

# Colors and Intensities Combination on Purchasing Intention in Relaxing Services: A Virtual Reality Experimental Research<sup>1</sup>

*Guntalee Ruenrom\**

*Ake Pattaratanakun\*\**

## Abstract

The growth of the service business such as spa, resort, and health club indicates the increase in customers' interest in the relaxing service business. Color is one of the most visualized physical evidences that could help customers perceive the relaxing atmosphere embedded in the service. Although the influence of colors on emotion led behavior has been previously studied, there are various dimensions of colors to be further investigated. One of the questions is whether the combination of different colors and intensities of colors could have any impact on inducing the behavioral intention of consumers.

This study investigates the behavioral intention to use the relaxing service due to the designated combination of colors and different levels of intensity. The research objectives are to discover how the combination of colors and intensities can affect consumer purchase intention in the relaxing service business and what combination of colors or intensities can make the most impact on their decisions.

The data collection starts with the pilot test by asking 110 subjects to choose the colors that they think represent relaxing services. Blue and green are selected then the intensities (chromas) are applied to the two colors using low

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\* Professor, Department of Marketing, Chulalongkorn Business School, Chulalongkorn University.

\*\* Lecturer, Department of Marketing, Chulalongkorn Business School, Chulalongkorn University.

and high quartiles of the intensity. An experimental research is designed by using the virtual reality (VR) camera as the contact method to collect the data from the randomly chosen subjects whom repeatedly do the experiment twice with a two-month interval to assure the reliability of the study. Six treatments (color and intensity combinations of blue and green) are randomly assigned to 180 randomly chosen subjects. Subjects then give the scores for the six treatments that they see in the VRs to indicate their intention to use the service. The data are then analyzed using both qualitative and quantitative techniques.

The results reveal that while the combination of relaxing colors (blue and green) has significantly decreased customer's purchasing intention for the relaxing service, the combination of intensities do not have impact on the intention. It is suggested that the relaxing service business should apply the same color rather than using different colors to induce consumers' purchasing intention.

The research findings enhance better understanding of the combination of colors on purchasing intention in the context of relaxing service. The results could create interest especially among the interior designers and the management of the service business.

**Keywords:** Color (Hue), Intensity (Chroma), Relaxing Service, Virtual Reality Experiment

# การผสมผสานของสีและความอ่อน-เข้มของสีต่อความตั้งใจซื้อในธุรกิจบริการที่สร้างความผ่อนคลาย: การวิจัยเชิงทดลองโดยใช้โลกเสมือนจริง<sup>1</sup>

กฤษฏี รื่นรมย์\*  
เอกก์ ภาทรธนกุล\*\*

## บทคัดย่อ

การเจริญเติบโตของธุรกิจบริการ เช่น สปา รีสอร์ท และศูนย์สุขภาพแสดงถึงความสนใจของลูกค้าที่เพิ่มขึ้นในธุรกิจที่สร้างความผ่อนคลาย สีเป็นลักษณะทางกายภาพที่ลูกค้าสามารถมองเห็นได้อย่างชัดเจน สามารถทำให้ลูกค้ารับรู้ถึงบรรยากาศผ่อนคลายในธุรกิจบริการ แม้ว่าในอดีตจะมีการศึกษาผลกระทบของสีต่อพฤติกรรมที่เกิดจากอารมณ์ความรู้สึกของลูกค้าอยู่บ้าง แต่เรื่องของสียังมีอีกหลายแง่มุมที่สามารถศึกษาเพิ่มเติมได้ คำถามสำคัญข้อหนึ่งคือ การผสมผสานกันของสีและความอ่อน-เข้มของสีจะนำไปสู่ความตั้งใจซื้อของลูกค้าหรือไม่

การวิจัยนี้ศึกษาถึงความตั้งใจซื้อการบริการที่สร้างความผ่อนคลาย อันเป็นผลมาจากการผสมผสานกันของสีและระดับความอ่อน-เข้มของสี วัตถุประสงค์ของงานวิจัย คือ เพื่อศึกษาถึงการผสมผสานกันของสีและความอ่อน-เข้มของสีจะส่งผลต่อความตั้งใจซื้อในธุรกิจบริการที่สร้างความผ่อนคลายอย่างไรบ้าง และการผสมกันของสีหรือความอ่อน-เข้มของสีใดจะสร้างผลกระทบมากที่สุดต่อการตัดสินใจ

การเก็บข้อมูลเริ่มจากการศึกษาเบื้องต้นโดยให้กลุ่มตัวอย่างจำนวน 110 คน เลือกสีที่ตนคิดว่าเป็นตัวแทนที่ดีของการบริการที่สร้างความผ่อนคลาย สีฟ้าและสีเขียวได้รับเลือกมากที่สุด สีทั้งสองจึงถูกนำมาใช้ในการทดลองโดยกำหนดให้มีความอ่อน-เข้ม (โครมา) ที่ควอไทล์สูงและต่ำ การวิจัยเชิงทดลองได้รับการออกแบบขึ้นโดยใช้กล้องเสมือนจริงเป็นเครื่องมือในการเก็บข้อมูล โดยการสุ่มกลุ่มตัวอย่างเข้ารับการทดลองสองครั้ง โดยการทดลองครั้งแรกห่างจากครั้งที่สอง

