular pattern sets.

With a review of qualitative analyses regarding two-color combination preferences, possible explanations for this confliction occurred. The comments made by participants to explain their preferences in the regular and irregular pattern set shared the following perspectives in common. First of all, the perceptions of the arousal level were associated with participant's two-color combination preferences. The comments showed that the store scene with the simple (SC and SI) color scheme was preferred, because it was less stimulating and distracting; conversely, the store scene with the complex (CC and CI) color scheme was not preferred, because it was too overwhelming and distracting. The findings aligned with prior evaluations of overall liking suggesting the level of complexity within the complex color-combination scenes may exceed the moderate level of arousal, so viewers' pleasure declined (Berlyne, 1974). The results reconfirmed Bellizzi's (1983) finding that too much excitement and attraction created by colors within a retail environment may become an uncomfortable and irritating overstimulation which can lead to customers' preferences.

Second, the perceptions of overall store settings were associated with participant's two-color combination preferences. The comments showed that the store scene with the simple (SC and SI) color scheme was preferred, because it matched the rest of the store and went with the color scheme of the store, conversely; the store scene with complex (CC and CI) color scheme was not preferred, because it failed to match the

rest of the color scheme. According to the Kaplan and Kaplan environmental preference (1982), how well the visual information offered by the environment hangs together determines the perception of coherence and preference of a scene. The qualitative date reflected that participants perceived whether the visual information evoked by the color scheme hangs together with the overall interior context rather than the color appearance itself for the judgments of coherence. The qualitative date aligned with prior evaluations of overall liking suggesting the simple (SC and SI) color scheme was perceived as more coherent, thus was preferred over the complex (CC and CI) color scheme. Moreover, due to the interrelations of three color attributes and instability of the yellow hue, the Scene B (SI), with the manipulations of complementary hues, lower saturation and value, turned out to be a combination with the greyish yellow and pastel purple. Comments reflected that the color combination in the Scene B was preferred, because it not only matched well with the “high-end” store image of the retail environment. The results reinforced prior research (Kincade & Moye, 2003; Alawadhi, 2009; Portillo, 2009) suggesting the store environment with a more “sophisticated” image (Scene B) was more appealing to up-scale customers. Furthermore, the qualitative findings aligned with prior color research (Hogg, 1969, Hogg et al., 1979; Kobayashi, 1981; Sato, 2000; Kaya & Epps, 2004) suggested color has different psychological meanings and associational themes which was closely tied to color preferences.

Regarding the evaluations of overall likings, when comparing the mean scores of the independent variables in the regular and irregular pattern set, it was found that the irregular pattern set was more preferred than the regular pattern set. The qualitative

data revealed that the irregular pattern set was more preferred, because it was perceived as a more coherent color pattern in the interior context. The findings aligned with Kaplan and Kaplan (1987) reinforcing that the coherence characteristic can be used as a predictor for interior preference.

In the preference rankings, the store scenes rankings in the regular and irregular pattern set were constant. However, when comparing the frequency in each color pattern set, more people selected the Scene B (SI) as their most preferred one rather than the Scene A (SC), and more people selected the Scene D (CI) as their least preferred one rather than the Scene C (CC) in the irregular pattern set. The findings suggested that the irregular pattern had positive effect, leading to a preferred (SI) color combination, whereas the regular pattern had a negative effect, leading to a less preferred (CI) color combination. That is, both the findings in preference ratings and rankings suggested color pattern may influence color preference in a high-end retail environment. However, they were not statistically supported. Therefore, it was suggested that future studies can examine the interaction of color combinations and color pattern difference on environmental preferences in a high-end retail environment.

In sum, conflicts between findings and expectations regarding color combination preferences implied that “color” may be more complex and contextually sensitive than other visual attributes related to environmental preferences. This may explain the paucity of environmental research using the Kaplan and Kaplan environmental preferences. However, the quantitative and qualitative findings of the current study can help advance the body of knowledge for the color combination preferences in retail environments.

Limitations and Future Research

Several limitations may have affected the results in this study. First of all, the simulation research method in the current study has some shortcomings. Though the simulation method has its benefit for color-related research to examine cause-effect relationships by excluding potentially confounding stimuli such as sound, odors, and light that would occur in an actual environment, this advantage may cause possible bias between the experience of a simulated store scene and the experience of visiting an actual store environment, because of other visual stimuli within an actual retail setting may evoke certain emotional responses and then influence environmental preferences. Munsell (1921, cited in Portillo, 2009) noted that colors may shift in appearance under different lighting conditions or environmental conditions. Besides, the material and dimension differences of colors planning within three-dimensional spaces may also influence color appearances and how people perceived the environments (Portillo, 2009). Therefore, it was suggested that future studies can apply the color schemes in different lighting conditions (e. g. bright /dim, warm/cool, natural/artificial), finishes and materials selections (e. g. matte/gloss/paint, metal/ wood/glass), placements (e. g. ceiling/floor/wall), proportion (e. g. accent color/ambient color) for investigating the possible effects on individual color perceptions and preferences in a high-end retail environment.

Second, the color palette was selected systemically based on prior color literature for examining the cause-effect relationships. However, all interactive effects between color attributes and the environmental context were impossible to fully controlled, since colors are always seen together and appear as interrelated visual sensation (Gao, 2007). Colors placed in three dimensional spaces could interact with each other and

create illusions (Smith, 2008). Moreover, according to the Gestalt principles of perception, people tend to visually assemble individual objects into groups or ‘unified wholes’; the objects placed close together or enclosed in a common space will be perceived as belonging together (Palmer, 1999). That is, not only the interaction between hue, value and saturation of the color applications but also its relationship with the environmental color scheme may influence individual color perceptions and preference toward an environment. In fact, the present study findings had revealed the interaction of color attributes on color perceptions and preference. Moreover, individual responses to the color stimuli are involved in the considerations of the overall interior context. Therefore, it was suggested that color combinations should be selected with the considerations of the interactive effect of color attributes and the context of a space in future studies.

Third, Schlosser (1998) found that the effect of store atmospheres on different types of products varied, which influenced the perceptions of social identity products but had little effect on the perceptions of utilitarian products, that is, consumer’s preference of a retail store may differ based on the types of products and the marketing segments. Moreover, it was noted that people had specific expectations within specific retail settings (Wirtz et al., 2000). Their motivational-orientations may influence their responses and preferences toward the retail environments (Kaltcheva & Weitz, 2006). Additionally, people with the same shopping motivation may vary in different market segments (Portillo, 2009). Therefore, future studies can examine how shopping motivational orientations (task versus recreational) influence individual color perceptions

and preferences in different types of retail environments, such as a big-box store and department stores to compare with a high-end space.

