
The Associations of Color Adjectives and Color Preferences among Children Aged 9 To 12

Ching-Yi Wang¹, Chun-Shan Tung² and Hao-Cheng Fan³

¹Assistant professor, Department of Creative Product Design, Asia University, Taichung City, Taiwan

^{2,3}Master, Department of Creative Product Design, Asia University, Taichung City, Taiwan

¹catincar@gmail.com, ²108153008@gmail.com and ³tesu0815@gmail.com

¹0000-0001-8142-5796, ²N/A, ³N/A

How to cite this article: Ching-Yi Wang, Chun-Shan Tung and Hao-Cheng Fan (2024) The associations of color adjectives and color preferences among children aged 9 to 12. *Library Progress International*, 44(3), 3721-3731.

Abstract

The current literature lacks information on how children associate colors with their content. This study investigated children's personal color preferences to explain their associations with color adjectives. The experiment was divided into two stages: (1) color association vocabulary collection and (2) investigation of color adjectives and color preferences. Five elementary school teachers and thirty children aged 9-12 separately participated at these stages. The results of this study found that: (1) preference affects the association of adjectives in color, (2) cultural differences affect the perception of color, and (3) difference of the preference color in gender. In the future, the color association caused by media changes may change from time to time. The results of this research can help children use color in learning.

Keywords: children; emotion; color adjective; color preference; color vocabulary.

INTRODUCTION

Colors surround children's living environment from their toys, clothes, school bags, home accessories and so on. Color conveys a lot of psychological information for children. Different colors represent different meanings, and colors also affect display preferences, cognition, behavior, and performance [1]. Previous studies have revealed the emotional significance of color to children [2][3]. Most of these color studies on children are based on association tasks (e. g., color/word). Additionally, color preference stems from emotional responses to color-related objects [4][5]. [6] found that children generally like the color red, but they also think that red is connected with facial expressions of fright. There seems to be a contradiction between children's preference color and the corresponding emotional feelings. Based on the above statements, this study raises two questions: (1) In addition to the emotional meaning, what are the children's feelings about different aspects of color? and (2) How do children's color preferences affect their meaning of color? These are the issues to be investigated in this study.

(a) Color preference

Recent theories about color preference rely on "Ecological valence theory" (EVT)[4]. Color preference stems from emotional responses to color-related objects. It means that the degree to which people like or dislike colors depends on the degree to which they are associated with objects that they like or dislike. Therefore, when people has repeated positive emotional experiences with colored things (for example, delicious strawberries), this repeated experience will lead to a general preference for RED. Having negative emotional experiences with colored things (e.g., rotten food) will reduce the preference for BROWN. In addition, EVT can explain differences in cross-cultural color preferences [4][7][8]. [7] found that Chinese adults associate RED with Revolution and Auspiciousness, while the United States does not; American adults associate red with Anger and Sex, while Chinese adults do not. Moreover, the emotional symbolic associations between Japanese and Chinese adults seem to be relatively strong (for example, RED represents Good Luck) [4]. Also, EVT can confirm the identity of certain things through color preference. For example, [9] surveyed the color preferences of students (means 24 years) from Berkeley and Stanford universities and found that these students preferred their college colors (for example, colors used for sports teams and marketing) compared to colors from other universities. The stronger the effect, the more students like and identify with their university. In addition, the preliminary survey results of [10] showed that differences in saturation and specific hues also affect the color preference of children (4 years) and adults, rather than affecting the learning of basic color terms, indicating that

the perceptual characteristics of color may affect color preference, and subsequently affecting the cognitive process of color perception.