<sup>1</sup> งานวิจัยนี้อยู่ภายใต้โครงการเงินต้นทางธุรกิจ คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย และได้รับการสนับสนุนงบประมาณส่วนหนึ่งจากโครงการ “เสริมสร้างพลังภาษา ก้าวสู่ศตวรรษที่ 2” จุฬาลงกรณ์มหาวิทยาลัย

\* ศาสตราจารย์ประจำภาควิชาการตลาด คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย

\*\* อาจารย์ประจำภาควิชาการตลาด คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย

สองเดือนเพื่อจะยืนยันความเชื่อถือได้ของการศึกษา ปัจจัยในการทดลองหกปัจจัย (จากการผสมผสานกันของสีฟ้าและเขียว โทนสีเข้มและอ่อน) ถูกสุ่มใช้ทดลองกับกลุ่มตัวอย่าง 180 คนที่ถูกสุ่มขึ้นมาเช่นกัน หลังจากนั้นผู้เข้ารับการทดลองได้ให้คะแนนปัจจัยในการทดลองแต่ละปัจจัยที่เห็นในกล่องวิอาร์ว่าตนมีระดับความตั้งใจจะใช้ธุรกิจบริการมากเพียงใด ข้อมูลที่ได้ถูกนำมาวิเคราะห์ทั้งเชิงคุณภาพและเชิงปริมาณ

ผลการทดลองพบว่า การผสมผสานกันของสีที่สร้างความรู้สึกผ่อนคลาย (ฟ้าและเขียว) จะมีอิทธิพลต่อความตั้งใจซื้อบริการที่ให้ความผ่อนคลายน้อยกว่าเมื่อเทียบกับการใช้คู่สีเดียวอย่างมีนัยสำคัญ ในขณะที่การผสมผสานกันของความเข้มอ่อนของสีไม่มีผลกระทบต่อความตั้งใจซื้อ นั่นคือธุรกิจบริการที่ให้ความผ่อนคลายควรใช้คู่สีที่เหมือนกันมากกว่าคู่สีที่แตกต่างกันเพื่อเพิ่มความตั้งใจซื้อ

ประโยชน์ที่ได้รับจากงานวิจัยนี้ สามารถสร้างความเข้าใจเพิ่มขึ้นในเรื่องผลกระทบที่เกิดจากการผสมผสานของสีและความเข้มอ่อนของสีที่มีต่อความตั้งใจซื้อในบริบทของการบริการที่สร้างความผ่อนคลาย ผลการวิจัยเป็นเรื่องน่าสนใจอย่างยิ่งสำหรับนักออกแบบภายในและผู้บริหารในธุรกิจบริการ

**คำสำคัญ:** สี ความอ่อน-เข้มของสี ธุรกิจบริการที่สร้างความผ่อนคลาย การทดลองโดยใช้โลกเสมือนจริง

## Introduction

Color has been playing a major role in people's lives. In marketing and branding, designers designed many colors to be used in different industries such as products, packaging, places and many more. Colors can have influence on consumers' emotion and subsequently lead to buying decisions (Bitner, 1992).

The Munsell Colour System (Munsell, 1905) illustrates that color exists in three dimensions which are hue, value and chroma.

According to the Munsell Colour System (Figure 1), hue refers to the perceivable colors that are characterized as discrete or saturated such as red, yellow, or blue. The word "color" is a normal term that people regularly used to denote the colors of things that they see. Value is defined as the relative lightness or darkness of a color or hue. Value ranged from black to white or dark to light or it is a shade of lightness. It indicates the quantity of light reflected. When referring to pigments, dark values with black added are called "shades" and light values with white pigments added are called "tints" of a hue. Chroma is from the Greek word means the quality of a color's purity, or the intensity of saturation. Thus, a color or hue that has some value adds on will have the intensity of darkness or lightness. This intensity is also known as chroma or saturation.

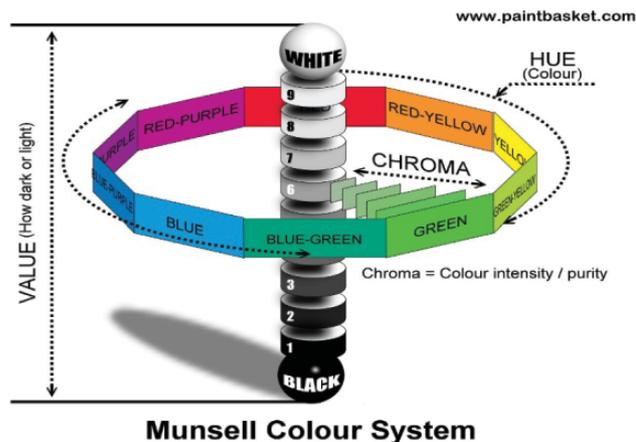


Figure 1 Munsell Colour System

Source: Munsell (1905)

Briggs (2012) illustrated colors in hue, value and chroma. Figure 2 denotes these three dimensions that have been found to elicit feeling of a human being especially in his cognition, affection and conation.

