In Color We Live

Can you imagine a world without colors? The physical and psychological effects of colors contribute to a satisfying and joyful way of life, far beyond aesthetic pleasure, in both natural and man-made environments. Color as an interface connects us with our surrounding environment, and color differentiates the things we need not only to survive, but to indulge in life and to appreciate it.

The aim of the conference is to explore how colors interact with our daily life, to approach the conscious and unconscious influence color may have on individual thought and perception, and how we can identify and apply colors from a healthier and more sustainable perspective. Seven fields of discussion have been selected for discussion: Color and Environment, Color Culture, Art and Design, Color Communication, Color Synesthesia and Visionary Projects, Color Science and Technology, Color Psychology, and Color Education.

"In Color We Live - Color and Enviroment" hopes to emphasize the importance of a colorful environment for a sustainable and healthy way of life, by addressing both individual and basic human needs, and by giving examples drawn from all aspects of life.

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Conference Proceedings AIC 2012 In Color We Live: Color and Environment

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Interim Meeting of the
International Colour Association (AIC)
22-25 September 2012 Taipei, Taiwan

Conference Proceedings

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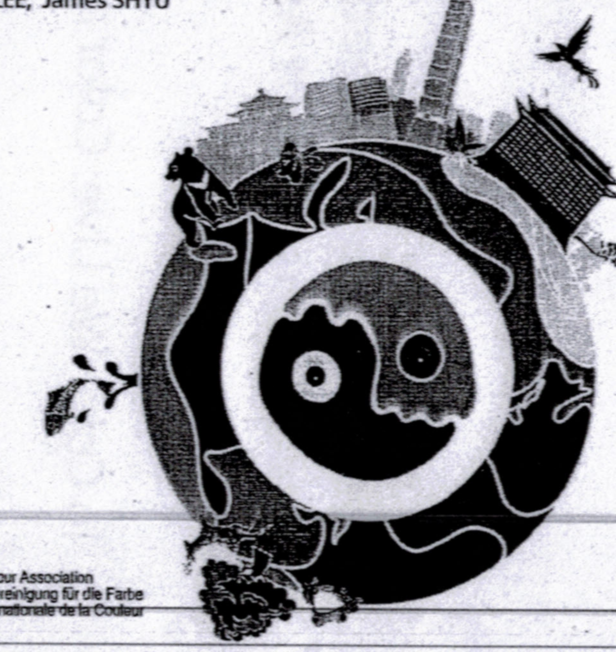

International Colour Association
Internationale Vereinigung für die Farbe
Association Internationale de la Couleur

AIC 2012 Interim Meeting of the International Colour Association (AIC)

In Color We Live: Color and Environment

Conference Proceedings

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Effect of Ambient Illumination on Color Preference

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ABSTRACT

A color of object not only was observed under white illumination, but also various colored illuminations. This study, hence, was carried out to explore the influence of ambient illumination on color preference. Eight color chips and one achromatic color chip chosen from the Munsell notation were presented under various ambient illumination conditions that consist of reddish, greenish and white illuminations. The empirical evidence indicated that color preference was inconstant when the colors are viewed under colored illumination. We concluded that a colored illumination has an effect on color preference. In addition, we found that color illumination had a small effect on color preference in the light source color mode.

1. INTRODUCTION

It is well known that color is one of the critical factors influencing customer's satisfactory; an understanding of color preference is thus important in many fields, for instance, product design, advertisings, marketing, lighting designs and so on. Color preference indicates whatever a color or color combination is preferred by a group of viewers. It was also referred to as an estimate for the pleasantness of a color so that the color preference is a powerful tool to attract a subject's attention and to arouse the desire to consume. Studies on color preference have long focused on the hue effect; what colors were generally preferred and what colors were not. Many researchers have attempted to deal with color preferences and their variations as a function of age, gender, geographical region, culture, and circumstances (e.g., Guilford, 1934; Eysenck, 1941; Guilford and Smith, 1959). Along with the aforesaid variations, color preference also depends on illumination. Much of the earlier work dealing with color preferences has failed to observe colors under white illumination. In our daily life, color is observed under plenty of ambient illuminations. For instance, the color of interior design at restaurant and products at department store are viewed under colored illumination. Is there consistency in color preference on different illumination? The major aim of this work, hence, is to investigate the relationship between color preference and ambient illumination.

2. EXPERIMENT

As shown in Figure 1, the apparatus was composed of subject's room and test chart's room separated by a wall having a 1° square aperture. The subject's room was 1.3 x 2 x 2 m^3 (W x L x H) and a wall inside the room was covered with wallpaper of about N9 and illuminated by two set of adjustable fluorescent lamps. The one set is of two daylight lamps covered by colored filter and the other ones is of one uncovered lamp. The intensity of the lamps was adjusted by a light controller and the room illuminance was measured by an illuminometer placed on a shelf below the test stimulus at a distance of 44 cm. Many objects such as artificial flowers, dolls, books were put into this room. Color patches to serve as the test stimuli were attached to a rotating wheel placed in test chart's room. They were illuminated by daylight fluorescent lamps. The subject sat in subject's room and looked at them through the aperture from a distance of 1.3 m.