(b) Color emotions

There is an association between the processing of color words and the perception of color stimuli [11]. Many studies have reported that perceived experience of RED affects attractiveness and intellectual performance [12][13][14]. For example, descriptions of men in red shirts enhance women's perceptions of male attractiveness. However, when the RED word appeared on the test paper, it hindered the intellectual performance of the students. Moreover, manipulating the brightness of color produces polarized emotional connections. For example, typical RED is associated with both positive and negative emotions (i.e., love, anger, and hatred), while light RED is only associated with positive emotions (i.e., love, joy, and pleasure) [6][15][16][17][18][19]. In addition, color also affects emotion recognition and judgment based on facial expressions. [20] asked participants to categorize angry and fearful faces against RED, BLUE or GRAY backgrounds. Angry faces with a red background were judged the fastest, suggesting that RED helps identify angry faces because of its association with anger. [21] also demonstrated that the metaphorical association of anger and happiness with RED can be powerful, and that this association can facilitate the speed of judgment of the associated emotion. [22] confirmed that RED effects can still be achieved through different psychological processes; BLACK can also lead to attractiveness through perceived fashion ability. It is known that the physical and psychological environments in which people perceive a color affects its meaning. [23] proposed color-in-context theory to explain that colors convey different meanings depending on the context. Therefore, RED is not always associated with anger or joy. However, this theory cannot comprehensively and accurately explain and predict the link between color and psychological functioning in specific contexts [24][25]. Moreover, most of the color effects of these studies related to adults, and the applicability of children's age conditions should be considered in order to increase the accuracy and clarity of the theory. [26] required children with two age groups (means 6 years and 8 years) to use colors to depict people with emotional characteristics. They found that children used different colors to depict negative and positive characters. Children choose their favorite colors (such as PINK and ORANGE) for coloring positive figures. On the contrary, all of children often use black to express annoying characters, because black is associated with negative events (such as funerals). Moreover, [6] used three different color backgrounds (RED, GRAY, and GREEN) on surprised faces and asked children to judge whether they "feel good" or "feel bad" in response to these faces. It was found that all children of different age groups (5-6 years, 7-8 years, and 9-10 years) believed that RED was associated with negative valence. They speculated that surprised faces are considered ambiguous by children, because these faces share features with both happy (i.e., open mouth) and fearful (i.e., open eyes) expressions.

(c) Color adjectives

Adjectives are content words that express the nature or state of a person or thing. Compared with nouns and verbs, adjectives are more abstract. The development of adjectives is an indicator of children's sentence complexity, and also symbolizes the rapid development of children's (7-12 years) understanding of the nature of things [27]. Children with knowledge of color vocabulary can employ abstract associations [28]. In recent years, an increasing number of studies have begun to examine the process affecting children's acquisition of the meaning of adjectives, a process that can be challenging for young children because the types of attributes described by adjectives can differ greatly [29]. First, adjectives can be labeled as perceived characteristics (for example, blue), transient emotional states (for example, happiness) or transient physiological states (for example, thirst), and attributes related to stable characteristics (for example, friendly). Second, the exact meaning of adjectives depends on the noun they modify [29]. Children can extend the color to describe basic categories (for example, BLUE chairs), and can cross different categories (for example, BLUE cars).

Different colors evoke specific emotions and significantly affect cognition and behavior [2][3][30][31][32][33][34][35]. [36] reported that adults can associate subjectively between color and abstract words (for example, Joy is associated with YELLOW). When adjectives (such as desolate) use standard colors to refer to prototype objects, they may be the most consistently and most reliably associated with the corresponding colors. In other words, abstract words may provide the best link to colors. In addition, in semantic association tasks, colors such as red and orange are considered very warm, and BLUE is considered the Least Warm [37][38], while ORANGE has the highest correlation with Happiness [34]. [32] believe that color identification for adults can be used to distinguish the diagnostic function of emotional and non-emotional objects. They found that normal-valued images contain more orange hue than non-emotional images. Moreover, evidence indicates a close connection between BLUE and sadness [3][39].

(d) The purpose of this research

The purpose of this study is to investigate children's personal color preferences to explain their associations with color adjectives based on the "Ecological valence theory" (EVT) [4]. This study assumes that the more fun and positive influence children get from their own experience of color, the more likely they are to like this color, and the adjectives should have a positive response; vice versa.

1) METHODOLOGY:

The experiment was divided into two stages: (1) color association vocabulary collection and (2) investigation of color adjectives and color preferences.

(a) The first stage: Color association vocabulary collection

At this stage, 5 teachers from Nantou Puli Elementary School in Taiwan (1 male and 4 females; Mean=51.8 years old; SD=3.9 years old) were invited as participants to the experiment. These teachers have an average of over 19.8 years of teaching experience in grades four to six. The selected teachers have been teaching Chinese in elementary schools for many years and have experiences in editing Chinese textbooks. In addition, these teachers understand the Chinese grammar abilities of children in these grades and select Chinese words that they can understand. Moreover, these teachers can propose adjectives of different aspects for these colors.