Fourth, color pattern seemed to have certain impacts on each dependent variable based on prior findings. However, the present study didn't further examine the interaction of color combination and color pattern difference on individual color perceptions and preferences in a high-end retail environment. Moreover, according to Pieters (2010), the dissimilarity and irregularity of shapes can increase the perceptions of complexity in a design. Yet, the current study only applied the regular and irregular patterns which were formed by the same regular square shapes. Therefore, it is suggested that further studies can expand on the current study's framework to investigate how the four two-color combinations in more different patterns (e. g. regular/extremely random arrangement) or irregular shapes (e. g. a mix of square, triangular and round shapes) affect individual color perceptions and preferences in a high-end retail environment.

Additionally, regardless of color combinations, the irregular pattern seems more (pleasing) preferred than the regular pattern. This may be due to the creativity dimension of the study participants, since a creative individual tends to prefer asymmetry (Runco & Pritzker, 1999). The age effect was often discussed in creativity research (Simonton, 1975; Runco & Pritzker, 1999). Besides color pattern preference, the age effect on color image preference was also addressed (Beke & Kutas, 2008). Yet, the current study only targeted the young generation (age 18-30). Therefore, future studies can replicate the current study to examine the age effect on individual color

perceptions and preferences between the regular an irregular pattern with the sample of older adults.

Fifth, the sample size of this study may be one possible limitation. Though a total of 153 valid participants were used in the current study, the participants were randomly assigned to rate only one of the nine store scenes including one achromatic store scene and the other eight store scenes with four color combinations by two patterns applications. That is, the average number of participants within each scene is less than 20. Although the study has found significant results with the existing sample size, the result may have more validity and reliability with a larger number of participants. Additionally, all samples are composed of universities students from marketing programs, so they may not represent the actual shoppers of a boutique store. Therefore, future studies may be conducted by a replication of this study with a demographic more representative of high-end shoppers.

Sixth, classic color preference researcher found the a gender difference in color preferences (Warner, 1949). However, there is a wide diversity and argument regarding gender difference in color preference (Ou & Luo, 2012). For instance, Camgo et al., (2001) found gender does not have an effect on color preference. However, it was contradicted by Ebru and Ilker's (2007) findings. Besides, Ou and Luo (2006) also found a gender difference in the evaluations of color emotions for two-color combinations. Yet, none of the existing research compared the gender effect on the perceptions and preference of two-color combination in a retail environment. Though this study had recruited both female (56.86 %) and male (43.14%) participants, but it was beyond the study's scope to compare the gender differences in color perceptions and preference.

Therefore, it was suggested that another further study can compare the gender effect by replicating this study.

Seventh, the color symbolism associated with color emotions and preferences has been noted as differing across various cultures (Kaya & Epps, 2004). Ou and Luo (2012) found that the cultural difference strongly affected individual two-color combination preference. However, none of the existing research examined the cultural effect on the perceptions and preferences of two-color combinations in a high-end retail environment. In the contemporary global society, many high-end retail businesses had expanded their footprint throughout the world, such as Louis Vuitton, Gucci, Burberry…etc. Therefore, it is worthy for further researcher to identify culturally related differences in color perceptions and preferences by replicating this study with a sample composed of people from various cultural backgrounds (e. g. Caucasian versus Asian) or in different nationals (e. g. USA versus Taiwan).

Conclusions and Implication

Color represents one of the most pervasive environmental elements within our daily surroundings, and has been typically examined contextually by researchers. It was found that color plays an important role in creating the store atmosphere, predicting consumers' preference, store patronage and purchase intentions in the retail environments. Colors always work together and interact with each other in an actual environment. Therefore, the findings of the single color studies do not guild interior designers in practice. Considering the lack of knowledge regarding the influences of colors as a combination within the store context, this study adopted the Kaplan and Kaplan environmental preference framework using the complex and coherence

characteristic as the predictors for two-color combination preferences in a high-end retail environment.

The complexity and coherence chacterestics regarding two-color combinations were identified through a review of literature and then systematically manipulated by the complementary hues (yellow/purple), value, and saturation. The manipulations of the four two-color combination applications (2 levels of complexity x 2 levels of coherence) were verified on color swatches. When applying the two-color combinations into the store scene, though the complexity characteristic still contributed to the significant difference in individual perceptions of complexity, regarding coherence characteristic, no significant difference in the perceptions of coherence was found.

According to the Gestalt principles of perception, people tend to visually assemble individual objects into groups or unified wholes (Palmer, 1999), and how well the visual information offered in the environment reinforces itself determines the perceptions of coherence of a scene (Kaplan & Kaplan, 1982). This study's results strengthened these principles suggesting individuals tended to evaluate coherence for the overall store context rather than only the color combination itself. Both the quantitative and qualitative data revealed that the coherence characteristic perceived in the interior context plays a pivot role in individual color preferences. Specifically, whether the mood, personality, style, and atmosphere, in relations to the store image evoked by colors, integrated well with the overall store context is involved in individual perceptions of coherence and color preferences. A "high-end" sophisticated color scheme unifying with a high-end retail environment is more appealing. Moreover, despite the lack of direct statistical supports, both the quantitative and qualitative data suggested that the forms of the color

placement may influence individual perceptions of coherence and color preferences. A color pattern, irregular pattern in this study, unifying with a high-end retail environment is more appealing. In other words, individual perceptions of color and preference are involved with the composition of the overall context.

In addition to the Kaplan and Kaplan framework, the Mehrabian and Russell (1974) model was also integrated in the current study to examine how two-color combinations as the environmental stimuli affect individual emotional states and then how the emotional states mediate preferences. The results aligned with the M-R theory revealing that two-color combinations had significant effects on individual states of arousal and pleasure in mediating preferences toward a high-end retail environment. It was clear that a highly contrasting complementary color combination that aroused more active and vibrant emotions was perceived as a less pleasing and less preferred color scheme, whereas a less contrasting complementary color combination that aroused moderate active and vibrant emotions was perceived as a more pleasing and more preferred color scheme in a retail boutique store.