Color stimuli were selected from four chromatic elementary hues and four intermediate hues between them and one achromatic. The appropriate Munsell colored papers for presenting them were 5R 4/14, 5YR 6/14, 5Y 8/14, 5GY 6/10, 5G 3/10, 10BG 4/9, 10B 4/10, 5P 4/10, and N5. All of them were observed under seven illuminations (three reddish and greenish illuminations and white illumination). It was namely RI_1, RI_2, R_3, GI_1, GI_2, GI_3, and WI. The experimenter randomly adjusted illumination condition in the real room. For reasonably perceiving different color appearance mode, the illumination condition was kept constantly at 50 lx in subject's room and 700 lx in test's chart room for perceiving color in light source color mode and at 100 lx in subject's room and 30 lx in test's chart room for perceiving color in object color mode.

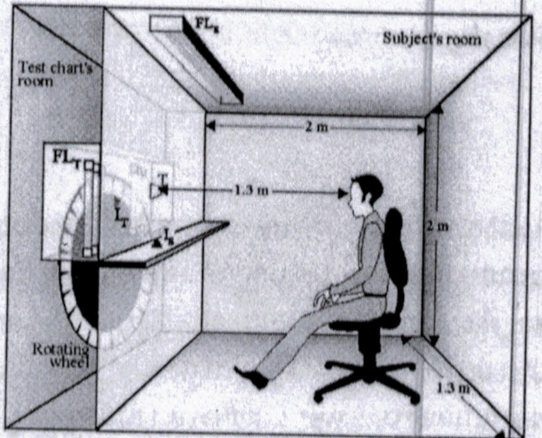

Figure 1. Schematic diagram of the apparatus.

In the experiment, the subject engaged in three tasks. First, the subject were asked to rate the degree of color preference for each given color by using the scale which was divided into 7 levels, as -3 (dislike) to +3 (like). Second, subjects were asked to perform elementary color naming on the basic of the NCS color system. In the last one, subject judged the color appearance mode. The subject was instructed to look around and not stare at the color chip during evaluation. One session is composed of 9 color patches observed under 16 illumination conditions. Each session had 5 times of repetition.

3. RESULTS AND DISCUSSIONS

Figure 2 shows the average of color preference score of N5, 5R 4/14, and 5G 3/10 in reddish and greenish illuminations. The abscissa represents to x and y value of CIExy color space and the ordinate represent to color preference score. The opened symbol denoted a color chip appearing in light source color mode (LS mode) and the other denoted that appearing in object color mode (OB mode). The color appearance mode of each color chip was quantitatively expressed using the color appearance mode index, i_{CAM}. This index was determined using the following equation:

$$\text{Color appearance mode index } (i_{CAM}) = \frac{-1(N_{OB}) + 0(N_{UN}) + 1(N_{LS})}{N_{OB} + N_{UN} + N_{LS}} \quad (1),$$

where N_{OB}, N_{UN}, and N_{LS} are the numbers of responses in OB mode, UN mode, and LS mode, respectively. If $i_{CAM} \geq 0.5$, the color chip was classified as the LS mode. On the other hand, if $i_{CAM} \leq -0.5$, the color chip was classified as the OB mode. An i_{CAM} between -0.5 and +0.5 was classified as the UN mode.

The result in reddish illumination condition showed that the color preference score in LS mode has a small change when the subject's room was redder. On the contrary, the score in OB mode started to decrease and then grew up except the score of 5R 4/14. In the greenish illumination condition, the score in LS mode resulted as same as the result in reddish illumination condition except the score of 5G 3/10 whereas the score in OB mode decreased when the room was greener. The same tendency occurred on the most of color patches. Regarding the result in OB mode, the color of chips that were opposite to the color of illumination would be improved. This feature implied that a colored illumination has an influence on a color preference. An increase in poster

color preference might be explained by color constancy. Hence, a perceived color attribute was investigated.

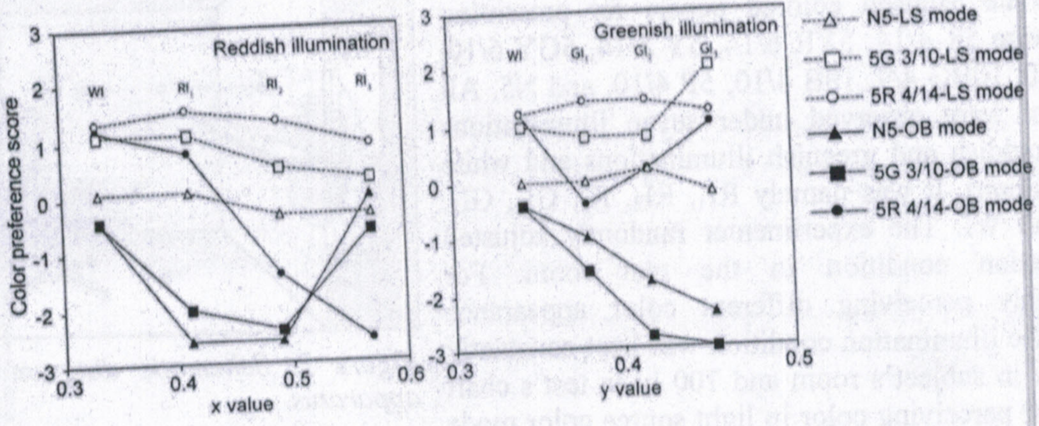

Figure 2. Mean color preference score of red, green, and gray color patches observed under reddish and greenish illuminations.