The test of color association was programmed and presented on the internet platform Google Docs. It included a categorical color palette, and was adapted from previous studies [40][41][42][43][44]. Graphemes (A-Z, 0-9) were presented in a non-serif black font against a white background, above a palette of 9 colors (RED [RGB: 255, 0, 0], ORANGE [RGB: 255, 161, 23], YELLOW [RGB: 255, 255, 0], GREEN [RGB: 0, 128, 0], BLUE [RGB: 0, 0, 153], PURPLE [RGB: 128, 0, 128], BLACK [RGB: 0, 0, 0], GRAY [RGB: 128, 128, 128], and WHITE [RGB: 255, 255, 255]).


In the experiment, all the participants were asked to use word association to propose at least three adjectives for each of the nine colors. Each color was based on the adjectives that the subjects thought the children would use during the teaching process. Word association is a qualitative method widely used in psychology and sociology [45][46][47]. First, present the color stimulus to the participants, ask them to write down associations, and let them find the mental representation of these words without restriction. The ideas expressed in the word association task are generated spontaneously, and are less constrained than those usually imposed in interviews or closed questionnaires [48]. Finally, ten adjectives were selected for each color, based on the number of citations. A total of 90 adjectives were available for the next stage.

(b) Second stage: Investigation of color preferences and color adjectives

Thirty children aged 9-10 years (8 boys and 6 girls; mean age=9.29 years; SD=0.47) and 11-12 years (11 boys and 11 girls; mean age=11.69 years; SD=0.48) were randomly selected by their teachers to participate in this phase of the study. Children about 7 to 12 years old are at the concrete-operational stage which depicts an important step in children’s cognitive development [49]. Children in this period are able to engage in logical thinking based on specific examples, but they cannot yet rely solely on abstract thinking to reason. Nevertheless, specific operational thinking represents an important premise of formal thinking [50]. Therefore, children at this age are suitable for observing the logic of their abstract thinking about colors.

The test of correlations between colors and abstract words (see the Table 1) was provided on the internet platform Google Docs. The color settings are the same as in stage 1. Children are asked to match colors and adjectives according to their feelings and thoughts and choose 3 to 5. Then, each color was evaluated the preference ranging from 1 (strongly dislike) to 5 (strongly like).

Table 1.An example of the test of color adjectives and color preferences

Color	Adjective word
	<input type="checkbox"/> Scorching <input type="checkbox"/> Warm <input type="checkbox"/> Bright <input type="checkbox"/> Angry <input type="checkbox"/> Joyous <input type="checkbox"/> Passionate <input type="checkbox"/> Generous <input type="checkbox"/> Bloody <input type="checkbox"/> Flaming <input type="checkbox"/> Dazzling
How do you like this color?	<input type="checkbox"/> Strongly Dislike <input type="checkbox"/> Dislike <input type="checkbox"/> Normal <input type="checkbox"/> Like <input type="checkbox"/> Strongly Like

(c) Data analysis

Based on fewer than 30 participants in each group, Non-parametric Statistics was performed to analyze the data. Independent samples analysis were used to test the data on the color preferences and the color adjectives. The Mann-Whitney U (M-W) Test type was chosen. Gender (boys and girls) and Age (9-10 years and 11-12 years) variables

examined the significant effects in Colors (RED, ORANGE, YELLOW, GREEN, BLUE, PURPLE, BLACK, GRAY, and WHITE) and Adjective words (90 words for 9 colors; see Table 2), respectively.

2) RESULTS:

(a) Color adjective words

The total number of valid elicited items was 227, which represents an average of five or six associations per participant. The number of mentioned words from most to least were: YELLOW, BLUE, BLACK, WHITE, PURPLE, ORANGE, RED, GRAY, and GREEN, respectively.

