

Relationship between color and emotion: a study of college students

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Ninety-eight college students were asked to indicate their emotional responses to five principle hues (i.e., red, yellow, green, blue, purple), five intermediate hues (i.e., yellow-red, green-yellow, blue-green, purple-blue, and red-purple), and three achromatic colors (white, gray, and black) and the reasons for their choices. The color stimuli were referenced from the Munsell Color System. The results revealed that the principle hues comprised the highest number of positive emotional responses, followed by the intermediate hues and the achromatic colors. The color green evoked mainly positive emotions such as relaxation and comfort because it reminded most of the respondents of nature. The color green-yellow had the lowest number of positive responses because it was associated with vomit and elicited the feelings of sickness and disgust. For the achromatic colors, white attained a large number of positive responses, followed by the colors black and gray. The reasons for the color-emotion associations are discussed and future research areas are suggested.

Introduction

Color is an inseparable part of our everyday lives and its presence is evident in everything that we perceive. It is widely recognized that colors have also a strong impact on our emotions and feelings (Hemphill, 1996; Lang, 1993; Mahnke, 1996). For instance, the color red has been associated with excitement, orange has been perceived as distressing and upsetting, purple as dignified and stately, yellow as cheerful, and blue has been associated with comfort and security (Ballast, 2002; Wexner, 1982). Moreover, some colors may be associated with several different emotions and some emotions are associated with more than one color (Linton, 1999, Saito, 1996). Red, symbolically known as a dominant and dynamic color, has an exciting and stimulating hue effect. It has both positive and negative impressions such as active, strong, passionate, warm, but on the other hand aggressive, bloody, raging and intense. Green has been found to have a retiring and relaxing effect. It too has both positive and negative impressions such as refreshment, quietness, naturalness, and conversely tiredness and guilt (Davey, 1998, Mahnke, 1996, Saito, 1996).

The relationship between color and emotion is closely tied to color preferences. In particular, color preferences are associated with whether a color elicits positive or negative feelings. While particular colors have been found to be highly preferred regardless of age, racial group, or culture (Adams & Osgood, 1973, Eysenck, 1941), there is some evidence that color preference may be culturally-based. For example, Choungourian (1968) found that the colors red and blue were the most preferred colors among American subjects, but were less preferred in other cultures. In a comparison of Japanese and Korean subjects, Saito (1996) found unique color preference tendencies between the two countries, and also with respect to age, gender, and geographical region within the individual country.

In an investigation of children's emotional associations with colors, Boyatzis and Varghese (1994) found that light colors (e.g., yellow, blue) are associated with positive emotions (e.g., happy, strong) and dark colors (e.g., black, gray) with negative emotions (e.g., sad, angry). In a study examining color-emotion associations among college students in Australia, Hemphill (1996) also found that bright colors elicited mainly positive emotional associations, while dark colors elicited negative emotional associations, confirming the results obtained by Boyatzis and Varghese (1994). However, Saito (1996) found that the color black elicited both negative and positive responses among Japanese subjects, and that black was often a preferred color among young people.

Colors can also be described in temperature terms, such as "warm" or "cool" as related to the dominant wavelength of the color. The cool colors (e.g., blue, green, purple) are generally considered to be restful and quiet, while the warm colors (e.g., red, yellow, orange) are seen as active and stimulating (Ballast, 2002). As cited in Lang (1993), Grandjean made observations about the effects of color on perceptions of room size and psychological response noting that cool colors such as blue and green make a space restful and increase spaciousness; however warm colors such as red, orange, and yellow make a space less spacious, while increasing stimulation. Furthermore, people exposed to red and yellow colors reported higher levels of anxiety than did people exposed to cool blue and green colors (Kwallek, Lewis, & Robbins, 1988; Mahnke & Mahnke, 1993). However, in other studies, no relationships have been found between the individuals' mood states and colors (Ainsworth, Simpson, & Cassell, 1993; Kwallek, Lewis, Lin-Hsiao, & Woodson, 1996).

Of the numerous color systems that exist (see Jacobson & Bender, 1996 for discussion), one color system noted internationally for its precise identification process is the Munsell Color System (Ballast, 2002; Valdez & Mehrabian, 1994). According to this system, each color has three basic attributes: hue, value (brightness), and chroma (saturation). Hue is the first attribute of a color by which we distinguish one color from another (e.g., blue from red, green from yellow). There are 10 hues, five of which are identified as principal hues (i.e., red, yellow, green, blue, and purple) and the other five are intermediate hues (i.e., yellow-red, green-yellow, blue-green, purple-blue, and red-purple). Value, the second attribute of color, describes the degree of lightness or darkness of a color in relation to white and black. Black, white and the shades of gray are called neutral (achromatic) colors. The third attribute of a color is chroma, which is the degree of purity or vividness of the hue (i.e., with high saturated colors containing less gray) when compared with a neutral gray of the same value (Ballast, 2002).