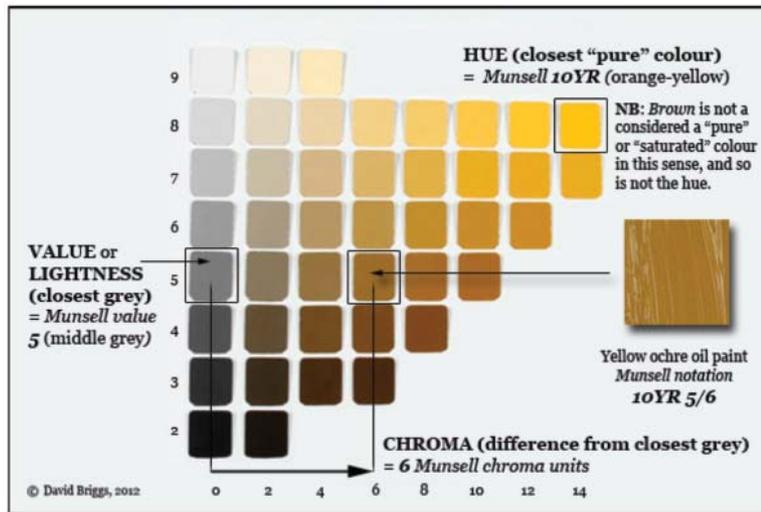


Figure 2 Colors in Three Dimensions: Hue, Value and Chroma

Source: Briggs (2012)

These three dimensions of colors can create the visual impact which leads to the perception of consumers. Scholars have investigated the influence of colors or hues in various contexts such as child education (Hamid and Newport, 1989), architecture (Eiseman, 1998), fashion (Choo and Kim, 2003), communication (Gorn, Chattopadhyay, Sengupta, and Tripathi, 2004), marketing and branding (Bellizzi and Hite, 1992) including in fluencing of colors across cultural dimensions (Posnock, 2009), personalities (Kargere, 1979), lifestyles (ibis.) and many others. At present, the color research has expanded to the online customer behavior domain (e.g., Ettis, 2017; Zhen and Huang, 2017). Although the influence of hues on emotion that could lead to behavior had been explored in the past, there are still dimensions of hue (color), value (degree of lightness) and chroma (intensity or saturation) to be further investigated for more understanding in people's emotion.

In other words, the issue of “how to use the color?” remains an up-to-date issue (Pelet, 2014; Roschk, Loureiro, and Breitsohl, 2017). One of interesting questions that remains unanswered is whether the combination of different colors and intensities could have any impact on inducing behavioral intention of consumers. In other words, will different hues with different intensities can create the effect to consumer decision making more than using a single hue with a single intensity?

## **The Context of Interest: Relaxing Services**

One key service sector is the relaxing services which mean services that can comfort consumers in hectic and busy lifestyles to become more mentally balanced and peaceful. The emerging of spa, boutique resort and hotel, fitness center, club house, tea & coffee house, etc. are well known examples of relaxing service businesses. These relaxing services have been used color to help make their targeted customers perceived relaxing from their services. (Kang, Boger, Back, and Madera, 2011)

Studies in the relaxing service context suggested the importance of choosing suitable colors that fit to the business and compatible with customers’ emotions (Singh, 2006; Kang et al., 2011; Roschk et al., 2017; Setiowati and Putri, 2012). In this research, we emphasize on the combination of colors and intensities and their effects on consumers’ emotions which may subsequently create purchase intention in the relaxing service context.

## **Research Questions and Objective**

To our knowledge, very limited studies have explored the effect of colors intensity to stimulate the decision making in a relaxing service business. More studies are needed in order to gain better understanding of consumer buying decision in this particular business. The main research question is whether the mix or the combination of colors with different intensities or saturation can induce consumer behavioral intention to purchase the relaxing service. And if this will be the case, which combination of colors intensity can induce their purchase intention. In sum, the research questions are:

1. What are combinations of colors and intensities that impact consumer purchase intention in the relaxing service business?
2. How does the combination of colors and intensities impact on consumer purchase intention in the relaxing service business?

### **Accordingly, the research question is as follow:**

To discover how the combination of colors and their intensities can affect consumer purchase intention in relaxing service business and what combination of colors intensity can make the most impact on their decisions.

### **Literature Review**

Evidence from past research indicated that certain hues were more relaxing than others. Ettis (2017), Gorn, Chattopadhyay, Yi and Dahl (1997), Valdez and Mehrabian (1994) found that blue could induce a feeling of relaxing. On the other hand, Ettis (2017), Adams and Osgood (1973); Jacobs and Suess (1975) found that yellow and red could elicit a less relaxed feeling. Specifically, yellow and red were found to trigger excitement, which was opposite to relaxing. Research also indicated that color value had a strong effect on relaxing. With more blackness, colors elicit greater feelings of relaxing (Valdez and Mehrabian, 1994). Chroma, which ranges from high to low saturation also has the effect. With more saturation, colors are more vivid and intense which lessen a feeling of relaxing (Valdez and Mehrabian, 1994). Table 1 summarizes the relationships of the three color dimensions with relaxing based on the literature reviewed.

**Table 1 Relationships of the Color Dimensions with Relaxing**

Dimension of color	Inducing more relaxing	Inducing less relaxing	Studies
Hue	Blue	Red, yellow	Ettis (2017), Gorn et al. (1997, 2004), Valdez and Mehrabian (1994)
Value	More black	Less black	Adams and Osgood (1973), Jacobs and Suess (1975)
Chroma	More saturation	Less saturation	Valdez and Mehrabian (1994)

Although the previous studies had found relationships between the three color dimensions of the relaxing, these previous studies were short of the information in purchasing decision. There has been a very limited understanding of the relationship between colors intensity and relaxing in the service sector that relaxing might be influenced by different hues and color intensity.