Table 2 shows that the children had a frequency of 994 associations between colors and abstract adjectives. The colors in descending order of the mentioned frequency were: RED, BLACK, GREEN, ORANGE, WHITE, GRAY, BLUE, YELLOW, and PURPLE. The adjectives most mentioned by children of these colors were: Passionate, Mysterious, Emerald, Warm, Pure, Dirty, Cold, Sunny, and Dreamy, respectively. This means that RED was the color best able to make children associate abstract adjectives, while purple was least able.

Table 2. The frequency of children's mention between color and abstract adjectives (frequency of the mean in parentheses)

Color	Adjective word	Sum
RED	Passionate (22), Flaming (22), Joyous (15), Scorching (11), Angry (11), Bright (11), Bloody (9), Dazzling (8), Warm (7), and Generous (5)	121
ORANGE	Warm (22), Acidic and Sugary (19), Autumn (18), Evening (14), Soft (9), Joyful (9), Sweet (8), Comfortable (6), Naughty (6), and Cute (5)	115
YELLOW	Sunny (27), Bright (21), Shining (20), Obvious (9), Desert (6), Arrogant (6), Free (5), Peaceful (5), Warm (3), and Hot (2)	104
GREEN	Emerald (22), Relaxed (21), Fresh (18), Comfortable (16), Alive (9), Crisp (8), Refreshing (8), Clear (5), Equal (4), and Steady (4)	115
BLUE	Cold (21), Depressed (20), Broad (13), Refreshing (13), Comfortable (10), Beautiful (8), Light (6), Weak (6), Deep (5), and Fluttering (5)	107
PURPLE	Dreamy (26), Noble (21), Romantic (11), Domineering (9), Outstanding (9), Proud (6), Dancing (6), Beautiful (5), Weird (5), and Dynamic (2)	100
BLACK	Mysterious (26), Dark (15), Dirty (16), Unfathomable (12), Handsome (11), Silent (10), Horrible (10), Scheming (8), Far (5), and Misanthrope (3)	116
GRAY	Dirty (16), Boring (16), Discouraged (15), Vague (15), Dim (13), Weird (9), Sad (8), Calm (7), Chaotic (5), and Lazy (4)	108
WHITE	Pure (20), Clean (19), Unsullied (11), Empty (11), Bright (10), Kind (9), Calm (9), Transparent (8), Match Everything (6), and Vast (5)	108
Sum		994

(b) Color preferences

Table 3 displays the average of color preferences in relation to different gender and ages. The overall average color preference scores from most to least were: GREEN, YELLOW, PURPLE, BLUE, WHITE, BLACK, ORANGE, RED, and GRAY. Interestingly, GREEN is the favorite color for boys and girls, even for the children with 9-10 years and 11-12 years, while RED and GRAY are the least favorite colors for boys and girls, respectively. GRAY is still not popular among different age groups.