Despite a rapidly growing literature on the impact of color on our emotions and considerable interest in this research area, many studies have failed to use color samples from a standardized system of color notation (Boyatzis & Varghese, 1994; Hemphill, 1996; Terwogt & Hoeksma, 1995), while others elicited individuals' responses to verbal labels of color (e.g., "red", "blue") instead of using actual color stimuli (Hupka, Zaleski, Otto, Reidl, & Tarabrina, 1997). Furthermore, several studies have used color-emotion matching tasks (Zentner, 2001); matching colors (e.g., red, yellow, blue) to a certain number of emotions (e.g., happiness, sadness, anger), which results in limited assessments of reactions to colors.

The purpose of the present study was to examine college students' color-emotion associations, referencing color samples from the standardized Munsell Color System and to investigate the reasons for students' emotional reactions to each color.

Method

Participants

The sample consisted of 98 volunteered college students (44 men and 54 women) at a public institution in the southeast. The mean age was 21 years (range = 18-25 years). None of the participants had defective color vision as verified with the Ishihara Color Deficiency test (1993).

Stimuli

Ten fully saturated chromatic colors were chosen from the Munsell Color System: red, yellow, green, blue, purple, yellow-red, green-yellow, blue-green, purple-blue, and red-purple. The Munsell notations are shown in Table 1. The color samples were prepared by using Freehand 10.0 software, in which Munsell color notations were available in that computer program. Apart from these ten hue groups, three achromatic colors (white, black and middle gray) were also used.

Procedure

Participants were tested individually in an office space where they were seated at a personal computer. Each color sample (10 cm _ 12 cm) was displayed in the middle of the computer screen one at a time on a neutral gray background, Munsell N/7. Order of presentation of the color samples was randomized across participants. Participants were asked, "What emotional response do you associate with this color? How does this color make you feel?" and "Why do you feel this way?" These questions were adapted from Boyatzis and Varghese (1994) and Hemphill (1996). Students were allowed to state only one emotional response for each color. Their answers were recorded on an observation sheet. Each experimental session lasted for about ten minutes.

Results

Data were analyzed using Statistical Package for Social Sciences (SPSS) software program. Descriptive statistics were used to summarize data. Based on the results obtained from the student's responses, a total of twenty-two emotions were gathered (see Table 2). Some of the emotions had the same meaning (e.g., empty, void) and some were overlapped (e.g., happy, happiness, joy), so they were grouped under the same emotion category. There was also a category for those responses that indicated no emotional response.

Because of the low frequencies in several cells, the emotions were coded as "positive", "negative", or "no emotion" (see Table 3). Overall, 62.2% of the participants expressed

positive responses to colors, 34.2% expressed negative responses, and 3.6% expressed no emotion. About 80% of the responses to the principle hues, including red, yellow, green, blue, and purple were positive, compared with only 29.2% for the achromatic colors, including white, gray, and black (see Table 3). Only 17.8% of the responses to the principle hues were negative, whereas 68.4% of the responses were negative for the achromatic colors.

As shown in Table 3, the color green attained the highest number of positive responses (95.9%), closely followed by yellow (93.9%). The majority of emotional responses for the green color indicated the feelings of relaxation and calmness, followed by happiness, comfort, peace, hope, and excitement. Green was associated with nature and trees, and thus creating feelings of comfort and soothing emotions. The color yellow was generally seen to be lively and energetic and elicited positive emotions including happiness and excitement because it was associated with the sun, blooming flowers, and summer time.

Among the principle hues, the next highest number of positive response was given for the color blue (79.6%), followed by red and purple (64.3% each). Blue revealed the feelings of relaxation and calmness, followed by happiness, comfort, peace, and hope. The negative emotions for the color blue were sadness, depression, and loneliness (see Table 2). Furthermore, the color red prompted both positive and negative emotional reactions. Red was seen to be positive because it was associated with love and romance, while the negative aspects of red included having associations with fight and blood as well as Satan and evil. Finally, the color purple elicited the feelings of relaxation and calmness, followed by happiness, sadness, tiredness, power, fear, boredom, excitement, and comfort (see Table 2). The positive aspects of purple are tended to be mainly associated with children and laughing, while reasons given for negative responses to purple consistently showed that purple was not a favorite', color.

