

## A Study on Color and Emotion for the Development of a Product Design Portfolio

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### ABSTRACT

The more globalized a market is, the more important it became to learn the local markets or even sub-groups within them. Color, as a dominant medium of visual communication, appeals the message of the product in very short time but in an individual manner. The domain of color design includes a single hardware product, digital contents and corporate identity. The goal of a successful product color design is, hence, to arouse emotional reaction from the target group, as expected.

This study intended to set up an approach as a global matching theory among color, product/brand character and emotion, to be applied for the development of product color design. We have measured a set of color and that of adjective with SAM pictogram and co-ordinated them into 3 dimensional space of emotion accordingly. The experiment was carried by 2 young adult groups in Germany and in South Korea.

### 1. INTRODUCTION

It has been frequently mentioned about symbolic meaning of color in a certain geographical and cultural context in previous studies<sup>1,2</sup>. Those studies on generalized emotional reactions are applied for visual communication, for instances, international traffic systems or stations: red for warning or stop, green for safety or operation. The traditional color references are, on the other hand, dealing with basic colors, which indicate mainly focus colors<sup>3</sup>.

Since the consumer market became more diversified and crowded, the product identity is an important issue in getting a market position and winning target consumers. The color nuances of the product as well as product package is therefore one of the major tasks of designers<sup>4</sup>, to express the character of the product.

Meanwhile there are some remarkable researches available on color scale related with visual adjectives<sup>5,6</sup>, mostly for domains of fashion, automobile industry or living space, where the majority of designers are busy with. The visual database in those researches are, however, collected from existing cases and the results are highly dependant on the authors or the photographers. Moreover the visual adjectives used for the emotional co-ordinations may only explain the relationship within those terms. In this way some of them are redundant or none of them could cover another emotional state.

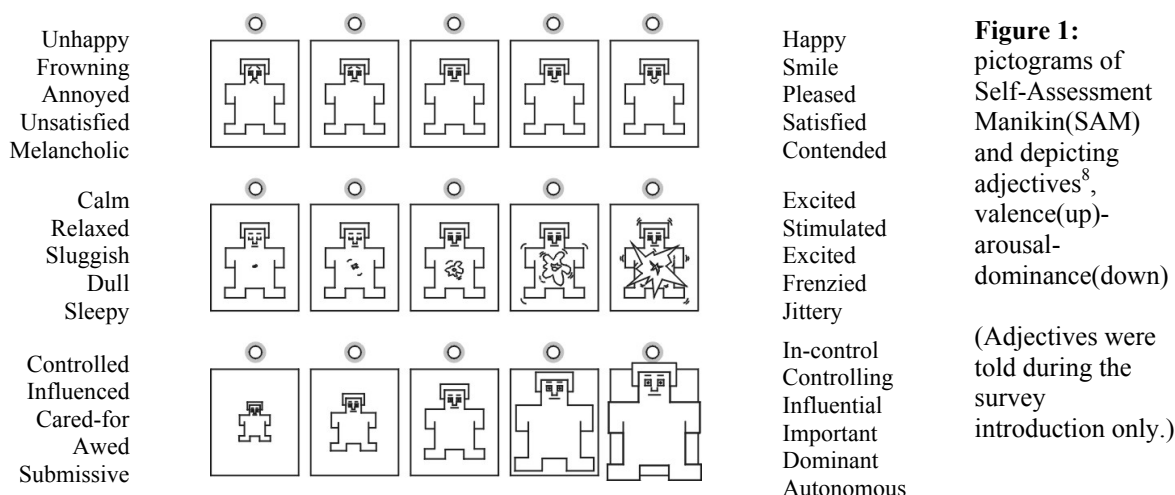
There is a necessity of an apex work to relate color with human emotion based on a common analysis base. Therefore the goal of this study is to develop a method for building a database of color and adjective to be assessed (SAM)<sup>7,8</sup> and co-ordinated in 3 dimensional emotional space and to prove it by applying the results for product color design.

### 2. METHOD

If possible, we had to find a way to measure color and emotion numerically, so that we might be able to match two completely different substances, as long as one of them is given.

#### 2.1 Common measurement: Self Assessment Manikin (SAM)

Much of recent evidence supports a three-dimensional approach for accurately assessing emotional response. The Self Assessment Manikin(SAM) provides a promising solution to the problems that have been associated with measuring emotional response to sensoric stimuli, avoiding semantic differentials. This model assumes, that emotion is not limited to isolated incidents, rather, it is ever present<sup>9</sup>.



