■講演要旨（VISION Vol.15, No.1, 29-32, 2003）

The psychological effects of non-typical-combination of color and object

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1．Introduction

How does combining unfamiliar（non-typical）colors with object pictures influence observer's impression? One of the previous studies showed that the object pictures with non-typical colors give observers less pleasant impressions（e.g. ugly, tired）compared to the impression that the object pictures with typical colors do [1]. This suggests that non-typical colors tend to give negative impressions in the dimension of evaluation. However, the effects of non-typical colors in the other two basic dimensions found by Osgood et al.（activity, potency）[2] were not examined in that study. When the object pictures are combined with non-typical colors, do they give observers negative impression in the scales related to the other basic dimensions? In this study, we conducted experiments to examine the effect of non-typical colors on observer's impression for object pictures by the adjective pairs that cover the dimension of activity as well as the dimension of evaluation. Also, we aimed to compare the effect of typical and non-typical colors between natural and artificial objects. Moreover, we investigated how the familiarity of individual observer to the objects with different color affects the observer's impression.

2nd ACV（July 23, 2002）

2．Preliminary experiment

We conducted a preliminary experiment to decide the combination of colors and object pictures used in the main experiment.

2.1 Methods

40 naïve observers（20-25 years old, 20 males and 20 females）took part in the preliminary experiment. We prepared 12 color tips（10 vivid colors from Mansell color system plus white and black）and 20 monochrome object pictures（e.g. goldfish, piano, and so on）. Each object picture was presented with a series of 12 color tips on a 19' display.

2.2 Procedure

Observers selected a color tip that fitted to the object picture from the 12 color tips.

2.3 Results

Table 1 shows the selected colors for each object picture. We used seven of them in the main experiment［the pictures of three natural and four artificial objects（Fig.1）］because, for those seven objects pictures, observers' selections of the typical colors were most consistent.

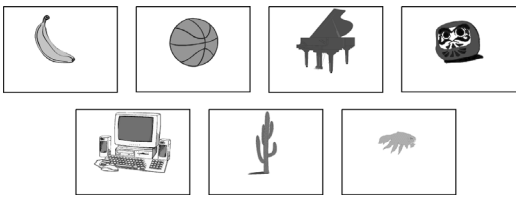

Fig.1　The objects pictures used in the main experiment.

3．Main experiment

3.1 Methods

26 naïve observers（20-36 years old, 12 males and 14 females）took part in the main experiment. Apparatus was the same as in the preliminary experiment. Stimuli were the 40 pictures in which one of the seven objects was combined with the typical or non-typical colors（Table 2）. The typical colors were decided in accordance with the results of the preliminary experiment. For the case in which the typical color was chromatic, there were three conditions for non-typical colors. The first one was the color adjacent to the typical color in a hue circle that consisted of 10 hues（Fig.2）. The second one was the color opponent to the typical color in the hue circle. The third one was the color at the middle between the adjacent and opponent colors in the hue circle. For the case in which the typical color was black（or white）, red, yellow and blue were used as non-typical colors.

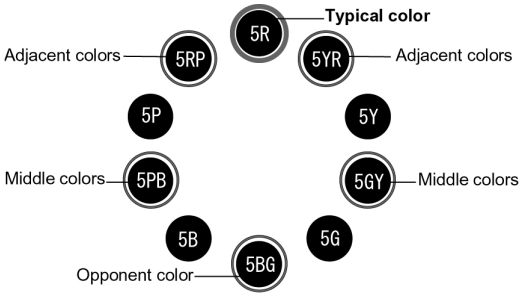

Fig.2 Examples of typical and non-typical colors.