## Studies on Colors in Relaxing Service

Spa service has become a popular type of relaxing service where the emphasis is on water-based relaxing as well as physical and psychological healing (Chen, Liu, and Chang, 2013). Various studies have found that relaxing was the most common reason cited for visiting spas, though physical healing, illness prevention, beauty treatments, the desire to improve fitness or lose weight, and the belief that spas could delay aging or increase longevity. This belief has been cited as the motives for purchasing spa service (Tawil, 2011). Although there are many recommendations for spa based on the studies in other contexts, there has not been any research to examine the impact of different mix of colors intensity applied to the spa on customers' intention to buy.

Hues or normally so called "colors" are often classified as warm or cool when examining their effects on mood and emotion in relaxing services, such as spa. Cool

colors such as green, blue, and purple are thought to induce the calm state of minds, whereas warmer colors such as yellow, orange, and red are believed to induce the feeling of excitement (Wang, Jia, Yin, and Cai, 2013). Therefore, given that relaxing is a common desire for using spa services, it would be expected that cool colors used in the spa decor would yield a more positive customer response because cool colors serve the emotional needs of customers better. However, some findings of the spa research suggested that warm colors could elicit more desirable emotional responses and revisit intentions. Research by Kang, Boger, and Back (2011) found that warm colors were pleasing to spa customers and were associated with positive behavioral intentions. Setiowati and Putri (2012) also found that warm colors contributed to the emotional value associated with spas. Ettis (2017), currently, discovered that even in the online domain, blue increases the customer's flow, while yellow worsens such the experience.

Previous research findings on emotional reactions to colors in other service contexts also provided some interesting insights. Research conducted in the restaurant had found that blue and green had a calming effect, whereas red and yellow could capture attention and stimulated appetite (Singh, 2006). Kaya and Epps (2004) found that green, blue, and purple were perceived as relaxing colors by some college students. However, color associations were affected by personal preferences and symbolism. For example, some respondents associated blue with sadness and red with love. Therefore, it was possible that warm colors evoke positive feelings due to the social value and subsequently making them appealing in the spa environment. Interestingly, they also found that chroma and value were more important to emotional response than hues. The meta-analysis of 66 research papers on color in the last 30 years by Roschk et al. (2017) confirms the argument.

Research conducted by Manav (2007) found positive associations with warm colors in some cases. When contemplating particular colors in general and as potential residence decor in particular, participants' responses varied significantly based on value and chroma. For example, students found yellow color was boring, tiring, annoying, anxiety-provoking, depressive, and fear-inducing with a low value (darker) and high chroma (intense saturation), but with a medium value and low chroma, yellow induced

feelings such as cheerfulness, warmth, and enjoyment. Therefore, even the same hue but if this hue had different color purity or saturation, it could bring different feelings. A particular shade of orange was also associated with cheerfulness and good fortune, and pink with romance, enjoyment, and warmth. A certain shade of red, by contrast, was considered tiring and depressive. Most respondents found green and blue relaxing, but some perceived green as exciting, dynamic, and vivid or depressing, and blue as dull or cold. Gender, age, and education level did not affect the findings for any color except achromatic black. (Manav, 2007)

Research conducted by Kido (2000) provided some confusing results that respondents prefer warmer colors in environments designed to promote relaxing. Kido (2000) examined the bio-psychological effects of colors. It was found that despite the belief that blue was a cool color, for some reasons, it had the stimulating effect on the sympathetic nervous system, increasing heartbeat, blood pressure, perspiration, and other physical effects that impede relaxation. While red and green had the least impact on sympathetic nervous system activation. It was not clear why a cool color like blue could stimulate the effect on the sympathetic nervous system.

It should be noted that other bio-psychological researchers had found different physiological responses to colors. For example, Ward (1995) indicated that in the working environment, cool colors such as violet and blue decrease sympathetic nervous system activation, as indicated by physiological responses (i.e., heart rate), whereas warm colors such as red and orange increase it. Table 2 provided a summary of the research findings.

Overall, studies of color affected on psychological and physiological relaxing had found mixed results and it was rather difficult to make conclusive recommendations. Until now, there has been very few research on the combination of colors intensity conducted to understand customers' behavioral intention within the context of relaxing services, Therefore, the study of the combination of colors intensity or chromas in the relaxing service business could enhance the understanding of what and how consumers react to the combination of colors intensity that might lead to the behavioral intention. These insights can benefit consumer behaviorists and top management of this business arena.

**Table 2** Prior Research on Responding to Colors in Various Environments

Researchers	Context	Findings
Ward (1995)	Workplace	Violet and blue decrease physiological arousal (and therefore promote physical relaxation); red and orange increase arousal.
Kido (2000)	General	Blue induces high sympathetic nervous system arousal (incompatible with relaxation); red and green induce less arousal.
Gao and xin (2006)	General	Chroma and value have a far more significant influence on emotion than hue.
Manav (2007)	Residence	Responses to warm and cool hues may be positive or negative based on value and chroma.
Singh (2006)	Restaurant	Green, blue, and purple have a relaxing effect; red and yellow capture attention and stimulate appetite.
Kang et al. (2011)	Spa	Warm colors have a positive effect on spa customers' perceptions and behavioral intentions.
Setiowati and Putri (2012)	Spa	Warm colors increase emotional value and, by extension, overall perceived value, which in turn increases the likelihood of repurchasing spa services and recommending the spa to others.
Ettis (2017)	Online	Blue increases the customer's flow but yellow decreases such the experience.
Roschk et al. (2017)	Meta-Analysis	An analysis of 66 studies and 135 effects leads to the concrete finding that cool colors produce higher levels of satisfaction than warm colors.