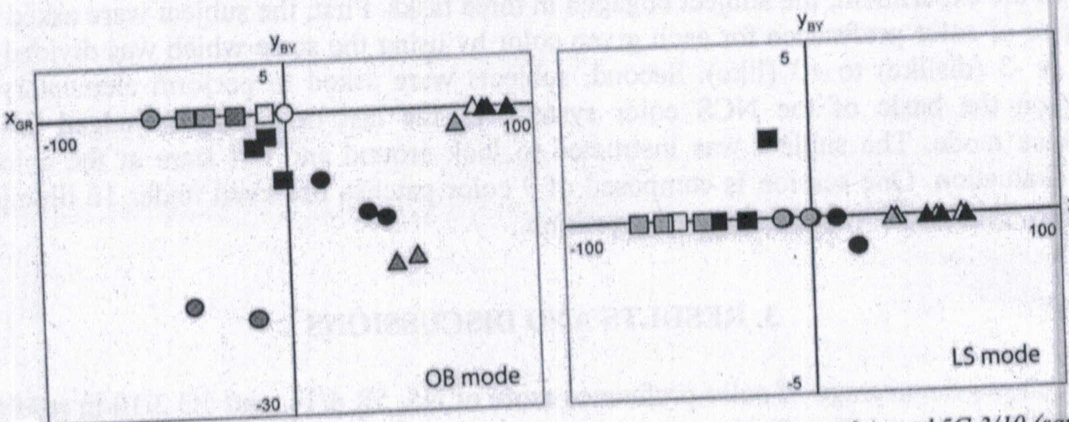

Figure 3. Results for perceived hue coordinates of N5 (circle), 5R 4/14 (triangle), and 5G 3/10 (square) classified into 3 illumination conditions (white, WI; gray, RI; black, GI).

Figure 3 showed the result of the perceived hue coordinates obtained from elementary color naming. The abscissa represents the x_{GR} values and the ordinate, the y_{BY} values. The outermost axis corresponds to a perceived chromaticness. The position of a point is expressed using the perceived hue coordinates (x_{GR},y_{BY}), and is represented by the following equation:

$$x_{GR} = \begin{Bmatrix} R \times C_P \\ (-1)G \times C_P \end{Bmatrix} \times \frac{1}{100}, \; y_{BY} = \begin{Bmatrix} Y \times C_P \\ (-1)B \times C_P \end{Bmatrix} \times \frac{1}{100} \quad (2),$$

where *R, G, B,* and *Y* are the amounts of the perceived red, green, blue, and yellow, respectively and C_P is the amounts of perceived chromaticness. As shown in Figure 3, a color chip appeared greener in the reddish illumination, whereas it appeared redder in the greenish illumination. For instance, a gray color chip appeared gray under white illumination (○) and transformed to greenish under reddish illumination (●) and to reddish under greenish illumination (●). Besides a change of perceived hue, a perceived chromaticness of color patches is also changeable. This feature implied that the reddish illumination gave the green patch more saturation and the greenish illumination gave the red patch more saturation. Most of previous study claimed that a vivid color was preferred to grayish color. This feature occurred in both color appearance modes. This result corresponds to the RVSI concept expressed by Ikeda *et* *al.*(2002). An increase in color preference score of green patch and red patch in Figure 2 might be yielded from the effect of color constancy.

In the addition, the result in different color appearance mode was reported. The scores of LS mode were higher than that of OB mode. The result agrees well with our previous studies (Tangkijviwat et al., 2010). However, the color preference in different color appearance mode might be to meet together at some point when a room was illuminated by colored lamp.

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5. CONCLUSION

In present study, a color patch was assessed on various colored illumination. Findings showed that the color appearing in object color mode which have a color opposite to a color of illumination were found to give an improving color preference. Although colored illumination has an influence on color preference, this effect does not strong in light source color mode. Color preference might be constant when a color appearing in light source color mode. Colors in our daily life are never viewed in white illumination only. This study, therefore, attempts to contribute to the preference response for colors in different colored illumination. The results of the study may be used in design application such as interior design, product design, advertising board, etc.

This study has focused on how the ambient illumination affects color preference. The results of this study obtained from a small number of subject and color patch. Thus, more subjects and color patches will be recruited for improving the results.

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