Table1 Objects and selected colors. The numbers in the parentheses are the frequency of the selection（%）or each object in the preliminary experiment. The objects with asterisks were used in the main experiment.

objects	selected colors(%)					
banana*	5Y 8/14	(100.0)				
sunflower	5Y 8/14	(100.0)				
tire	N-1.5	(100.0)				
basketball*	5YR 7/13	(100.0)				
piano*	N-1.5	(100.0)				
trumpet	5Y 8/14	(100.0)				
dharma doll*	5R 4.5/14	(100.0)				
grape	5P 3.5/10	(97.5)	5PB 4/12	(2.5)		
swan	N-9.5	(97.5)	5Y 8/14	(2.5)		
personal computer*	N-9.5	(97.5)	5B 4.5/9	(2.5)		
toilet bowl	N-9.5	(97.5)	5Y 8/14	(2.5)		
fire extinguisher	5R 4.5/14	(97.5)	5YR 7/13	(2.5)		
cactus*	5G 5/11	(95.0)	5GY 7/10	(5.0)		
tomato	5YR 7/13	(92.5)	5YR 7/13	(7.5)		
carrot	5YR 7/13	(92.5)	5R 4.5/14	(7.5)		
wall socket	N-9.5	(92.5)	5Y 8/14	(5.0)	5YR 7/13	(2.5)
tobacco	N-9.5	(92.5)	5R 4.5/14	(5.0)	5YR 7/13	(2.5)
goldfish*	5R 4.5/14	(85.0)	5YR 7/13	(12.5)	5PR 4/13	(2.5)
incense stick	5BG 4.5/10	(72.5)	5G 5/11	(25.0)	5GY 7/10	(2.5)
lion	5YR 7/13	(60.0)	5Y 8/14	(40.0)		

Table2 The color combined with each object in the main experiment.

objects	typical colors	non-typical colors				
		adjacent		middle		opponent
banana	5Y 8/14	5YR 7/13	5GY 7/10	5BG 4.5/10	5PR 4/13	5PB 4/12
cactus	5G 5/11	5GY 7/10	5BG 4.5/10	5PB 4/12	5YR 7/13	5PR 4/13
goldfish	5R 4.5/14	5YR 7/13	5PR 4/13	5GY 7/10	5PB 4/12	5BG 4.5/10
basketball	5YR 7/13	5R 4.5/14	5Y 8/14	5G 5/11	5P 3.5/10	5B 4.5/9
dharma doll	5R 4.5/14	5PR 4/13	5YR 7/13	5GY 7/10	5PB 4/12	5BG 4.5/10
personal computer	N-9.5	5R 4.5/14	5Y 8/14	5B 4.5/9		N-1.5
piano	N-1.5	5R 4.5/14	5Y 8/14	5B 4.5/9		N-9.5

3.2 Procedure

Observers rated their impression for each object picture by the method of semantic differential (SD method) with 13 adjective pairs (Table 3). Also, they rated their familiarities to the objects by the use of five point scales for three indexes; preference, frequency to see, and frequency to contact.

3.3 Results and discussion

We conducted the factor analysis for the observers' rated values for the 13 adjective pairs by varimax-rotated and principal factor method; the factors of Evaluation and Activity were detected (Table 3).

Fig.3 shows the averages of rated value for each adjective pair. The tendencies of the rated value

Table3 Factor loading and communality of each scale. Bold and italic numbers show the factor loadings whose absolute values were more than 0.6 and 0.4, respectvely.

				factor loading	
				factor Ⅰ	factor Ⅱ
factor type	adjective pairs		communality	Evaluation	Activity
Ⅰ	beautiful	ugly	0.807	**0.826**	0.353
Eigen value: 5.2	like	dislike	0.791	**0.826**	0.329
Contribution: 40.2%	lovely	fearful	0.662	**0.794**	0.176
	attractive	dull	0.579	**0.758**	-0.069
	cheerful	dismal	0.330	*0.574*	-0.023
Ⅱ	novelty	usual	0.729	-0.240	**-0.820**
Eigen value: 3.5	interesting	boring	0.603	0.391	**-0.671**
Contribution: 26.9%	exacitable	calm	0.359	-0.082	*-0.593*
Ⅰ・Ⅱ	pleasant	unpleasant	0.879	**0.824**	*0.448*
	fit	diffit	0.827	**0.670**	**0.615**
	content	anxious	0.709	**0.612**	*0.579*
	composure	uncomposure	0.726	*0.581*	**0.624**
	real	unreal	0.779	*0.566*	**0.677**

