

CHAPTER 3

EXPERIMENT

3.1 Materials

3.1.1 Neutral grey mask.

3.1.2 The color samples are 20 hues, 13 tones and 6 achromatic colors, which are shown as following.

20 hue : 5R, 10R, 5YR, 10YR, 5Y, 10Y, 5GY, 10GY,
5G, 10G, 5BG, 10BG, 5B, 10B, 5PB, 10PB,
5P, 10P, 5RP and 10RP.

6 achromatic colors : N1, N2, N4, N6, N8 and N9.5.

13 tones : Pale, Pale Greyish, Light, Light Moderate,
Light Greyish, Bright, Moderate, Greyish,
Vivid, Strong, Deep, Dark and Dark Greyish.

Some colors were not used because of the non-existence of dyestuffs with acceptable fastness in some tone regions textile dye were not available. Therefore, the totals of color samples were used in the experiment are 218. There are shown in the Table 3-1. The size of the 218 color samples is about 1 cm. x 1.5 cm.

Table 3-1 Color samples using in the experiment

Hue	Details
5R	5R1, 5R2, 5R3, 5R4, 5R5, 5R6, 5R7, 5R8, 5R9, 5R10, 5R11, 5R12
10R	10R1, 10R2, 10R3, 10R4, 10R5, 10R6, 10R7, 10R8, 10R9, 10R10, 10R11, 10R12
5YR	5YR1, 5YR2, 5YR3, 5YR4, 5YR5, 5YR6, 5YR7, 5YR8, 5YR9, 5YR10, 5YR11, 5YR12
10YR	10YR1, 10YR2, 10YR3, 10YR4, 10YR5, 10YR6, 10YR7, 10YR8, 10YR9, 10YR10
5Y	5Y1, 5Y2, 5Y3, 5Y4, 5Y5, 5Y6, 5Y7, 5Y8, 5Y9, 5Y10
10Y	10Y1, 10Y2, 10Y3, 10Y4, 10Y5, 10Y6, 10Y7, 10Y8, 10Y9, 10Y10
5GY	5GY1, 5GY2, 5GY3, 5GY4, 5GY5, 5GY6, 5GY7, 5GY8, 5GY9, 5GY10, 5GY11, 5GY12
10GY	10GY1, 10GY2, 10GY3, 10GY4, 10GY6, 10GY7, 10GY9, 10GY10, 10GY11
5G	5G1, 5G2, 5G3, 5G4, 5G6, 5G7, 5G9, 5G10, 5G11
10G	10G1, 10G2, 10G3, 10G4, 10G6, 10G7, 10G9, 10G10, 10G11
5BG	5BG1, 5BG2, 5BG3, 5BG4, 5BG6, 5BG7, 5BG9, 5BG10, 5BG11
10BG	10BG1, 10BG2, 10BG3, 10BG4, 10BG6, 10BG7, 10BG9, 10BG10
5B	5B1, 5B2, 5B3, 5B4, 5B6, 5B7, 5B9, 5B10
10B	10B1, 10B2, 10B3, 10B4, 10B5, 10B6, 10B7, 10B8, 10B9, 10B10
5PB	5PB1, 5PB2, 5PB3, 5PB4, 5PB5, 5PB6, 5PB7, 5PB8, 5PB9, 5PB10, 5PB11, 5PB12
10PB	10PB1, 10PB2, 10PB3, 10PB4, 10PB5, 10PB6, 10PB7, 10PB8, 10PB9, 10PB10, 10PB11, 10PB12

Table 3-1 Color samples using in the experiment (cont.)

Hue	Details
5P	5P1, 5P2, 5P3, 5P4, 5P5, 5P6, 5P7, 5P8, 5P9, 5P10, 5P11, 5P12
10P	10P1, 10P2, 10P3, 10P4, 10P5, 10P6, 10P7, 10P8, 10P9, 10P10, 10P11, 10P12
5RP	5RP1, 5RP2, 5RP3, 5RP4, 5RP5, 5RP6, 5RP7, 5RP8, 5RP9, 5RP10, 5RP11, 5RP12
10RP	10RP1, 10RP2, 10RP3, 10RP4, 10RP5, 10RP6, 10RP7, 10RP8, 10RP9, 10RP10, 10RP11, 10RP12
N	N1, N-2, N-4, N-6, N-8, N95

3.2 Apparatus

3.2.1 Gretag SPM 50 spectrophotometer.

3.2.2 Light cabinet with the illuminant D65.

3.3 Observers

The observers are the capital city university students, who are Thai native speaker between 17-25 years old. The number of observers are 60 persons.

3.4 Procedure

3.4.1 *Preparation of color samples*

In this research, 218 polyester color samples were supported by Japanese

research group, were prepared by Kensaikan Co, Ltd in Japan. These color samples were selected systematically in color space from the SCOTDIC PLUS 2000 polyester system (34).