For the intermediate hues, the majority of emotional reactions (64.5%) were positive. As shown in Table 3, blue-green elicited the highest number of positive responses (81.6%), followed by red-purple (76.5%), yellow-red (75.4%), and purple-blue (65.3%). On the contrary, the color green-yellow elicited the highest number (71.4%) of negative emotional responses because it was associated with vomit and elicited the feelings of sickness and disgust (see Table 2 and 3).

For the achromatic colors, white attained a large number of positive responses (61.2%), compared with only 19.4% and 7.1% positive responses for black and gray, respectively. White was seen to be positive and was associated with the feelings of innocence, peace, and hope because it tended to be related with purity and being simple and clean. Further, it reminded some respondents of bride, snow, dove, and cotton. Reasons given for negative emotional responses to white consistently showed that white elicited the feelings of emptiness, loneliness, and boredom. In addition, the color black was seen to evoke negative emotions such as sadness, depression, fear, and anger because it was associated with death; mourning and tragic events as well as darkness and night time. The positive aspects of black were richness, wealth, and power. It also reminded some respondents of tuxedos and formal gowns.

Finally, the color gray was mainly associated with negative emotions (89.8%); including the feelings of sadness, depression, boredom, and confusion, as well as tiredness, loneliness, anger, and fear. Reasons given for negative emotional responses to gray consistently showed that the color gray tends to make reference to bad weather, rainy, cloudy or foggy days and brings out the feelings of sadness, depression, and boredom.

Discussion

The primary goal of this study was to examine the color-emotion associations among college students, referencing color stimuli from the standardized Munsell Color System. Based on Munsell Color System, the present study used five principle (i.e., red, yellow, green, blue, and purple) and five intermediate hues (i.e., yellow-red, green-yellow, blue-green, purple-blue, and red-purple), in addition to three achromatic colors (i.e., white, gray, and black). Overall, the participants' responses of color-emotion associations for the principle hues were positive (79.6%), compared with the positive responses for the intermediate hues (64.5%) and achromatic colors (29.2%). The color green elicited mainly positive emotional responses, including the feelings of relaxation, calmness, and happiness as well as comfort, peace, and hope. This is somewhat in agreement with the findings of Saito (1996), whose subjects found green to be refreshing and beautiful. Reasons given for positive responses to green showed that green was associated with nature, grass, trees, and reminds someone of outdoors and springtime, consistent with Hemphill's (1996) findings. Similarly, Saito (1996) noted that some of the Asian subjects who preferred green indicated the positive feeling about the color because of its association with the image of a forest.

Blue elicited a high number of positive emotional responses, including the feelings of relaxation and calmness, happiness, comfort, peace, and hope, with a low number of negative responses, including sadness and depression. Reasons that blue elicited positive emotions seem to be because many participants associated the color blue with the ocean, beach, water, or the sky and thus inducing relaxing and calming effect. Blue evoked negative emotions because it was associated with the night and dark skies, thus making someone feel depressed. One respondent said blue made her sad because "it makes you feel blue". Interestingly, Saito (1996), who found that vivid blue was the preferred color among all of the Asian groups, noted only positive aspects related to the color blue, namely refreshing, beautiful, and bright.

Colors are rich with symbolism. This symbolism can be apparent in how an individual associates colors with things, objects or physical space. For instance, in the present study, the color yellow-red was associated with the color of autumn or Halloween. One respondent said that yellow-red made her happy because "it reminds me of school buses and my childhood". Furthermore, the color blue-green was associated not only with the ocean and the sky, but also reminded some respondents of cool mints and toothpaste. Red-purple was associated with the color of red wine, plum, bridesmaid dress, or the color of a bedroom. One said red-purple makes her feel happy because "it reminds me of being in love". In addition, the color red was associated not only with love and romance, but also with evil, Satan and blood. One respondent said that the color red reminded her of Valentine's Day and the shape of heart. Another said that the color reminds her of red lingerie and Victoria's Secret. Some associated

black with "power," and said it reminded them of nice sport cars. Black made some respondents feel sophisticated and reminded them of "fashion and clothing". Yet, another respondent said black made him sad and reminded him of "funerals where people wear black". Therefore, it seems that a color-related emotion is highly dependent on personal preference and one's past experience with that particular color. A replication of this study at different institutions in the United States should give us a more comprehensive understanding of the issues raised here. Cross-site studies could be conducted to identify similar or different patterns in students' emotional associations to colors.