### 3. EXPERIMENT DESIGN

#### 3.1 Subjects

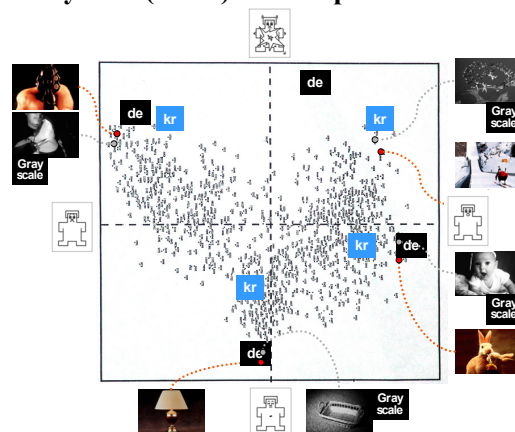
The experiment was programmed by PXLab<sup>®</sup> ([www.pxlab.de](http://www.pxlab.de)) software and carried in two countries as offline in Germany and as online in South Korea.

	Germany		South Korea	
<b>Number of subjects</b>	F:27	M:11	F:9	M:9
<b>Mean of age</b>	20.7		16.5	
<b>Occupations</b>	psychology students at 2 <sup>nd</sup> semester		high school students	

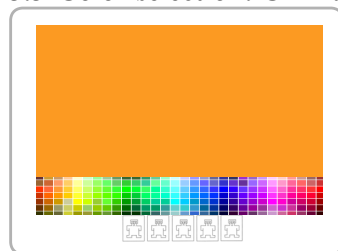
#### 3.2 Tolerance control: International Affective Picture System (IAPS) anchor pictures

In the beginning and the end of the survey, 2 sets(4 pictures each) of IAPS pictures were shown, in order to filter the extremely partial or narrow cases by anchoring 8 points at the 3 dimensional space of emotion. The pictures selected from IAPS were supposed to stimulate specific emotional reaction and all the participants followed to the general distribution of IAPS statistics, so none of subjects was exempt.

**Figure 2:** 2 sets of 4 pictures selected and their positions according to IAPS database, on which the answers from experiments are distributed- [de: German subjects] and [kr: Korean subject].



#### 3.3 Color selection: CIELab Lch System



**Figure 3:** A color palette was presented to let subjects recognize subtle nuance of the given color.

This method is a calculation technology derived from CIELab equations. It uses the basic CIELab information, but presents the graphical information with a focus on chrome and hue that may be visually easier to understand than typical CIELab graphical presentations. We selected 6 different tones from 5 hues(40°, 85°, 160°, 270°, 320°), 3 gray, black, white and additional 8 colors- either very vivid ones in some hue values or basic ones.

In doing so, it enabled an analysis between emotion and color in terms of lightness(L), chrome(c) and hue(h).

### 3.4 Case project for assigning product character: low calorie product



We have chosen low calorie products, as they are typical cases, in which designers are dealing with color variation, keeping the previous frame work, such as form. Low calorie products are created mostly as alternative ones, after the original products have launched on the market, so they are displayed next to original ones

and distinguished by color. The two study groups University of Mannheim generated a network of 19 adjectives associated with a low calorie product. One of them concerned with low calorie soft drinks and the other one did with low calorie dairy products.

During the experiment another 6 negative adjectives were added, in order to let subjects evaluate adjectives in a balanced way. The adjectives were translated into Korean by native speakers for the survey carried in South Korea.

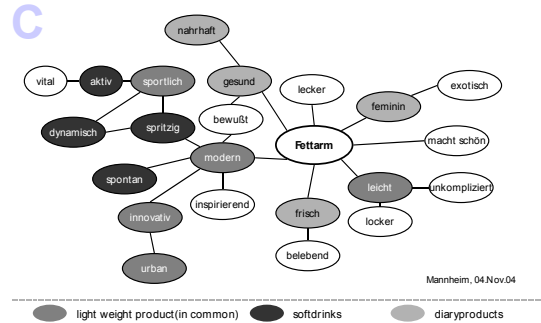


Figure 4: a semantic network generating adjectives

### 3.5 Flow of Experiment

As Table 1 shows below the experiment was designed with 4 steps.