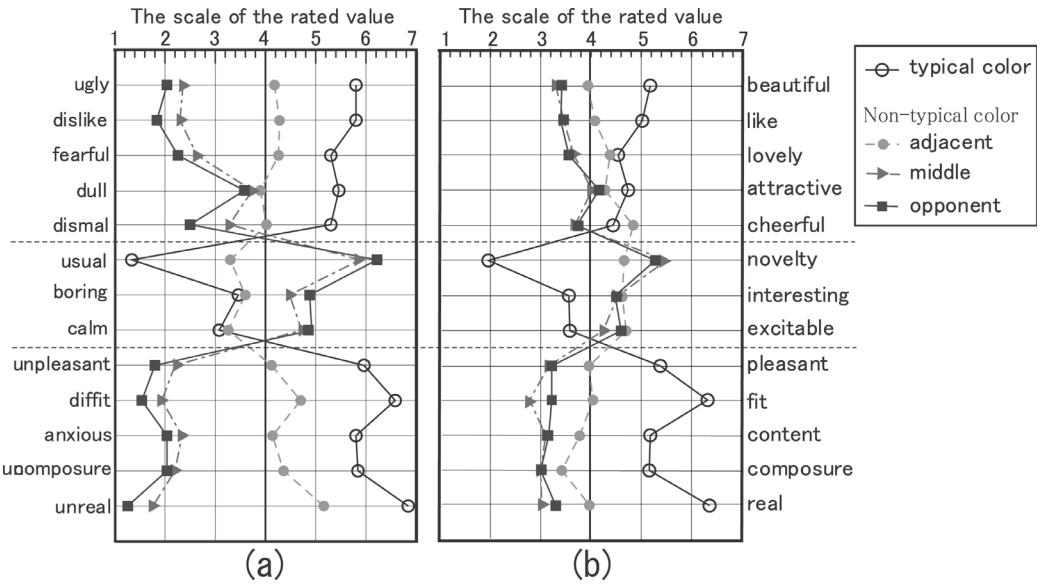

Fig.3 Averages of rated value for each adjective pair. The result of natural objects (a) and artificial objects (b). The adjective pairs 1-5 were mainly related to the factor of Evaluation. The adjective pairs 6-8 were mainly related to the factor of Activity. The adjective pairs 9-13 were related to both factors.

Table4 Results of stepwise multiple regression analysis. The influential independent variables were shown from a top.

dependent variables	independent variables	weight for factor	β	intersection	R	F	p
Evaluation	typicalness	0.007	0.258	0.042	0.267	$F(2,1037)=39.774$	<0.001
	frequency to see	-0.055	-0.071				
Activity	typicalness	0.017	0.570	0.000	0.574	$F(2,1037)=254.515$	<0.001
	preference	-0.079	-0.064				

for natural objects were similar to those for artificial objects. However, the difference of rated value between typical and non-typical color conditions was larger for the natural objects than that for the artificial objects. The rated values of "novelty", "interesting" and "excitable" for the non-typical color conditions were larger than those for the typical colors.

We conducted the multiple regression analyses for the factor scores related to the factors of Evaluation and Activity as dependent variables. Independent variables were the typicalness of color and the rated values for the familiarity (preference, frequency to see, frequency to contact). The typicalness of color was defined by the selected rate of colors for each object picture in the preliminary experiment (Table 1). We found that the typicalness of color correlated positively with of observer's impression in the dimension of Evaluation and Activity (Table 4). The frequency to see had negatively correlated with that in the dimension of Evaluation, and the preference negatively correlated with that in the dimension of Activity.

4. General discussion

Non-typical colors make observer's impression less positive in the dimension of Evaluation although they make observer's impression more positive in the dimension of Activity. The difference in the observer's impression for the object pictures caused by typicality of the colors was larger for the natural objects than for the artificial objects. We found the effects of familiarity to the objects on impression. The frequently seen objects tend to acquire lower Evaluation scores when combined with the non-typical colors. The preferred objects tend to acquire lower Activity scores.

References

1) K. Takeichi: Psychological valuation of apparent of color and figure (in Japanese). *VISION*, **4**, 9-12, 1992.

2) C. E. Osgood, G. J. Suci and P. H. Tannenbaum: The Measurement of Meaning. University of Illinois Press, Chicago, 1957.