Moreover, color conventions differ from one society to another. In Western cultures, red is supposed to be a fiery color, green is said to be soothing. Another well-known example is with the two achromatic colors, black and white. Black is accepted as the symbolism of mourning in some countries, however it symbolizes wedding in some others (Linton, 1991). Many attempts have been made to identify the impact of various hues, but it cannot be ascertained whether these reactions are innate or cultural. For example, death and mourning are associated with the color black in Western traditions, whereas in China the color of death is white. Our findings of both positive and negative feelings about the color black were in agreement with those of Saito (1996), although the specific associations differed between the two studies. In the present study, the color black was associated not only with royalty, power, and wealth, but also with death, mourning, and tragic events. Saito noted positive images of clearness, tightness, sharpness, dignity, and nobleness, but negative associations with anxiety, fear, sin, and death. Saito (1996) also found a very strong preference for the color white among the Asian groups studied, particularly the Japanese subjects. Within Saito's study, white was found to be positively associated with the feelings of being clean, pure, harmonious, refreshing, beautiful, clear, gentle, and natural. Saito (1996) further explained the possible influence of ancient Japanese religion and mythology on the Japanese preference for white. A small number of Saito's subjects in Taipei expressed a negative feeling toward white, indicating an association with the image of death. In the present study, the findings revealed that the color white was seen to be generally positive and was associated with purity and being simple and clean. Some respondents associated white with innocence and peace and said it reminded them of a bride or dove. Another said the color white reminded her of snow. However, it also evoked negative emotions and was associated with emptiness and void. Some associated white with loneliness and boredom because it reminded them of insane asylum. Cross-cultural research could shed light on these issues by determining how cultural differences vary in color-emotion associations.

In addition to cross-cultural studies and investigation to reasons for color associations, future work might also utilize rating scales for color associations, such as "beautiful-ugly", "warm-cold", etc. that have been studied by Kawamoto and Soen (1993). Also, in our study, all colors were presented on a neutral background. Future work might involve investigation of color-emotion associations in which colors are presented on different colored backgrounds. This could lead to investigations of feelings about color harmony and color associations, which have been studied by others (Sivik & Hard, 1994).

Table 1

Munsell Notations for Color Samples

Color	Hue	Value/Chroma
Red	5R	5/14
Yellow	7.5Y	9/10
Green	2.5G	5/10
Blue	10B	6/10
Purple	5P	5/10
Yellow-red	5YR	7/12
Green-yellow	2.5GY	8/10
Blue-green	5BG	7/8
Purple-blue	7.5PB	5/12
Red-purple	10RP	4/12
White	N/9	
Gray	N/5	
Black	N/1	

Table 2
Frequencies of Emotional Reactions Given to Each Color

Emotions *	Red	Yellow	Green	Blue	Purple
Angry (a)	28 (28.6)	0	0	0	0
Annoyed (a)	0	0	0	0	0
Bored (a)	0	0	0	0	5 (5.1)
Calm (b)	4 (4.1)	0	29 (29.6)	60 (61.2)	28 (28.6)
Comfortable (b)	0	0	15 (15.3)	4 (4.1)	3 (3.1)
Confused (a)	0	0	0	0	0
Depressed (a)	0	0	0	6 (6.1)	0
Disgusted (a)	0	0	0	0	0
Empty/void (a)	0	0	0	0	0
Energetic (b)	5 (5.1)	10 (10.2)	0	0	0
Excited (b)	18 (18.4)	8 (8.2)	2 (2.0)	0	4 (4.1)
Fearful (a)	0	0	0	0	5 (5.1)
Happy (b)	21 (21.4)	74 (75.5)	28 (28.6)	10 (10.2)	21 (21.4)
Hopeful (b)	0	0	8	0	0