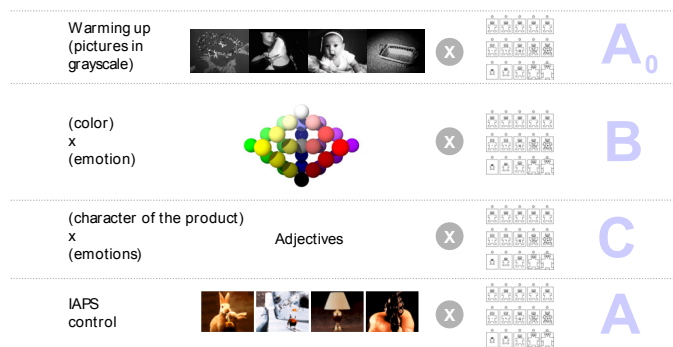


Table 1. a flow of experiment:

- A<sub>0</sub>: exercise of SAM evaluation with 4 IAPS pictures in gray scale
- B: evaluation of 43 color stimuli and emotion
- C: evaluation of 13 adjectives and emotion
- A: evaluation of 4 IAPS pictures in color

## 4. RESULT

### 4.1 Distribution of Color and Adjectives in Emotional Space(X: valence, Y: arousal)

43 color and 19 adjectives were co-ordinated into emotional space and following figure shows the results of XY (X: valence, Y: arousal) co-ordination.

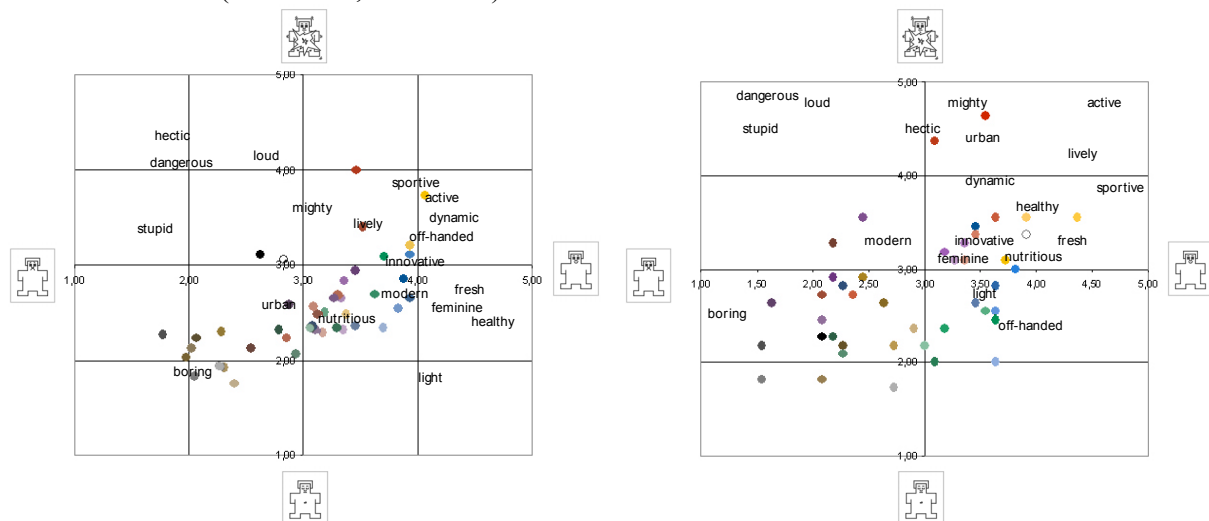


Figure 5: the distribution of adjectives and color into 2 dimensional co-ordination of space between valence(horizontal) vs. arousal(vertical): German subjects(left) and those from Korean ones(right).

In both results 'L' and 'c' (from Lch) were clearly correlated in proportion to emotional scale and 'h' didn't show any significant relationship with change of emotion. This implies that tone plays more dominant role than hue in product color design. Moreover it emphasizes that the tone of color should be defined in setting up a color strategy of products.

**Table 2.** Mean of Standard Deviation

Stimuli	4 IAPS pictures in color			43 color			19 adjectives		
	valence	arousal	dominance	valence	arousal	dominance	valence	arousal	dominance
<b>German group</b>	0.82	0.76	0.97	0.96	0.98	0.94	0.83	1.02	0.97
<b>Korean group</b>	1.02	1.16	1.39	0.90	1.01	1.00	0.91	1.04	1.28

#### 4.2 General Discussion

It was a new approach in finding out color solution, matching the character of target product/brand with color by means of emotional factors. The advantages of this method are:

- an original color solution can be found, regardless of experience of existing products.
- cultural color research can be economically and quantitatively presented.

This research does not ignore aesthetic skills of designer at product color design, but rather acquires their knowledge for qualitative evaluation, after the color tendency is analyzed.

Related with more extroverted results from Koreans or introverted ones from Germans in general we assume that subjects were the experiments in different mood, considering that German psychology students were participating more than ten experiment within a semester. Therefore it is too early to conclude that the difference of these two groups was significant or represented the cultural difference.

In future research, the methods will be applied for the groups of specific interest with larger number of subject.

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