## Research Methodology

It is essential to initially discuss with the specialists in the color and design areas in order to get their opinions which will lead to the development of the appropriate experimental research. The objective of the expert interview is to validate the objectives and elicit the methodology of the experimental research to collect the valid and reliable data.

Two color experts are identified for the interview. The first one is the Director of the Institute of the Development of the Garment Industry, Ministry of Industry. The second expert is the former head of the Department of Image and Printing Technology, Faculty of Science of the leading university in Thailand who has internationally and extensively published in the field of color. Both of them have extensive experiences in the color and emotion research area.

The experts point out the impact of light and the surface of materials that can have effect on the colors. They particularly mention the importance of the combination of colors that might have some impact on the emotions of people in different circumstances. Obviously, they assert that the knowledge of the effect of the colors intensity combined is very premature at this stage and the appropriate experimental research design can help to find some meaningful information in the area to help the academics and management to understand much better.

Further, the experts point that the experimental design should be done with cautions. Many confounding variables, such as demographical variables and environmental variables, should be greatly controlled. Accordingly, the experimental research is carefully designed. The design is two-fold:

1. The pilot test to specify the colors or hues to be used in the main experiment
2. The virtual reality experiment to test the impacts of colors and the intensities combination on purchasing intention and the underlining reasons of the impacts

## 1. Pilot test

The objective of the pilot test is to identify which hue(s) or color(s) to be perceived as the color(s) for the relaxing service. 110 subjects, both males and females graduate students in a business school of a leading university in Bangkok, Thailand. They are about the same age and have been exposing to similar environment in terms of their normal lifestyles. Thus the condition of equivalence of the subjects could be assumed.

### Method of the pilot test

110 business students are shown 7 cards with different colors (yellow, blue, purple, red, orange, navy blue, and green). Then they were asked to choose only two colors that represent what they think should be the colors to be used for the relaxing services. The two most chosen cards by these students would be the colors for the experiment in the next step. Students were given a few minutes to choose the cards and then they answered two questions: 1) What could be the specific place that you think of when you want to feel relax? And 2) Why do you chose these two colors?

For the first question, the majority of the students in the pretest reveal that they think of resorts, spa, seaside, garden and temples when they want to feel relax. As spa is the most chosen place for relaxation, it will be used as a proxy of the relaxing service business in the next step.

For the second question, the two most chosen colors are blue (66.36%) and green (51.81%). The main reasons of choosing blue are warm, relax, and peaceful while green makes the subjects feel close to nature, cool, and calm. The results from the pretest get along well with the results of the past studies (Kaya and Epps, 2004; Singh, 2006). According to the results from the pretest, researchers decide to use blue and green colors for the experimental research.

## 2. Virtual Reality Experiment

From the results of the pilot study, the two most chosen colors, blue and green are designed into 2 levels of intensity: light (L), and dark (D). The method that is used to categorize the saturation of color is simply the quartile of the intensity of colors. Given that there are four quartiles ranging from the first to the fourth (the degree of the intensity or saturation). The first quartile (1-25%) depicts the visualized light color and the fourth quartile (75-100%) depicts the dark color.

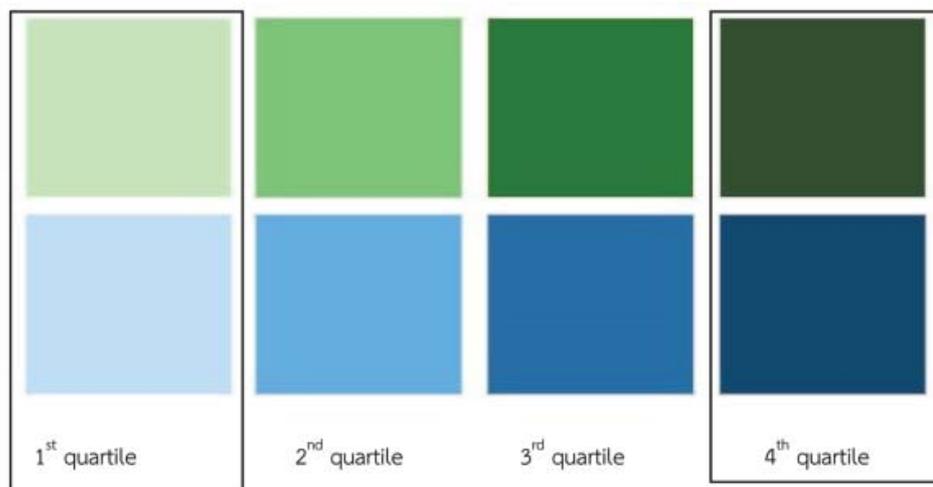


Figure 3 Quartiles of Colors: Green and Blue

After the two chosen colors are identified, six pairs of the combination of the blue and green colors will be used for the further experiment as shown in Figure 4.