Creating store atmospheres becomes more and more important for the retailers to express the desired brand identity for engaging consumers (Landa, 2006). The current study's findings can help retailers and interior designers in establishing an ideal brand identity for a high-end retail environment regarding their color choice. However, they should not follow the findings blindly without considering thoroughly what the consumers need. Consumer needs differ as a result of their personalities, shopping motivations, and expectations for different store settings. A successful color plan for an interior design should satisfy consumer needs (Portillo, 2009). Therefore, it was risky for the

interior designer to apply the color schemes prescriptively without adapting them to different store settings. A highly contrasting complementary color scheme may not be ideal for the shoppers who are looking for a light, spacious environment, but it may appeal to the shoppers who are looking for a more intimate, private environment. Additionally, a tonal, pastel complementary color scheme may work for the shoppers who are looking for a calm, relaxed environment, but it may not satisfy the shoppers who are looking for excitement.

Moreover, spatial dimensionality is a critical issue when planning colors in an interior environment (Portillo, 2009). The three-dimensional form certainly influences the interpretation of colors. Further color preference sometimes varies across age groups and cohorts. For example, a randomly-placed color pattern may be perceived as more creative and appealing for young high-end retail shoppers, but it may not work as well for older adults. Additionally, a highly contrasting complementary color scheme applied liberally may be too overwhelming for a high-end retail environment, but used sparingly as the accent color can create an aesthetically pleasing and exciting focal point. In sum, to create a successful design solution, interior designers should develop a color palette by considering both spatial, psychological and behavioral considerations rather than just select colors intuitively. .

APPENDIX A
IRB APPROVAL

UF | Institutional Review Board
UNIVERSITY *of* FLORIDA

PO Box 112250
Gainesville, FL 32611-2250
352-392-0433 (Phone)
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irb2@ufl.edu

DATE: October 28, 2011

TO: Yu-Ting Chang; Dr. Hyunjoo Oh
3700 Windmeadows Blvd. Apt. X247
Gainesville, FL 32608

FROM: Ira S. Fischler, PhD, Chair
University of Florida
Institutional Review Board 02

SUBJECT: **Approval of Protocol #2011-U-1131**

TITLE: The Effect of Two-Color Combinations on Consumers' Preference in a Retail Environment

SPONSOR: None

I am pleased to advise you that the University of Florida Institutional Review Board has recommended approval of this protocol. Based on its review, the UFIRB determined that this research presents no more than minimal risk to participants, and based on 45 CFR 46.117(c), An IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects if it finds either: *(1) That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or (2) That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context.*

The IRB authorizes you to administer the informed consent process as specified in the protocol. If you wish to make any changes to this protocol, ***including the need to increase the number of participants authorized***, you must disclose your plans before you implement them so that the Board can assess their impact on your protocol. In addition, you must report to the Board any unexpected complications that affect your participants.

This approval is valid through **October 25, 2012**. If you have not completed the study by this date, please telephone our office (392-0433), and we will discuss the renewal process with you. **Additionally, should you complete the study before the expiration date, please submit the study closure report to our office.** The form can be located at http://irb.ufl.edu/irb02/Continuing_Review.html. It is important that you keep your Department Chair informed about the status of this research protocol.

ISF:dl

An Equal Opportunity Institution

APPENDIX B
CONSENT FORM

The effect of two-color combinations on consumer preference dimensions in a retail environment

Please read this consent document carefully before you decide to participate in this study.

Purpose of the study:
The following survey is part of a study that seeks to determine the effects of the different color combinations on consumers' environmental preference in retail spaces. The results will help interior designer to develop and design the retail spaces more appealing to shoppers.
What you will be asked to do in the study:
You will be asked to rate four different color conditions generated by computer graphic software. Then, you will be given a short survey including your demographic information and perception of the scenes. This questionnaire is expected to take no longer than 15 minutes to complete.
Risk and Benefits: There are no expected risks or benefits associated with the study.
Compensation: There is no compensation for participating in this study. There are no direct benefits to you in completing this survey.
Confidentiality:
You will NOT be asked to give your name or contact information. Any personal demographic information will only be used to compare your answer to other participants. Your responses will be anonymous.
Voluntary Participation:
Participation is voluntary and you are under no obligation to complete this questionnaire.
Right to withdraw from the study:
You have the right to withdraw from the study at any time without consequence. You do not have to answer any questions that you do not want to answer. If you choose to withdraw, please inform the administrator and your questionnaire will be destroyed.
If you have any questions about this research project, please feel free to contact Yu-ting Chang, Graduate Student at (352) 665-1958 (yutina.chang@gmail.com) and Dr. Park, Nam-Kyu, Assistant Professor, Department of Interior Design at (352) 392-0252 ext.338 (npark@ufl.edu). For additional information regarding human participation in research, please contact the Campus Institutional Review Board (IRB) in the University of Florida Gainesville IRB Office at (352)392-0433.

_____ _____
Principal Investigator's Signature Participant's Signature
(Yu-ting Chang)

APPENDIX C
INSTRUMENT - PILOT STUDY

Section One

INSTRUCTIONS: You will be shown four sets of color combinations. Please evaluate each color combination and answer the following questions.

Simple-Coherent (SC)

This time, please rate your impression of this color combination by using the following adjectives.

Simple	1	2	3	4	5	6	7	Complex
Coherent	1	2	3	4	5	6	7	Incoherent
Disharmonious	1	2	3	4	5	6	7	Harmonious
Unbalanced	1	2	3	4	5	6	7	Balanced
Dissimilar	1	2	3	4	5	6	7	Similar

Simple-Incoherent (SI)

This time, please rate your impression of this color combination by using the following adjectives.

Simple	1	2	3	4	5	6	7	Complex
Coherent	1	2	3	4	5	6	7	Incoherent
Disharmonious	1	2	3	4	5	6	7	Harmonious
Unbalanced	1	2	3	4	5	6	7	Balanced
Dissimilar	1	2	3	4	5	6	7	Similar

Complex-Coherent (CC)

This time, please rate your impression of this color combination by using the following adjectives.

Simple	1	2	3	4	5	6	7	Complex
Coherent	1	2	3	4	5	6	7	Incoherent
Disharmonious	1	2	3	4	5	6	7	Harmonious
Unbalanced	1	2	3	4	5	6	7	Balanced
Dissimilar	1	2	3	4	5	6	7	Similar

Complex-Incoherent (CI)

This time, please rate your impression of this color combination by using the following adjectives.

Simple	1	2	3	4	5	6	7	Complex
Coherent	1	2	3	4	5	6	7	Incoherent
Disharmonious	1	2	3	4	5	6	7	Harmonious
Unbalanced	1	2	3	4	5	6	7	Balanced
Dissimilar	1	2	3	4	5	6	7	Similar

Section Two

INSTRUCTIONS: You will be shown a store image of a retail boutique store. Please evaluate the image and answer the following questions.

