CROSS PREFERENCE FOR COLOR COMBINATION AND SHAPE

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Keywords: Color Combination, Correlation, Preference

ABSTRACT

Preferences for *single hue color* and shape are intertwined; our previous study showed that people who prefer certain colors also tended to prefer certain shapes (Chen, Tanaka, Matsuyoshi, & Watanabe, 2013). In the present study, we investigated the relationship between preferences for *color-pair* and shape. Participants rated how much they liked the color pairs and shapes. The visual stimuli were 56 hue color pairs based on 8 hue colors taken from the Natural Color System, and 12 geometric shapes including 8 kinds of 2D shapes and 4 projected images of 3D shapes. Results showed that there are some correlations between preference for color pairs and shapes. People who preferred the basic 2D shapes (square and triangle) tended to prefer certain distant-color pairs (i.e., orange and blue-green combination). In addition, people who preferred the 3D shapes (pyramid, and truncated pyramid) tended to prefer some similar-color pairs (i.e., yellow and orange combination). These results suggest that preferences for color-pair and shape are intertwined.

INTRODUCTION

People have a general tendency of preferences for colors and shapes irrespectively. For example, people tend to prefer “cold” hue colors (e.g., blue, cyan) to “warm” hue colors (e.g., red) (Hurlbert & Ling, 2007; Palmer & Schloss, 2010) and prefer "curved shape" to "sharp shape" (Bar & Neta, 2006). Then, we previously investigated relationships between preferences for single color and shape and found that people who prefer certain colors would tend to prefer certain shapes sharing the same semantic information (e.g., warmth and lightness) (Chen, Tanaka, Matsuyoshi, & Watanabe, 2013).

Here we were interested in relationships between preferences for color pairs and shapes. Previous studies have shown that preference for color pairs relies on preference of each color, contrast of color pairs, hue harmony and similarity. Thus, preference for the color combinations might be related with semantic impression of color pairs (Schloss & Palmer, 2011; Ou, Luo, Woodcock, & Wright, 2004). Preference for visual shapes were also found to be affected by the positive emotion associated with shape features such as shape symmetry, curve or sharped features, complexity, and process fluency (Bar & Neta, 2006; Fischer & Hawkins, 1993; Leder, Tinio, & Bar, 2011; Silvia & Barona, 2007; Reber, Schwarz, & Winkielman, 2004). Therefore, preferences for color combinations and shapes might also have some correlations by the connections of congruent semantic information as in our previous work (Chen et al., 2013). Then, in the present study, we investigated whether preferences for color pairs (i.e., contrast, harmony, and similarity) and shapes (i.e., basic 2D shapes, basic 3D shapes, and created 3D shapes) were correlated.

METHODS

Participants

Fifty-eight Japanese participated for the experiment (twenty females; mean age = 21.2, standard deviation = 2.4) and conducted three consecutive sessions: liking rating task for single color, shape, and color pairs, respectively. All participates have normal or corrected to normal visual acuity and normal color vision.

Apparatus and stimuli

Stimuli were displayed central on a 15.5-inch LCD color monitor with 1920 × 1080 resolution with refresh rate of 60 Hz and controlled by a laptop computer.

The visual stimuli in the rating task for single color consisted of 40 hue colors (taken from the Natural Color System Atlas) filled rectangles (7.1 cm × 5.3 cm; 6.7 deg × 5 deg in visual angle). Visual shapes were composed of 12 basic line-drawing shapes, including three basic 2D shapes (circle, triangle, square), and three types of 3D shapes (cone, pyramid, truncated-pyramid). In particular, the 3D shapes had three types of complexity (i.e., simple, regular, complex; Fig. 1a).The geometric shapes were all drawn with black lines with the width of 2.6 mm (0.03 deg) on a white background (100 cd/m^2). We prepared 3 sizes of each shape (i.e., small, medium, and large) and three levels of spatial rotation except for circle (i.e., 0°, 15° and -15°). Thus, we had 102 shape stimuli in total (11 shapes × 3 sizes × 3 rotations + 1 shape × 3 sizes = 102 shapes). The visual stimuli in the rating task for color pairs were composed of two rectangles with different colors (7.1 cm × 5.3 cm; 6.7 deg × 5 deg in visual angle; Fig. 1b). The color pairs were chosen from 8 unique hue colors (yellow, orange, red, purple, blue, blue-green, green, chartreuse), resulting in 56 combinations (i.e., trials). The visual stimulus appeared at the center of the screen, above a 7-point-Likert scale (Fig.1b).