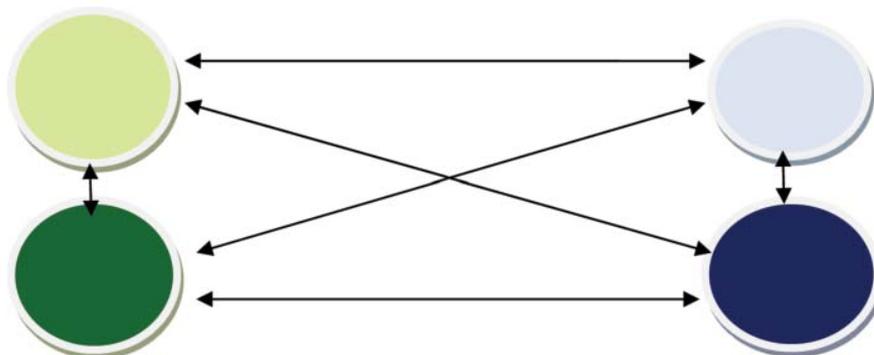


Figure 4 Six Pairs of Blue and Green Colors Intensity Combination

#### Experimental subjects

Subjects are undergraduate students of a leading business school in Thailand both male and female age 20-22 years old. They have very similar background of lifestyles and education. The subjects are volunteers and they are randomly assigned the different treatments. Subjects are brief about the situation in the experiment and they allow the researchers to use the virtual cameras on them. The determined sample size are 180 subjects which is considered sufficient for the analysis.

#### Treatments: colors X intensities combination

The 3-D pictures of 6 spa rooms are drawn by an interior artist. The 3-D picture is designed to reflect the virtual reality of a spa room as much as possible. 6 pairs of colors are applied to the left and the right walls of a room in an equal proportion of the wall space. All the furniture and decorations, including bed, lamps, chandelier, chair, tables, etc. are identical in all the rooms to make sure that the overall condition of the room is controlled. Only the combination of the colors and the intensities will be the treatment factors in the experiment (see Figure 5-10).



Figure 5 Room # 1: Light Green and Dark Green



Figure 6 Room # 2: Light Green and Dark Blue



Figure 7 Room # 3: Light Green and Light Blue



Figure 8 Room # 4: Light Blue and Dark Green



Figure 9 Room # 5: Light Blue and Dark Blue



Figure 10 Room # 6: Dark Green and Dark Blue

### Virtual reality equipment

To avoid possible external confounding variables, an equipment for the eyes control is used. 3-D virtual reality cameras are generously provided by a leading international firm in electronics and telecommunication industry.



Figure 11 3-D VR Cameras

### Procedure

The experimental room is located in a business school of the leading university in Bangkok, Thailand. The condition of the room is suitable for conducting the experiment to make subjects feel comfortable and relax throughout the experiment.

A 6x6 Latin square design is used to eliminate sources of biases. Table 3 shows six sets of the combination of colors intensity. 30 subjects are then randomly assigned to each set of the combination of colors intensity. Altogether there are 6 sets of students for the experiments. Therefore, the total sample size is 180 subjects. The subjects will be given an instruction before the experiment starts about how to use the 3-D VR camera and how to adjust the clarity of the pictures that they will see. The researchers set up all 6 pairs of color combination into the cameras and ask the subjects to test the clarity of the picture first by showing unrelated / irrelevant picture before the real experiment

begins. When the subjects are ready, they will start the experiment at the same time. The research assistant will click the first picture for them and ask what they actually see to ensure the accuracy. The subjects look at the first picture for a moment, then they will take off the cameras and rate a spa room # 1 from score 1 to 10 how they feel like to use the room they just see.

When subjects finish answering the first question, they are requested to put on the cameras again and proceed to the second room. The process be repeated until the subjects see a room #6 which is the last room. At the end of the experiment, each subject will be asked to *choose only one room that they feel like to use the service the most*. They must also provide a brief reason why they choose this specific room.

**Table 3 The Experimental Research Design**

Set of colors	Colors intensity in a random order					
Set 1	R1	R2	R3	R4	R5	R6
Set 2	R2	R3	R4	R5	R6	R1
Set 3	R3	R4	R5	R6	R1	R2
Set 4	R4	R5	R6	R1	R2	R3
Set 5	R5	R6	R1	R2	R3	R4
Set 6	R6	R1	R2	R3	R4	R5

Note: R1 = Room 1 : Light green and dark green (LG/DG)

R2 = Room 2 : Light green and dark blue (LG/DB)

R3 = Room 3 : Light green and light blue (LG/LB)

R4 = Room 4 : Light blue and dark green (LB/DG)

R5 = Room 5 : Light blue and dark blue (LB/DB)

R6 = Room 6 : Dark green and dark blue (DG/DB)

To verify the results of the first experiment. The second study using a within-subjects design is conducted. Two months after the first experiment, the same group of students is requested to perform similar experiment with the same set of the combination of colors intensity.



Figure 12 Experimentation with a VR Camera

### Data Analysis

After checking the completeness and the accuracy of data obtained, the analyses are performed in four parts: i) differences in relaxing level induced by colors and intensities combination, ii) impacts of intensities or chromas on purchasing intention, iii) impacts of colors on purchasing intention, and iv) reasons of choosing the specific colors and intensities.