1. Please rate your impression of overall store image by using the following adjectives.

	Strongly Disagree						Strongly Agree
Upper class	1	2	3	4	5	6	7
Sophisticated	1	2	3	4	5	6	7
Modern	1	2	3	4	5	6	7
Traditional	1	2	3	4	5	6	7

2. Please list adjectives that describe your impression of this store image.

Section Three

1. What is your gender?

(1) Male (2) Female

2. What is your age?

(1) Less than 21 (2)21 – 25 (3) 26 – 30 (4) 31 – 35 (5) more than 35

3. Please indicate your date of birth (Month/Year)

4. Do you have visual impairments (such as color deficiency) that cannot be corrected by your glass or contact lenses?

(1) Yes (2) No

5. What is your UFID?

6. Please initial here.

Thank you for your participation!

APPENDIX D
INSTRUMENT - MAIN STUDY

Section one

INSTRUCTIONS: You will be shown a store image of a retail boutique store. Please evaluate the image and answer the following questions.

1. Overall how much do you like this boutique store?

Dislike Very much	-4	-3	-2	-1	0	+1	+2	+3	+4	Like very much

2. Please explain what you like about this boutique store.

3. Please explain what you dislike about this boutique store

4. Please rate your impression of this store by using the following adjectives

Displeasing	1	2	3	4	5	6	7	Pleasing
Ugly	1	2	3	4	5	6	7	Beautiful
Unsatisfying	1	2	3	4	5	6	7	Satisfying
Relaxed	1	2	3	4	5	6	7	tense
Excited	1	2	3	4	5	6	7	calm

5. This time, please rate your impression of the interior colors by using the following adjectives.

Simple	1	2	3	4	5	6	7	Complex
Coherent	1	2	3	4	5	6	7	Incoherent
Discordant	1	2	3	4	5	6	7	Harmonious
Separated	1	2	3	4	5	6	7	Unified
Disorderly	1	2	3	4	5	6	7	Orderly
Dissimilar	1	2	3	4	5	6	7	Similar
Unbalanced	1	2	3	4	5	6	7	Balanced
Dynamic	1	2	3	4	5	6	7	Static
Still	1	2	3	4	5	6	7	Vibrant
Lifeless	1	2	3	4	5	6	7	Lively
Passive	1	2	3	4	5	6	7	Active
Light	1	2	3	4	5	6	7	Heavy
Youthful	1	2	3	4	5	6	7	Mature

6. This time, please rate your impression of overall store image by using the following adjectives.

	Strongly Agree						Strongly Disagree
Upper class	1	2	3	4	5	6	7
Sophisticated	1	2	3	4	5	6	7

Section Two

1. What is your gender?

(1) Male (2) Female

2. What is your age?

(1) Less than 21 (2)21 – 25 (3) 26 – 30 (4) 31 – 35 (5) more than 35

3. Please indicate your date of birth (Month/Year)

4. Do you have visual impairments (such as color deficiency) that cannot be corrected by your glass or contact lenses?

(1) Yes (2) No

5. What is your UFID?

6. Please initial here.

Thank you for your participation!

APPENDIX E

CONTENT ANALYSIS – STORE IMAGE OF THE ACHROMATIC BOUTIQUE STORE SCENE

Table E-1. Content analysis – store image of the achromatic boutique store scene

Total (N = 509)							
Category	n	%	Adjective (Frequency)	Category	n	%	Adjective (Frequency)
Luxurious	122	23.97	Luxurious (67); Expensive (25) High-end (20); Upscale (13) Sophisticated (7)	Clean	117	22.97	Clean (63); Organized (25) Simple(13); Neat (11) Orderly (3)
Modern	121	23.77	Modern (54); Trendy (13) Sleek (13); Fashionable (9) Hip (8); Cool (8) Fancy (5); Chic (3) Stylish (3); Edgy (3) Contemporary (2)	Bright	35	6.88	Bright (29); Well-lit (6)
Nice	33	6.48	Nice (7); Beautiful (6) Comfortable (4); Classy (4) Elegant (4); Welcoming (4) Pretty (2); Awesome (2)	Others	19	3.73	Cold (4); Light (3) Youthful (2); Boring (2) Clustered (2); Unique (2) Unfriendly (2); Soft (2) Exciting (2)
White	22	4.33	White (14); Plain (4) Sterile (4)	Open	13	2.56	Open (7); Spacious (4) Big (2)
Calm	19	3.74	Calm (13); Relaxed (6)	Long	8	1.58	Long (5); Narrow (4)

APPENDIX F
CONTENT ANALYSIS – OF COLOR PREFERENCE

Table F-1. Content analysis – of color preference

Themes	What you like about the store scene	#S-F	What you dislike about the store scene	#S-F
Color	Ceiling design, light color, nice ceiling, I like the ceiling, white, the color scheme, the ceiling, I like the ceiling, colorful, the color on the ceiling, the white wall, the colors on the roof, the ceiling, the clean white, the white walls and shelves, colors, the colorful ceiling, white, the off-white floors and walls, the color design on the ceiling, how the plain color of the store attracts more attention to the actual clothing, it manages to avoid being too plain and boring with the ceiling design, the roof, cool colors, everything is white makes it appealing to the eye, has subdued colors, gives it that extra color so it's not so mundane, like the neutral colors, the white shelving, the white walls and floors, the white, kind of like the bright pop of color in the ceiling, colors are pleasant on the eyes, the white walls and floors, the contrast of the ceiling with the white look of the store	**T-32** Regular Pattern SC-4 SI-1 CC-5 CI-8 Irregular Pattern SC-7 SI-3 CC-1 CI-3	The color of the ceiling, the ceiling color, the ceiling, the colors involved in ceiling, the purple and yellow ceiling doesn't go with the theme, the tacky ceiling, the ceiling colors are so tacky, it takes away from the store's clean and trendy atmosphere. the ceiling is a bit over the top, the ceiling color is nice and unique but too out of place with the white colors of the wall and floor, the ceiling does not fit in with the rest of the room, roof color is distracting, the ceiling design, it takes away from the clothes and is a little intimidating, the ceiling color, The thing that throws me off the most is the ceiling, the ceiling, the ceiling, the ceiling is tacky, the confusing roof top which bothering eyes, the ceiling, the ceiling, the colors in the ceiling are distracting and do not fit with the style of the store, the ceiling is really annoying, the ceiling, the purple and yellow roof, it is too flashy and lowers the elegance of the store. It doesn't really match the rest of the setup, the ceiling; the contrasting colors are unpleasant and distracting from the clothes, the color on the roof, the ceiling color, the ceiling, the purple and green roof looks terrible and it would really annoy me to be in this store, I do not like the ceiling, colors clash and it is very distracting, the colors do not match, the roof colors, the awful ceiling arrangement, the ceiling is too bold and distracting. It also seems to clash with the other colors in the room, and the colors on the ceiling itself aren't a pleasant combination, the colors on the ceiling are offensive, awful ceiling colors, the ceiling appearance, the colors on the ceiling, the purple and yellow ceiling to be at a discord with the rest of the store. It pulls your eye up and away from the merchandise. It doesn't add to the value of the	**T-72** Regular Pattern SC-8 SI-8 CC-14 CI-13 Irregular Pattern SC-4 SI-3 CC-13 CI-9