3.4.2 *Measurement of the colorimetric values from 218 color samples*

The colorimetric values, L^* , a^* , b^* , C^* and h , of the color samples were measured by the Gretag SPM 50 spectrophotometer under the illuminant D65 and 2 degree standard observer condition. (see the data in Appendix A)

3.4.3 *The visual experiment*

3.4.3.1 The opponent word pairs in Thai meaning, which used in this research, are “Light-Dark”, “Soft-Hard”, “Warm-Cool”, “Transparent-Turbid”, “Deep-Pale”, “Distinct-Vague”, “Heavy-Light”, “Vivid-Sombre”, “Strong-Weak”, “Dynamic-Passive”, “Gaudy-Pain”, and “Striking-Subdued” as given in Table 3-2. For each of the opponent word pairs, the words on the right side and left side are assigned with -1 and $+1$ point, respectively. (see Appendix B) This process of characterization is called two-point method.

3.4.3.2 60 observers were asking to choose the opponent word pairs that expressed their feelings while they were looking at the color samples under illuminant D65 in the light cabinet. For example, in case of “Warm-Cool”, if the observer chose “Warm”, data would be collected as $+1$ point. On the other hand, if the observer chose “Cool”, data would be collected as -1 point.

Table 3-2 The opponent word pairs used for the visual assessments.

Symbol	The opponent pairs word in Thai	English Translation
LD	SAWANG (สว่าง) - MUED (มืด)	LIGHT - DARK
SH	NUM NUAL (นุ่มนวล) - KANG KRA DANG (แข็งกระด้าง)	SOFT - HARD
WC	RON (ร้อน) - YEN (เย็น)	WARM - COOL
TT	PRONG SAI (โปร่งใส) - TUEB (ทึบ)	TRANSPARENT - TURBID
DP	KHEM (เข้ม) - JANG (จาง)	DEEP - PALE
DV	CHAD JAN (ชัดเจน) - KA MUK KA MOE (คลุมเครือ)	DISTINCT - VAGUE
HL	NUCK (หนัก) - BOW (เบา)	HEAVY - LIGHT
VS	SOD SAI (สดใส) - MON (หม่น)	VIVID - SOMBRE
SW	KHEM KANG (เข้มแข็ง) - ORN AER (อ่อนแอ)	STRONG - WEAK
DYP	KLOEN WAI (เคลื่อนไหว) - SA NGOB NING (สงบนิ่ง)	DYNAMIC - PASSIVE
GP	CHOOD CHAD (จุกจิก) - REAB (เรียบง่าย)	GAUDY - PAIN
SS	DOD DEN (โดดเด่น) - SEED (ซิด)	STRIKING - SUBDUED

3.4.3.3 The visual scores were calculated from the answers of 60 observers as the percentage values ranging from +100% to -100% for each of the opponent word pairs. (see Appendix A) For example, the “Warm-Cool” visual score, WC%, was calculated as following

$$WC\% = \frac{A \times (+1) + B \times (-1)}{A + B} \times 100\% \quad (3.1)$$

where, A and B are the number of the observers who chose “Warm” and “Cool”, respectively.

The score of +100% means that all observers select “Warm” but if they all select “Cool”, the score become -100%. If one half of the observers select “Warm” and the other half select “Cool”, the score will be zero.

3.4.4 *Deriving the color perception equations*

The visual assessment and the colorimetric values were derived in order to set the empirical equation which is the color perception equation. The results of the color perception values were derived as general equation (35) based on CIE L^* , C^* , h , as following

$$CP_{CIE L^*, C^*, h} = [\{k_1(L^* - L^*_0)\}^2 + \{k_2(C^* - C^*_0)^2\}]^{1/2} - k_3 \quad (3.2)$$

where, CP : Color perception value

L^* : CIE L^* , C^* , h metric lightness

L^*_0 : CIE L^* , C^* , h metric lightness when visual assessment has the minimum value

C^* : CIE L^* , C^* , h metric chroma

C^*_0 : CIE L^* , C^* , h metric chroma when visual assessment has the minimum value

k_1 : Contribution of CIE L^* , C^* , h L^* for color perception

k_2 : Contribution of CIE L^* , C^* , h C^* for color perception

k_3 : Color perception value when visual assessment has the minimum value

CP is large when L^* and C^* are far away from the L^*_0 and C^*_0 coordinates. L^* and C^* make a smaller contribution to the CP value when k_1 and k_2 are small and L^* and C^* make a greater contribution to the CP value when k_1 and k_2 are large.

3.4.5 *Plot Iso-CP lines of the color on CIE L^* C^* diagram*

The color perception values were indicated by the color perception line in the CIE L^* C^* h color system. These color perception values were calculated from the color perception equation.

3.4.6 *Projection of CIE L^* , C^* , h color system on the color perception map*

The CIE L^* , C^* , h color system is projected on the color perception map. It represents relationships between two color perception words.

3.4.7 *Finding the Correlation Coefficients*

The results of the visual assessments of the twelve opponent word pairs were calculated in order to find out the correlation coefficients.



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