COLOR AND EMOTION FARBE UND EMOTIONEN

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01 BACKGROUND

Recent studies on color affectivity characterize emotional profiles of color in terms of emotional dimensions, thus approaching the issue of emotional influence of color attributes (i.e. Valdez & Mehrabian, 1994). In addition, the significant influence of Chroma (or saturation) of a color onto human emotions has been consistently confirmed. (Valdez et al., 1994).

_01 goals and hypotheses

The purpose of the experiment is to investigate whether color elicits emotion as pictures do, and especially, whether color can be profiled in terms of the three dimensions of emotion: valence, arousal, and dominance.

H. I Color stimuli elicit emotions as pictures do.

The second hypothesis tests if emotional responses are stronger with regard to Chroma and lightness than with regard to hue.

H. II An emotional response to a color stimulus is stronger with regard to Chroma and lightness than with regard to hue.

In addition, based on those experiments, a method for the development of a product-color scheme is suggested as a practical application tool for marketing purposes.

02 MEASURING EMOTIONAL RESPONSE TO COLOR

Developed by Lang (1980), the Self Assessment Manikin (SAM) is a nonverbal, culture-fair rating system based on a three-dimensional system of emotion consisting of valence, arousal, and dominance.

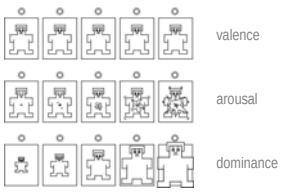


Figure 1. Self Assessment Manikin (SAM), Lang (1980)

Previous studies showed that SAM accurately measured emotional reaction to imagery as visual stimuli (e.g. Vrana, Cuthbert, and Lang, 1986).

03 EXPERIMENT

_01 subjects

Thirty-seven students (male:9, female:28) from the University of Mannheim served in exchange for extra credit. Participants were undergraduate students: M=23,57, SD=5,55.

_02 methods

color stimuli: : hue and tone categorizations

Five hue categories were fixed and the hue degrees of categories in CIELab Lch system are:

h=30°(red); h=80° (yellow); h=160° ('green); h=260° ('blue); h=320° (violet)

From each of them, representative colors of the following five tone segments were chosen (Figure 2).

Figure 2. The five tone categories: i.e. violet

By using tone categorizations, the Chroma and lightness of a color is recognized according to the relative proportion of vividness.
In addition, five achromatic colors were included: black, dark gray, medium gray, light gray, and white. Moreover, warm grays and cool grays from dark, medium, and light tone categories were added. Lastly, two more metallic colors were added, namely 'gold' and 'silver'. All color stimuli were presented in DIN A5-size glossy sheets, produced by RAL DESIGN SYSTEM™.

other types of stimulus: pictures and adjectives

Three sets of stimuli were added: four achromatic pictures (set 1) selected from the International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 2005) were employed in order to practice the SAM scale and four IAPS chromatic pictures were included for the baseline (set 4).

Besides, by means of a semantic network, 13 adjectives to describe a product concept (low fat as a case study) were collected and another six counterbalancing negative adjectives were added (Set 3).

_03 procedure

The instruction and sets of SAM pictograms were printed and provided along with black carbon pencils to tick off SAM pictograms.The experiment took place in an approximately 9m^2 (3mx3m) size room in daylight.

_04 results and analyses

Mean and standard deviation values of four IAPS control pictures were compared with IAPS data . According to the baseline, one subject was filtered out since he assessed one of the four IAPS control pictures (lamp) as extremely exciting.

Based on SAM ratings of 36 subjects, Cronbach's alphas yielded a satisfactory level of internal consistency. Thus, the emotional profiles of surface colors are describable in terms of valence, arousal, and dominance, supporting the first hypothesis.

	valence	arousal	dominance
color stimuli (on 38 variables)	.767 (36 cases)	.886 (36 cases)	.691 (36 cases)
adjectives (on 19 variables)	.512 (36 cases)	.827 (36 cases)	.490 (36 cases)
38 color stimuli + 19 adjectives + four IAPS pictures(on 61 variables)	.798 (36 cases)	.923 (36 cases)	.762 (36 cases)
	.905 (36 cases on 183 variables)		

Table 1. Reliability coefficients, N=36

In Figure 4, mean values of valence, arousal, and dominance concerning 38 colors and 19 adjectives from Experiment II are depicted in two emotion planes, defined by valence (abscissa) x arousal (ordinate) on the left and valence (abscissa) x dominance (ordinate) on the right.

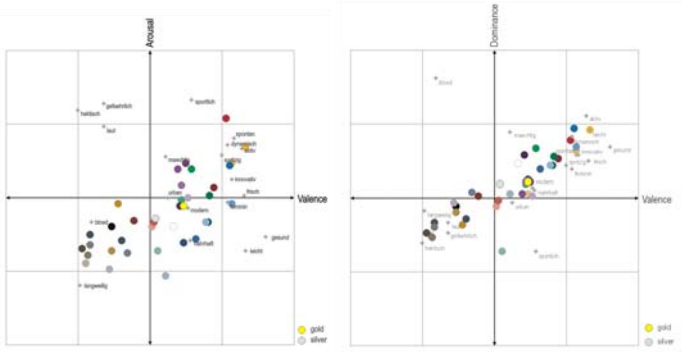


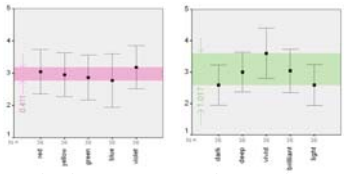
Figure 4. Plots of means of 38 colors and 19 adjectives in emotion spaces

In Figure 4, a diagonal pattern running roughly from the low-left to the upper-right can be observed. Within the pattern, colors of different hue are well distributed: each quadrant contains various categories of hue. The upper-right quadrant includes colors with the highest Chroma of the different hue categories. In the lower-right quadrant, there are color stimuli from various hue categories but colors that are little saturated. The observed tendencies can be observed throughout all hue categories and are analyzed with regard to hue and tone categories.

Figure 5 shows the averaged SAM ratings of 25 chromatic colors in terms of the hue category and the tone category with regard to arousal dimension .

The results emphasize the importance of variations of Chroma and lightness concerning emotional responses to colors.

Across the entire dimensions, the ranges by tone categories (light green) are bigger than those by hue categories (light red).



F (4, 140)=3.409 p=.016* F (3.077, 107.698)=28.954 ε=.769, p<.001***

Figure 5. Mean differences of predicted by hue (colored reddish) and by Chroma (colored greenish): i.e. arousal
ε: corrected by Greenhouse-Geisser

Therefore, the second hypothesis is confirmed: emotional responses to color vary stronger with tone, the combination of Chroma and lightness, than with hue.

04 PRACTICAL APPLICATION

The Experiment demonstrated how colors were found for a product concept (i.e. 'low fat' in the case study). the framework proposed was that the emotional profile of color concept and that of product concept should form a metaphor that links both color concept and product concept (Figure 4).

05 CONCLUSION

Two hypotheses were supported by the results of the experiments: colors elicit emotions as pictures do and emotional responses vary more strongly with regard to Chroma and lightness than with regard to hue. The affective judgment was made by means of SAM that assesses emotional response in valence, arousal, and dominance dimensions of emotion.
Based on the results, a methodology for the development of a product color-scheme was proposed as a practical application for marketing purpose.

06 ACKNOWLEDGEMENT

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