			store, colors of the ceiling, ceiling design and colors, the purple rectangles on the ceiling looks very tacky, and ruins an otherwise very nice color scheme, colors are crazy, dislike the colors on the ceiling, the design on the ceiling, the colors, colors of ceiling, color of the ceiling, the color of ceiling, the color on the ceiling, the ceiling is totally unrelated to the inside, ugly ceiling colors, the colors on the ceiling. These colors do not go with the theme of the store, the store without the ceiling would look elegant, probably expensive but comfortable, the color combination of the ceiling, the colors on the ceiling, they bring down the essence of a clean and mod space by adding dark and unpleasant colors, the color combination is not that appealing, the ceiling, the roof colors, the ceiling is distracting and very ugly, the ceiling design	
Lighting	The white lighting on the shelves, well-lit, bright, bright, the lighting, the ceiling is bright, lights on the ceiling are interesting, the light, it looks bright, the illuminating lights.	**T-8** Regular Pattern SC-1 SI-1 CC-1 CI-2 Irregular Pattern SC-0 SI-1 CC-1 CI-2	The lighting on the ceiling, the lighting is really intense and bright, the lighting on the clothes,	**T-3** Regular Pattern SC-1 SI-0 CC-0 CI-0 Irregular Pattern SC-0 SI-2 CC-0 CI-0
Color Pattern	The pattern , the patterns on the ceiling,	**T-2** Regular Pattern SC-0 SI-0 CC-1 CI-1 Irregular Pattern SC-0 SI-0	The tiles on the ceiling, clashing with the mood and the clothing, the ceiling rectangle pattern, checkerboard ceiling design, vulgar color pattern on the roof, The checkered ceiling is sort of distracting, the pattern of lights on the ceiling, the ceiling pattern, ceiling pattern, pattern of ceiling, the pattern on the ceiling, the way the ceiling of the store is painted is very distracting and takes away from the organization of the store.	**T-11** Regular Pattern SC-4 SI-1 CC-1 CI-3 Irregular Pattern SC-0 SI-0

		CC-0 CI-0		CC-2 CI-0
Composition of the Space	Big, spacy, openness, very open, organized, very organized, organized, very organized, very organized, very organized, clean, clean, very clean look and does not have a lot of clutter very spacious, spacious, open space, being open, wide aisle, openness of display, clean, neat, how the clothes are organized, very clean, clean, clean, clean feel, clean, cleanness of display, spacious, spacious, look spacious, very open, room to try on shoes and clothes, the clean appearance, the store layout, layout, organized, clean, clean and organized, clean, looks clean, clean, well-organized, neatly organized not cluttered, items are easily accessible, very clean, spacious, spacious, organization of the racks, very neat, the way the items are displayed, very things space out, the setup, everything is neat, the spacing of the clothes and shoes, the organization of it, it has an interesting layout that makes you feel as if you're walking down a runway instead of just shopping in an ordinary mall, openness, open layout, opening space, organization, it is organized, very organized, organization, well organized, well-organized, organization, looks clean, neat, clean look, clean, well-fit and clean, neat and organized there is a lot of room on the sides of the store, spacious, everything is spaced out, very spacious and open, like the open space, open space, very open space, openness, it is organized, looks clean, very neat and organized, very clean, it is clean, it is well organized, really clean and fresh, looks very organized and neat, the openness, clean, organized, the clean layout, very neat and not cluttered at all, the cleanness, everything looks very clean, organized, very	**T-105** Regular Pattern SC-16 SI-15 CC-9 CI-5 Irregular Pattern SC-18 SI-9 CC-13 CI-10	slightly too long, like a hallway than a store, things are too spread out, too spread out, an inefficient use of space, organization is very bad , a little narrow, too narrow, things are too spread out, too spread out, an inefficient use of space, organization is very bad, clothes doesn't look organized well, clothes doesn't look organized well too much spacing, there is too much open/ dead space for it to be a retail store, it looks more like a closet than a store, not spacious enough, it looks more like a closet than a store, not spacious enough slightly unorganized, slightly unorganized, disorganized clothing racks, the clothes are not organized in sections, disorganized clothing racks, the clothes are not organized in sections, bareness and empty space, too narrow, narrow, not the most efficient in order to show product	**T-26** Regular Pattern SC-2 SI-6 CC-1 CI-3 Irregular Pattern SC-1 SI6 CC-6 CI-1