- Differences in relaxing level induced by colors and intensities combination

Table 4 shows the averages or mean scores of different colors and intensities combination obtained from the first and the second experiment. It is found that the mean scores for each room obtained from both experiments are very consistent.

**Table 4 Mean scores of different colors and intensities combination**

Room	1 <sup>st</sup> Experiment			2 <sup>nd</sup> Experiment			
	N	$\bar{x}_1$	S.D.	N	$\bar{x}_2$	S.D.	$\bar{x}_1 - \bar{x}_2$
1: LG+DG	180	6.06	1.834	180	6.57	1.678	.51 (.08)a
2: LG+DB	180	5.73*	1.726	180	5.59	1.691	.14 (.02)
3: LG+LB	180	6.96*	1.773	180	7.28	1.750	.32 (.04)
4: LB+DG	180	5.16*	1.763	180	5.33	1.550	.17 (.03)
5: LB+DB	180	7.29*	1.549	180	7.57	1.434	.28 (.04)
6: DG+DB	180	4.93*	1.976	180	5.12	1.872	.19 (.04)

a. The percentages of ( $\bar{x}_1 - \bar{x}_2$ ) for  $\bar{x}_1$  are shown in parentheses

\* Dependent sample t-test reveals no significant differences between 1<sup>st</sup> and 2<sup>nd</sup> experiments ( $p > .05$ )

A one-way between subjects ANOVA was conducted to compare the effect of colors and intensities combination on purchasing intention in the six conditions. There were significant effects of colors and intensities combination on purchasing intention in the relaxing service at the  $p < .05$  level in both experiments [ $F(5, 1074) = 51.57, p = .045$ ] and [ $F(5, 1074) = 70.35, p = .04$ ]. Therefore, the impact of combination of colors and intensities on purchasing intention are significant different among the six combinations.

- **Impacts of intensities (chromas) on purchasing intention**

The intensity of color is known as “chroma” or the degree of saturation which is applied in a hue. One hue could have different degree of intensities. The colors combination of the six rooms can be classified into 2 categories: same intensity and different intensities. Specifically, Rooms #1, #2, #4 and #5 have different chromas but Rooms #3 and #6 have the same degree of chromas.

A paired-samples t-test is conducted to compare the purchase intention between the two categories. There is not a significant difference in the mean scores for the different chromas (Ex1:  $M = 6.06$ ; Ex2:  $M = 6.26$ ) and the same chroma (Ex1  $M = 5.95$ ; Ex2:  $M = 6.20$ ) categories; Ex1:  $t(1078) = -.52$ ,  $p = .6$ ; Ex2:  $t(1078) = -.91$ ,  $p = .37$ . Therefore, it can be concluded that different intensities or different degrees of chroma do not have impact on purchasing intention in the relaxing service business.

- **Impacts of colors (hues) on purchasing intention**

Color (hue) combination has not been studied in the past. Accordingly, it is interesting to discover whether “blue or green” or “blue and green” will have more impact on the purchase intention in relaxing services. The colors combination of the six rooms can be classified into 2 categories: same hue and different hues. Specifically, Rooms #1 and #5 have the same hue combination (blue or green) but Rooms #2, #3, #4 and #6 have different hues combination (blue and green).

A paired-samples t-test was conducted to compare the purchase intention between the two categories. There was a statistically significant difference in the scores for the same hue combination (Ex1:  $M = 6.68$ ; Ex2:  $M = 7.07$ ) and the different hues combination ( $M = 5.70$ , Ex2:  $M = 5.83$ ) categories; Ex1:  $t(1078) = 8.16$ ,  $p \leq .01$ ; Ex2:  $t(1078) = 10.48$ ,  $p \leq .01$ . Therefore, it can be concluded that a same hue has impact on the purchase intention in the relaxing service business. According to the results, using one hue has better impact on consumers purchase intention than using two hues combined.

- **Reasons of choosing the specific colors and intensities**

At the end of the experiment, respondents are asked to choose only one room that has the color/intensity that they prefer most and they have to write brief reasons why they choose the particular room. The content analysis is conducted for the answers of all 180 subjects by judging the meaning of stated reasons and grouping those reasons according to how subjects express their feelings. The reasons that are interpreted by experts that have the same meaning are grouped together.

According to the findings, Room #5, “light blue and dark blue,” has been chosen the most (Ex1: 41.67% ; Ex2: 38.89%) followed by Room #3, “light green and light blue” (Ex1: 38.89%; Ex2: 40.56%); Room #1, “light green and dark green” (Ex1: 7.22%; Ex2: 10.00%), Room #6, “dark green and dark blue” (Ex1: 5.00% ; Ex2: 5.00%), Room #4, “light blue and dark green” (Ex1: 3.89% ; Ex2 : 3.33), and Room #2, “light green and dark blue” (Ex1: 3.33%; Ex2: 2.22), respectively. It must be noted that the results from the second experiment are very similar to the results obtained from the first experiment. Room #5 (the same hue which is light blue and dark blue) is the most preferred room and Room #2 (the combination of light green and dark blue) is the least preferred colors.

The main reason for the most preferred colors is “pleasing to the eyes” (Ex1: 42.52%; Ex2: 41.45%) followed by “feeling relaxing” (Ex1: 31.63%; Ex2 36.00%) and “the colors are compatible and balanced” (Ex1: 15.31%; Ex2: 15.27%). The other reasons are “natural/forest/sea”, “personal preference” and “peaceful” Table 8 and 9 summarize the results of the content analysis from the first and the second experiment.