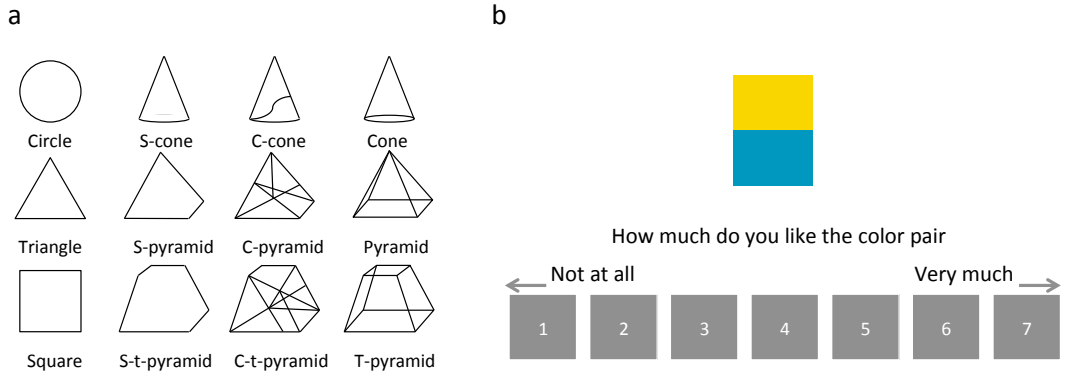

Figure 1. a) Visual stimuli of shapes. 't-pyramid' presents for truncated pyramid. 's' is short for simple; 'c' is short for complex. b) An example of color pairs in the task.

Procedure

The experiment was carried out in a laboratory with dimmed lighting conditions (1 lux on the wall). Participants seated in front of the monitor and were instructed to rate how much they liked each of color, color pair stimuli and shapes on a 7-point-Likert scale (from '1': "strongly dislike", up to '7': "strongly like"). Participants responded by mouse-clicking the numeric square labeled form 1 to 7. After they made their decision, the next trial started immediately. They performed the

three rating tasks for single color, shape, and color pairs, in order. The experiment lasted about 20 minutes.

RESULTS

First, we compared the ratings of preferences for single color and color pairs. One-way ANOVA for the mean ratings of each hue distance of color pairs (i.e., 0, 1, 2, 3, 4; "0" indicates single color and "4" indicates contrast color pairs) showed significant differences (F (4, 57) = 13.1, $p < .01$). Post-hoc multiple comparison revealed that people like the single color (i.e., zero hue distance) better than other color pairs ($p < .05$), which was identical to the previous study (Schloss & Palmer, 2011).

Second, we investigated whether preferences for single color and shapes were correlated as in our previous work (Chen et al., 2013). As a result, we could replicate our previous result that people who preferred the basic 2D shapes tended to prefer warm colors (e.g., orange) and people who preferred the basic 3D shapes tended to prefer light colors (e.g., yellow), which can be accounted for "warmth" and "lightness" as the shared semantic information.

Correlation analysis was performed on standardized liking ratings of color pairs and shapes. Since the number of levels for rating was more than 5 and the ratings followed the normal distribution, we employed Pearson's correlation coefficients as indication of the relationship between color pair and shape preferences. Preferences for the hue distance of color pairs were significantly correlated with preferences for some shapes ($r > .22$, $p < .05$) (Table 1). Notably, preferences for basic 2D shapes (triangle, and square) were positively correlated with preferences for contrast color pairs (the largest hue distances; HD4) such as green/orange, orange/blue-green, blue-green/orange, blue-green/red. Preferences for 3D shapes (pyramid, and truncated pyramid) were positively correlated with preferences for similar color pairs (the smallest hue distances; HD1) such as orange/red, red/orange, orange/yellow, yellow/orange color pairs, but, negatively correlated with preference for contrast color pairs (hue distance; HD3). Both preferences for complex 3D shapes (C-pyramid, C-cone, C-t-pyramid) and simple 3D shapes (S-pyramid, S-cone, S-t-pyramid) positively and negatively correlated with preferences for contrast color pairs of hue distance HD3 and HD4, but failed to show specific correlation tendencies.

DISCUSSION

The present study investigated the relationships between preferences for color pairs and geometric shapes. We found that participants who prefer the certain 2D shapes (i.e., square, and triangle) tended to prefer contrast color pairs (e.g., the largest hue distance; green/orange, orange/blue-green) and participants who prefer the certain 3D shapes (pyramid, and truncated pyramid) tended to prefer similar color pairs (e.g., the smallest hue distance; red/orange, orange/yellow). The created simple and complex 3D shapes did not show specific tendencies. Therefore, the present results show that preferences for color pairs (i.e., contrast, harmony, similarity) and shapes (i.e., basic 2D shapes, basic 3D shapes, and created 3D shapes) were correlated, which might indicate that these relationships can be accounted for the shared semantic information. Further investigations are warranted to examine the exact congruent semantic information between color pairs and shapes.

Table 1. Correlated preferences for hue distance of color pairs and shapes

	HD1	HD2	HD3	HD4
Circle	-0.061	0.064	-0.010	0.078
Triangle	-0.084	-0.096	0.008	**0.269**
Square	-0.109	-0.145	0.056	**0.308**
S-pyramid	-0.055	0.141	0.037	-0.079
S-cone	0.118	-0.011	**-0.248**	0.096
S-t-pyramid	-0.117	-0.061	**0.236**	-0.009
C-pyramid	-0.021	0.136	0.114	**-0.251**
C-cone	-0.003	0.159	-0.005	-0.152
C-t-pyramid	-0.126	0.046	**0.236**	-0.100
Pyramid	**0.247**	-0.177	**-0.254**	0.003
Cone	0.105	-0.032	-0.208	0.092
T-pyramid	**0.266**	-0.199	**-0.308**	0.057

Note: Cells in yellow indicate significant positive correlations, and cells in green indicate significant negative correlations; "HD" means hue distance

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