	organized, clean and organized, spacing, spacious, the way the shoes are organized, well-organized, it is very organized, neat and clean, the clean-cut look, clean layout and design, organized, clean, the clean lay out of the store, the organization of the store, the layout, open, spacious, nice spacious, very organized, clean, clean, the organization, clean, organized, organized neatly			
Shopping Orientation	It is easy to scan for what I am looking for. how the clothes have good space to see everything, each item can be seen well, the clothes are very spaced apart making it easy to look at the merchandise, the easy view of all the merchandise, how you see the items in the store easily, is easy see things, different store appearance then what the average costumer is used to, I would shop here for the experience, clothing looks nice, not too much merchandises, seems easy to find products that you're looking for, making it easy to find anything that I might be looking for, easy to spot the things you like, easy to shop at, everything is easy to see/find, the ability to see all of merchandise, items are grouped together making them easy to find, they are easy to sort through	**T-11** Regular Pattern SC-2 SI-3 CC-1 CI-1 Irregular Pattern SC-2 SI-0 CC-1 CI-2	not enough merchandise, the clothes selection can't tell if its girls our guys clothes, not my type of clothing, looks like exclusively women's clothes, there aren't many options and the racks look almost empty of clothes, It doesn't have a lot of items for sale, the items aren't my taste; it doesn't look as if there is a lot of selection, not many options. It is very limited, feel and not that many clothes, not a lot of clothes, there should be more chairs and more shoes beneath the clothes, doesn't seem like a lot of options are available, the amount of clothing are too limited, it doesn't look like they have a large variety, it would not have enough selection, there are not many options, Maybe it would be hard to find what you're looking for at first glance, doesn't seem to be many options for males, the selection of clothing is limited, too many shoes, has very little clothes, might take a while to find something,	**T-23** Regular Pattern SC-5 SI-4 CC-2 CI-0 Irregular Pattern SC-4 SI-3 CC-2 CI-3
Emotion	I feel that it has a nice flow and is inviting, visual appealing, very inviting, interesting it seems more welcoming, I will want to stay there for a while, it looks cozy, like the calming colors, inviting and visually satisfying, the ceiling it has a very interesting look, aesthetically appealing.	**T-9** Regular Pattern SC-1 SI-3 CC-0 CI-1 Irregular Pattern SC-2 SI-2 CC-1 CI-0	not comfortable place to buy clothes, doesn't look comfortable, be afraid to touch anything because it seems too kept, I'd much rather be in a place where I don't feel so pressured to be cool. I'd rather be somewhere that looks comfortable and welcoming, the ceiling is ugly, the center bench seem uncomfortable, too much, the ceiling draws a lot of attention, it is also slightly overwhelming	**T-9** Regular Pattern SC-2 SI-2 CC-0 CI-1 Irregular Pattern SC-1 SI-0 CC-3 CI-0

Store Image	The modern look, very modern look, chic, modern, modern feel, modern, the modern look, Very modern feel, modern, modern, very classy appeal, unique, very modern, looks hip, very stylish, unique, has a modern feel, modern feel, looks modern, the innovative look, modern, the modern feel to it, cool atmosphere, sleek look, look fashionable, looks very modern and classy, elegant, modern, looks modern and trendy, a futuristic feel, the modern layout, cool and modern, modern, very modern looking, unique looking, futuristic, the modern design, very futuristic atmosphere in this store, fancy, sleek looking, it is trendy I like the modern design and feel, post-modern styling of the room, sleek modern, very modern, modern, looks very modern, modern, edgy, futuristic, cool, modern look, modern look	**T-31** Regular Pattern SC-8 SI-6 CC-3 CI-7 Irregular Pattern SC-6 SI-11 CC-3 CI-10	Expensive, too trendy, unaffordable goods that tells college students on a budget to stay away, how upscale it is because it looks like it would be more expensive, it's too flashy, too futuristic, looks upscale, too modern, how modern it look, looks expensive, very pricey because of the upscale look, looks expensive, it's too modern, too expensive, too modern, looks expensive, perceived expensiveness, very expensive taste	**T-21** Regular Pattern SC-2 SI-5 CC-5 CI-1 Irregular Pattern SC-1 SI-1 CC-3 CI-3

APPENDIX G

CONTENT ANALYSIS – OF MOST PREFERRED AND LEAST PREFERRED SCENE IN THE REGULAR PATTERN SET

Table G-1. Content analysis – of most preferred and least preferred scene in the regular pattern set

Themes	Most Preferred	#S-F	Least Preferred	#S-F
Color Combination	I like the color combination the most, the colors jump out the least, I like the colors, interesting colors, the color combination was the best, color, color, neutral color, interior colors, light purple and light yellow are a good combination, like the faded contrasting colors, colors in the ceiling go best together, color go well together, favorite color scheme , like the colors, like the colors, the colors, like the hue of the colors, nice color, like the color combination, the colors, the light green is the nicest compliment to the light purple, colors are nice, like how black and purple look together, the color combination, like the colors, good color combo, the colors complement each other, colors go well together, colors go together, don't clash too bad together, the colors somewhat match compared to the others, the color combination is the best, color	**T-31** A-12 B- 17 C-2 D-0	The black and purple, purple and yellow combination, the bright yellow and purple together, colors are too opposite, colors do not look good together, green, and purple, the color combination, color combination, colors are hideous, colors clashing, bad colors, the green, bad color combination, bad color combination, don't complement each other, bad color combination, worst color scheme, bad color combination, odd colors, color don't go very well on a ceiling, purple and green together, hate this purple and green combo, the colors, greenish/brown color, colors, color combinations, colors look awful together, colors do not go together, colors don't match, don't go together at all and are very uncomplimentary, the ceiling don't go well together	**T-29** A-0 B-2 C- 4 D-23
Brightness	Light purple and light yellow are a good combination, brighter, not too bright, brighter, not as bright as the others, bright colors, has brighter colors, bright colors catch the eye, bright, color choices are too bright so having them darker looks better	**T-10** A-4 B- 1 C-4 D-1	Bright, bright, too bright, too bright, too bright, too bright, too bright, too bright, too bright, Too bright, too bright, Too bright, too bright, Too bright, bright, Too bright, too bright, Too bright, too bright, Too bright, too bright, Too bright, bright, Too bright, bright, too bright, too bright, too bright, so bright, too bright, too bright, bright and hurts your eyes to stare, too bright, too dark, too dark, too bright, too dark, too dark, too bright, very dark, too dark, too dark, too dark, too dark, too dark, dark, dark, too dark, too dark, dark, dark, dark, dark, dark	**T-54** A-2 B-0 C-30 D-22