			(8.2)		
Innocent (b)	0	0	0	0	0
Lonely (a)	0	0	0	3	0
				(3.1)	
Loved (b)	15	0	0	0	0
	(15.3)				
Peaceful (b)	0	0	12	4	0
			(12.2)	(4.1)	
Powerful (b)	0	0	0	0	7
					(7.1)
Sad (a)	4	0	0	8	13
	(4.1)			(8.2)	(13.3)
Sick (a)	0	0	0	0	0
Tired (a)	0	6	0	0	9
		(6.1)			(9.2)
No emotion	3	0	4	3	3
	(3.1)		(4.1)	(3.1)	(3.1)
Emotions *	Yellow-red	Green-yellow	Blue-green	Purple-blue	
Angry (a)	0	0	0	0	
Annoyed (a)	5	8	7	0	
	(5.1)	(8.2)	(7.1)		
Bored (a)	4	2	0	0	
	(4.1)	(2.0)			
Calm (b)	0	0	16	38	
			(16.3)	(38.8)	
Comfortable (b)	3	7	7	0	
	(3.1)	(7.1)	(7.1)		
Confused (a)	0	2	6	0	
		(2.0)	(6.1)		
Depressed (a)	0	0	0	12	
				(12.2)	
Disgusted (a)	9	26	2	0	
	(9.2)	(26.5)	(2.0)		
Empty/void (a)	0	0	0	0	
Energetic (b)	14	0	10	0	
	(14.3)		(10.2)		
Excited (b)	25	6	11	0	
	(25.5)	(6.1)	(11.2)		
Fearful (a)	0	0	0	0	
Happy (b)	31	11	36	13	
	(31.6)	(11.2)	(36.7)	(13.3)	
Hopeful (b)	0	0	0	5	
				(5.1)	

Innocent (b)	0	0	0	0
Lonely (a)	0	0	0	3 (3.1)
Loved (b)	0	0	0	0
Peaceful (b)	0	0	0	8 (8.2)
Powerful (b)	0	0	0	0
Sad (a)	0	0	0	10 (10.2)
Sick (a)	0	32 (32.7)	0	0
Tired (a)	0	0	0	5 (5.1)
No emotion	7 (7.1)	4 (4.1)	3 (3.1)	4 (4.1)
Emotions *	Red-purple	White	Gray	Black
Angry (a)	0	0	3 (3.1)	7 (7.1)
Annoyed (a)	2 (2.0)	0	0	0
Bored (a)	2 (2.0)	5 (5.1)	14 (14.3)	0
Calm (b)	13 (13.3)	8 (8.2)	5 (5.1)	0
Comfortable (b)	0	0	0	5 (5.1)
Confused (a)	0	0	6 (6.1)	0
Depressed (a)	8 (8.2)	0	23 (23.5)	22 (22.4)
Disgusted (a)	3 (3.1)	0	0	0
Empty/void (a)	0	25 (25.5)	0	0
Energetic (b)	0	0	0	0
Excited (b)	12 (12.2)	0	0	0
Fearful (a)	0	0	3 (3.1)	17 (17.3)
Happy (b)	26 (26.5)	0	0	0
Hopeful (b)	0	6 (6.1)	0	0

Innocent (b)	0	33	0	0
		(33.7)		
Lonely (a)	0	6	4	0
		(6.1)	(4.1)	
Loved (b)	17	0	0	0
	(17.3)			
Peaceful (b)	0	13	0	0
		(13.3)		
Powerful (b)	7	0	2	14
	(7.1)		(2.0)	(14.3)
Sad (a)	0	0	30	24
			(30.6)	(24.5)
Sick (a)	0	0	0	0
Tired (a)	0	0	5	7
			(5.1)	(7.1)
No emotion	8	2	3	2
	(8.2)	(2.0)	(3.1)	(2.0)

Note. Emotions are listed in alphabetical order.

The cell numbers indicate frequencies; the percentages are listed in parentheses.

(a) Negative emotions

(b) Positive emotions

Table 3
Color and Emotion Associations

	Emotional Association		
Color	Positive	Negative	No emotion
Principle Hues			
Red	63 (64.3)	32 (32.7)	3 (3.1)
Yellow	92 (93.9)	6 (6.1)	0
Green	94 (95.9)	0	4 (4.1)
Blue	78 (79.6)	17 (17.3)	3 (3.1)
Purple	63 (64.3)	32 (32.7)	3 (3.1)
Total	390 (79.6)	87 (17.8)	13 (2.6)
Intermediate Hues			
Yellow-red	73 (74.5)	18 (18.4)	7 (7.1)
Green-yellow	24 (24.5)	70 (71.4)	4 (4.1)
Blue-green	80 (81.6)	15 (15.3)	3 (3.1)
Purple-blue	64 (65.3)	30 (30.6)	4 (4.1)

Red-purple	75 (76.5)	15 (15.3)	8 (8.2)
Total	316 (64.5)	148 (30.2)	26 (5.3)
Achromatic Colors			
White	60 (61.2)	36 (36.7)	2 (2.0)
Gray	7 (7.1)	88 (89.8)	3 (3.1)
Black	19 (19.4)	77 (78.6)	2 (2.0)
Total	86 (29.2)	201 (68.4)	7 (2.4)
Overall	792 (62.2)	436 (34.2)	46 (3.6)

Note. The cell numbers indicate frequencies; the percentages are listed in parentheses.

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