**Table 5 Mean Scores and the Stated Reasons (1<sup>st</sup> Experiment: N=180)**

Reasons	Group	Group	Group	Group	Group	Group	Total	%
	1	2	3	4	5	6		
Pleasing to the eyes	21	23	18	25	18	20	125	42.52
Feel relaxing	15	14	14	20	15	15	93	31.63
Compatible/ balance	6	9	5	12	7	6	45	15.31
Nature/Forest/ Sea	3	-	3	1	2	4	13	4.42
Personal preference: light	1	2	2	1	1	5	12	4.08
Personal preference: dark	1	5	-	-	-	-	6	2.04
<b>Total</b>	<b>47</b>	<b>53</b>	<b>42</b>	<b>59</b>	<b>43</b>	<b>50</b>	<b>294</b>	<b>100</b>

**Table 6 Mean Scores and the Stated Reasons (2<sup>nd</sup> Experiment: N=180)**

Reasons	Group	Group	Group	Group	Group	Group	Total	%
	1	2	3	4	5	6		
Pleasing to the eyes	16	20	18	22	20	18	114	41.45
Feel relaxing	18	18	15	18	16	14	99	36.00
Compatible/ Balance	6	5	6	3	10	12	42	15.27
Peaceful	2	2	2	2	-	2	10	3.64
Nature/Forest/ Sea	4	-	1	-	1	1	7	2.54
Personal preference	-	1	-	2	-	-	3	1.09
<b>Total</b>	<b>46</b>	<b>46</b>	<b>42</b>	<b>47</b>	<b>47</b>	<b>47</b>	<b>275</b>	<b>100</b>

## Discussion

The objectives of this research are to discover how the combination of colors and their intensities can affect consumer purchase intention in relaxing service business and what combination of colors and their intensities can make the most impact on the purchase intention. The study is three-fold: expert interview, pilot study, and the VR experiments. The results from the expert interview demonstrates the need of a study of color combination. The pilot study reveals “Blue” and “Green” induce relaxing but “Blue” is more relaxing than “Green.” In the experiments, 180 undergraduate students both males and females in the Business School of the leading university are the subjects of the experiments. 30 subjects in each group of the total six groups are randomly assigned to receive the treatments which are colors and the intensities combined. There are altogether six different treatments. Two experiments are conducted using the same subjects and the same treatments to verify the reliability of the results.

The results of data analysis reveal that the highest purchase intention is Room #5 (light blue and dark blue) followed by Room #3 (light green and light blue).

The least purchase intention is Room #2 (light green and dark blue). The results from both experiments are very consistent. It is found that colors combination have different impacts on the purchase intention in the relaxing services.

Results from further analysis reveal some interesting results. Different intensities or different degrees of chroma do not have impact on purchasing intention in the relaxing service business. Interestingly, it is found that the combination of hues has impact on purchasing intention in relaxing services. Specifically, using the different relaxing colors, e.g. Room #2 (light green and dark blue), can reduce the impact of the colors on purchase intention.

The underlining reasons why some color combinations have better impact on purchasing intention are “pleasing to the eyes”, “feeling relaxing”, and “compatible, balanced, can go well together.” “Pleasing to the eyes” conveys the meaning that “seeing is pleasing.” All the major reasons fits the results of the impact of combination of the same color used in the relaxing service business.

## Contributions

This research is the first virtual reality experimental research in color in Thailand. The study contributes in both theoretical and managerial dimensions. For the theoretical contribution, the knowledge of the impact of color (hue) and intensity (chroma) is enhanced by emphasizing on the combination of both colors and the intensities. The findings reveal that colors (hues) combination moderate the impact of color on purchase intention than using one hue. Specifically, the combination of different relaxing colors (green and blue) can reduce the impact of colors on purchasing intention in the relaxing service business.

As for the managerial contribution, this study provides some clues to management in the relaxing service business. Consumers can be induced to purchase by the suitable application of colors. According to the findings, the color which is found the most pleasing to the eyes and give relaxing feeling to consumers in the relaxing services is light blue and dark blue. The interior design for the relaxing services should choose “Blue” over

“Green.” The combination of color intensity has no impact on purchase intention. More importantly, the combination of the two relaxing colors should be avoided because it reduces the impact of purchasing intention.

## Limitations and Suggestion for Future Research

Though the VR experiment is carefully conducted, there are some limitations. Using student subjects, though is the normal practice, can lead to some confounds, including experience in relaxing services of the students and many socioeconomic factors. We, therefore, conducted the 2<sup>nd</sup> experiment to control those confounding variables. Additional, it will be much interesting to conduct the experimental research in different service contexts such as hospital, school or university, fitness center, etc. in the real service atmosphere to better obtain the generalizability and to increase the external validity of the results. The future research can also consider additional treatments for the absolute completeness of the study, i.e. “dark green and dark green,” “dark blue and dark blue,” “light green and light green,” and “light blue and light blue.” Experiments using the subjects with relaxing service experiences would improve external validity of the findings. However, we argue that the current design of the research is appropriate for the research questions without losing the validity and reliability of the study. Last but not least, it is an ideal if the future research can study the impact of combination of colors and intensities on the actual purchase behavior in the service businesses as mentioned.

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