Saturation	like the pastel purple color	**T-11** A-0 B- 1 C-0 D-0	Pastel colors	**T-1** A-1 B- 0 C-0 D-0
Overall Store Settings	Fits in more well with the light atmosphere of the store, it seems to blend in more without taking the attention off the setting, fits the scene the most, without disturbing the entire setup of the store, the colors match with the rest of the store, fit the store and the clothing style offered, the colors match most with the building, fits the closest with the store's color scheme, go well with the colors used in the store, matches the rest of the store, blend better with the store, colors blend, the colors fit the theme, go with the color scheme of the store, the colors seem to blend better with the overall store colors, match with the black chair, goes with the store, better matching, color go with the rest of the store, looks good in store, go with the rest of the store, the perfect color combination with the rest of the store's theme and colors, colors match the atmosphere, best overall color scheme, colors went well with the interior of the store, blends in the best with the store	**T-25** A-8 B- 17 C- 0 D-0	Do not match , do not blend with the rest of the store, yellow that clashes with the other colors, yellow should never be in a clothing store, yellow doesn't go well with the store, do not flow with the image of the store, clash with the rest of the store, clashes against the colors used in the store, do not fit the store, the yellow color on the ceiling does not match anything in the store, the yellow does not go with anything in the store, colors do not look good together, bad colors and doesn't fit the store, dark colors clash with the spread out look of the clothes and shoes, the dark color contrasts with the store, the colors doesn't match with the rest of the store, do not mix well with the white,	**T-17** A-0 B- 0 C-12 D-5
Pleasure	Wouldn't give me a headache if I were shopping in the store, not overly shocking, pleasing to the eye, easier to shop in, more pleasing to look, It's not distracting or an eyesore, comfortable, most easy to look at, inviting, easy on the eyes, appealing, most soothing to the eyes, a welcoming, more pleasing, most pleasing, pleasing, prettiest, appealing.	**T-16** A-9 B- 5 C- 2 D-0	Ugly, ugliest, ugly, give me a headache shopping there, gives me a headache, intimidating, make me want to leave right away, annoying, ugly, unattractive, ugly, ugly, annoying, yellow is annoying, annoying, makes me want to vomit, ugly colors, ugly colors, ugly, ugly, color is not pleasing to me, unattractive color combination, not very pleasant together, contrast of bright purple and dull brown is unpleasant, ugly, ugly, ugly, colors are ugly	**T-28** A-1 B- 2 C- 12 D-13
Arousal	The least distracting, makes it a little less distracting, exciting place to shop,	**T-55**	Dull, too dull not that interesting, boring and barely noticeably, distracting, overwhelming, too much	**T-43**

	energized customers in the store, calm colors, calm, least busy and loud, dull, not over bearing, calm, not too intense, not an offensive, calmer, not too overwhelming, the most calming, calm, most calming atmosphere but aren't overwhelming, not so hard on eyes, calm, easy on eyes isn't wild and crazy, more muted, mute tone, makes the room a calm, not overwhelming, more interesting and subtle, not too loud, not as overwhelming, the most muted, not distracting, Interesting color choices, muted, less distracting, not too dull, are interesting and not too much, it's not so hard on the eyes, aren't quite as harsh, calmer not so intense, more relaxed, are not overwhelming, calming appearance, not as distracting, calm and relaxed, calm, not overly stimulating, least obnoxious, feel calm and relaxed, relaxed, interesting , more calm, not overwhelming, calming, less harsh on the eyes, calm not overwhelming, calm, interesting, but not overwhelming, interesting , more subtle	A-22 B- 31 C- 1 D-1	going on, too busy, distracting, too bold, distracting, too much contrast, too contrasting and annoying, distracting, too busy, too bold, distracting, overly stimulating, distracting, too loud, too overpowering, too distracting, too loud, too busy, harsh and overwhelming, too much going on, too overwhelming, too distracting, colors stand out too much Too bold, distracting, too loud, overwhelming, hideous and not exciting, bored, boring, distracting, dull, too dull, bored, distracting, too distracting, busy, the most bothersome	A-3 B-0 C-25 D-15
Store Image	Loosens up the theme of sophistication, modern color scheme,	**T-2** A-1 B- 0 C- 1 D-0	cheapens the store appearance more sophisticated theme to the store, a little too modern	**T-3** A-0 B- 0 C- 1 D-2
Color Emotion	Lighter ,light colored ceiling, the colors are the lightest, the light colors match the walls and floor well, the colors of this one are toned down, the colors are so light, light, lighter, light color, lighter colors add elegance to the store, light color, light light , lights colors, light colored, least vibrant colors, the colors are vivid, not as vibrant as the other choices, a little vibrant, most vibrant, colors are vibrant	**T-21** A-12 B- 7 C- 2 D-0	Too light, too light, strong color, too vibrant for a store, too vibrant, too vibrant, too vibrant, too vibrant, too vibrant, too vibrant, too heavy, heavy, too heavy, too heavy	**T-13** A-2 B-0 C- 7 D-4

APPENDIX H

CONTENT ANALYSIS – OF MOST PREFERRED AND LEAST PREFERRED SCENE IN THE IRREGULAR PATTERN SET

Table H-1. Content analysis – of most preferred and least preferred scene in the irregular pattern set

Themes	Most Preferred	#S-F	Least Preferred	#S-F
Color Combination	Best colors, color scheme, colors, color, nice contrasting colors, color combination colors , the color scheme, color scheme, color combination, color combination, color combination, colors go well together, colors, light purple and the gray, like the gray and purple colors together, color combination, colors, muted color purple and black go well together, colors, color combination, colors, good color contrast, color, color combo, color combination, colors somewhat match, the contrast with the colors, colors flow together the best complement each other, colors flow better, nice matching colors, colors, contrasted nicely, colors mixed nicely, colors look the best together, the contrasting colors, colors go well together,	**T-37** A-6 B-29 C-2 D-0	The colors, color combination, colors, color combination, worst color scheme, color, color, color combination, color combination, color scheme, color combination, color combination, colors, color combination, color combination, colors , bad color match, color combination, colors on the ceiling, colors, colors	**T-21** A-1 B-0 C-0 D-20
Brightness	Not too bright, not too bright, not too bright, not as bright, not bright, bright, bright colors, bright, bright colors	**T-8** A-1 B-4 C-3 D-0	Too dim, dark, too bright, too bright, too bright , too bright, too bright, too bright, too bright, Too bright, too bright, too bright, too bright, yellow is too bright, bright, brightness of the ceiling, too bright, too bright, too bright , too bright, too bright, too bright, too bright, too bright, the yellow is too bright, too bright, gloomy, too bright, too dark, dark, dark color, too dark, dimmed the store down, too dark, too bright, dark, gloomy, too bright, too gloomy, too dark	**T-41** A-0 B-3 C-24 D-14

Color Pattern	Pattern is not overwhelming, the ceiling pattern matches the store atmosphere, shapes are more intriguing with that color scheme, interesting pattern, pattern not simple repetitive shapes, pattern isn't taking away from the clothing, stand out pattern, the pattern is not over-bearing	**T-9** A-0 B-5 C-4 D-0	Pattern doesn't work, pattern looks silly, annoying pattern	**T-3** A-0 B-0 C-0 D-3
Overall Store Settings	The light colors go well with the light colored walls and floor, colors on the ceiling blend well with the white on the walls and the floor, colors balance each other, pastel yellow and purple is the most harmonious, light colors match the colors of the shelves and floors, continuous, blend with wall, the colors goes better with the white, flowing with the rest of the store, match the seat, fits in more with the color of the furniture and with the darker tone of the clothes/shoes in the store, the dark color of the ceiling blend well with the light purple and the rest of store, colors blend better, blends in the best with the store, blends into the aura of the room, the dark green color seems to flow nicely with the somewhat somber setting which contrasts with the white furniture, go well with the theme of the store, colors mesh fairly well with the theme of the store, blends in the best with the store, the color combo matches well with the rest of the store, the color scheme blends with the rest of the fixtures, muted color like the rest of the store, matches the best with the colors already in the store, colors complement the clothes, color gives a good overall contrast of the interior, the dark color really matches the store, It doesn't take away from the feel of the store as much as the others, flows with the design of the store, matches that throughout the store, balance as it ties in	**T-37** A-9 B-28 C-0 D-0	Colors don't match at all, doesn't math any of the store clothes, does not match the seating area, yellow doesn't match any of the colors in the store, the bright yellow and dark purple color is very jarring compared to the light colored floor and walls, colors, doesn't fit with the rest of the store, the color scheme is jarring, neon yellow didn't match with modern clothing and upscale furniture, clash with the store, color contrast, took away from the original atmosphere, too much of a contrast, it took away from the other aspects of the store, does not match anything else in the shop, colors don't fit the store, do not blend well with the color scheme of store , the color doesn't look right with the rest of the décor, the colors on the ceiling do not blend well with the rest of the atmosphere of the store, do not flow well together at all, color clash, colors don't match ruins the store image, two colors seemed to clash, clashes with the layout of the store, color didn't go well together, colors clash, colors don't go together, color doesn't go well with the store, dark colors contrast with white furniture of the store, and clashes, colors don't seem to mesh very well, colors did not at all complement each other, colors don't mesh	**T-33** A-1 B-0 C-15 D-17

	well with the rest of the room, color combination, colors somewhat match, the color scheme flows well with the atmosphere, following the color scheme of the store, softer colors complements the store best, colors flow better, colors aren't as contrasting with the store as the other ones			
Pleasure	Pleased, easy going feeling, more inviting, aesthetically pleasing, most attractive, more appealing, most welcoming, more pleasant, easier on the eyes, attractive, more happy looking at it, very pleasing to the eyes, pleasing color scheme, most appealing, colors look pretty together, very pleasant, don't hurt my eyes prettiest, appealing, not too hurtful to look at.	**T-19** A-9 B- 7 C-2 D-1	Unattractive, color scheme is very ugly, displeasing to look at , annoying, does not look good, bothering, ugly, too annoying, uninviting and unappealing, unappealing, color is not appealing at all to the eye, less appealing, Ugly colors, unappealing, ugly colors, less attractive, unpleasant, ugly colors, ugly, ugly, displeasing, ugly, too hard on eyes, hideous, ugly, ugly, bad colors together, ugly, ugly color, ugly, hideous color, ugly, ugly color, ugly, ugly color, ugly, ugly color, ugly, ugly, ugly, ugly, colors are ugly together, disgusting, ugly	**T-43** A-1 B-1 C-5 D-36
Arousal	Serene, subdued, energized, dim, not overwhelming, calming, not distracting, not distracting, subtle, subtle, subtle, most calming, calm, calming, dull, calmer, relax, colors add interest without being overwhelming, not too loud, not disrupting, least contrasting, interesting, interesting, interestin, not too intense, interesting without being overwhelming, not distracting, Not being distracting and overstimulating, Not too loud or boring, subdued but still interesting, makes me interested, Muted but still interesting, calming, subtle and cool without attracting too much attention, calmest, relaxed and low key, doesn't distract me too much from the actual clothing, More relaxing, The colors don't overpower the store's decorum, not grabbing my eyes to the roof, The ceiling does not take away from the store, not too boring, the roof was not over the top, Very	**T-54** A-24 B-25 C-5 D-0	Bland, too mundane, doesn't pop out enough, boring looks distracting, busy, makes my eyes hurt, too crazy, too much, and distracting, too distracting, too intense, too much yellow, too much yellow, the yellow is almost blinding, It hurts to look at, it is too much, and distracting, colors are blinding, very distracting and giving me a head ache, stands out too much, too much yellow, too loud, too distracting, too loud and distracting, overstimulate, boring, boring, least subtle, , boring, too dull, distracting	**T-32** A-4 B-0 C-22 D-6

	clam, calming, Calming, interesting, calm color combination, more relaxed feeling, grab my attention more, and it interests me, fun, colors attract me to the store most, really gets my attention.			
Store Image	Sophisticated, modern, sophisticated, still m odern, modern appearance, contemporary f eel and modern look	**T-6** A-2 B- 4 C-0 D-0	it cheapens everything	**T-1** A-0 B-0 C-1 D-0
Color Emotion	Light, light, light, light, light, not too heavy, light, light, light, vibrant, lighter, not so vibrant, very vibrant and alive, vibrant, cheerful, lively, vibrant, give the store a vibe.	**T-18** A-10 B-2 C-5 D-1	Too light, faded lighting, too light, too vibrant, too vibrant, too vibrant, too heavy, feel heavy	**T-8** A-3 B-0 C-3 D-2

APPENDIX I

STUDY COLOR PALETTE – FOUR TWO-COLOR COMBINATIONS SELECTED FROM THE HSV COLOR MODEL

Table I-1. Study color palette. Four two-color combinations selected from the HSV color model

Two-color combinations of yellow and purple		Hue (°)	Saturation (%)	Value (%)
Simple-Coherent (SC)		270	25	100
		60	25	100
Simple-Incoherent (SI)		270	25	50
		60	25	100
Complex-Coherent (CC)		270	100	100
		60	100	100
Complex-Incoherent (CI)		270	100	50
		60	100	100

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BIOGRAPHICAL SKETCH

Yu-Ting Chang was born in Taipei, Taiwan in December 1984, as the second oldest of three children. In June of 2007, she obtained a Bachelor of Arts in advertising and public relations with a concentration in graphic and interactive media design from Fu Jen Catholic University. After working for one year as a graphic designer, she decided to study graduate school at the University of Florida, in the field of interior design. Her primary research interest focuses on color in retail environments. After her May 2012 graduation, Yu-Ting plans to work for an interior design firm that specializes in hospitality design in Southern Florida.