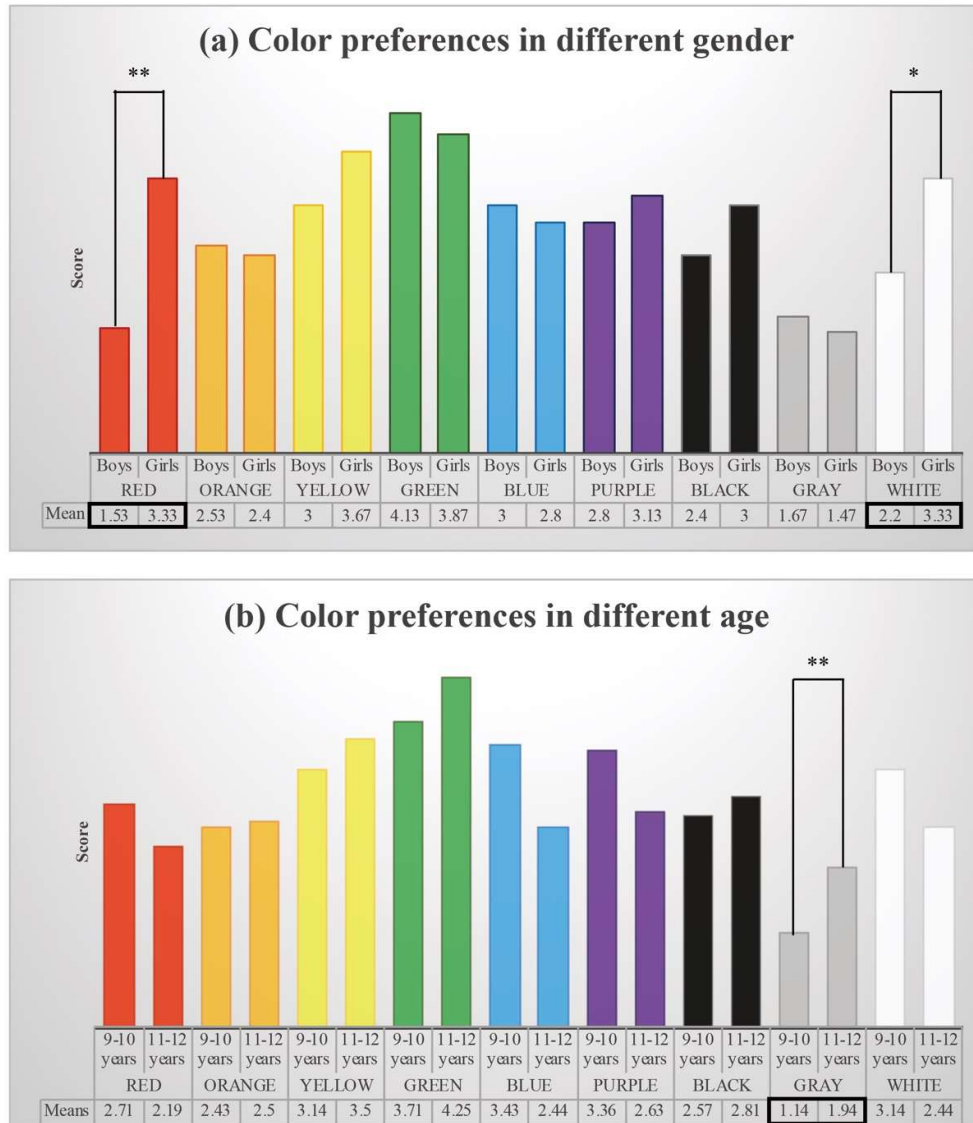
Table 3. The averages of color preferences

Color	Boys		Girls		9-10 years		11-12 years		All	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
RED	1.53	(0.74)	3.33	(1.35)	2.71	(1.33)	2.19	(1.47)	2.43	(1.41)
ORANGE	2.53	(0.83)	2.40	(1.06)	2.43	(1.09)	2.50	(0.82)	2.47	(0.94)
YELLOW	3.00	(0.00)	3.67	(1.23)	3.14	(0.86)	3.50	(0.97)	3.33	(0.92)
GREEN	4.13	(0.83)	3.87	(0.83)	3.71	(0.91)	4.25	(0.68)	4.00	(0.83)
BLUE	3.00	(1.20)	2.80	(1.57)	3.43	(1.45)	2.44	(1.15)	2.90	(1.37)
PURPLE	2.80	(0.94)	3.13	(1.41)	3.36	(1.22)	2.63	(1.09)	2.97	(1.19)
BLACK	2.40	(1.24)	3.00	(0.93)	2.57	(1.22)	2.81	(1.05)	2.70	(1.12)
GRAY	1.67	(0.72)	1.47	(0.74)	1.14	(0.36)	1.94	(0.77)	1.57	(0.73)
WHITE	2.20	(1.27)	3.33	(0.98)	3.14	(1.17)	2.44	(1.26)	2.77	(1.25)

Figure 1 presents the percentage of matching adjectives corresponding to the nine colors in different gender and ages. The M-W test on color preferences for different gender and ages is presented below.

An analysis of the M-W test on the differences of color preferences between boys and girls (Figure 1(a)) shows that only RED and WHITE exhibit a significant difference in relation to gender ($p=0.000$ and $p=0.019$, respectively). The results exhibited that girls like these two colors significantly more than boys do.

the further analysis of the M-W test on the differences of color preferences between 9-10 years and 11-12 years children (Figure 1(b)) shows significance for GRAY color ($p=0.006$), signifying a difference of color preferences for GRAY color between the two age groups.



* $p<0.05$ ** $p<0.01$

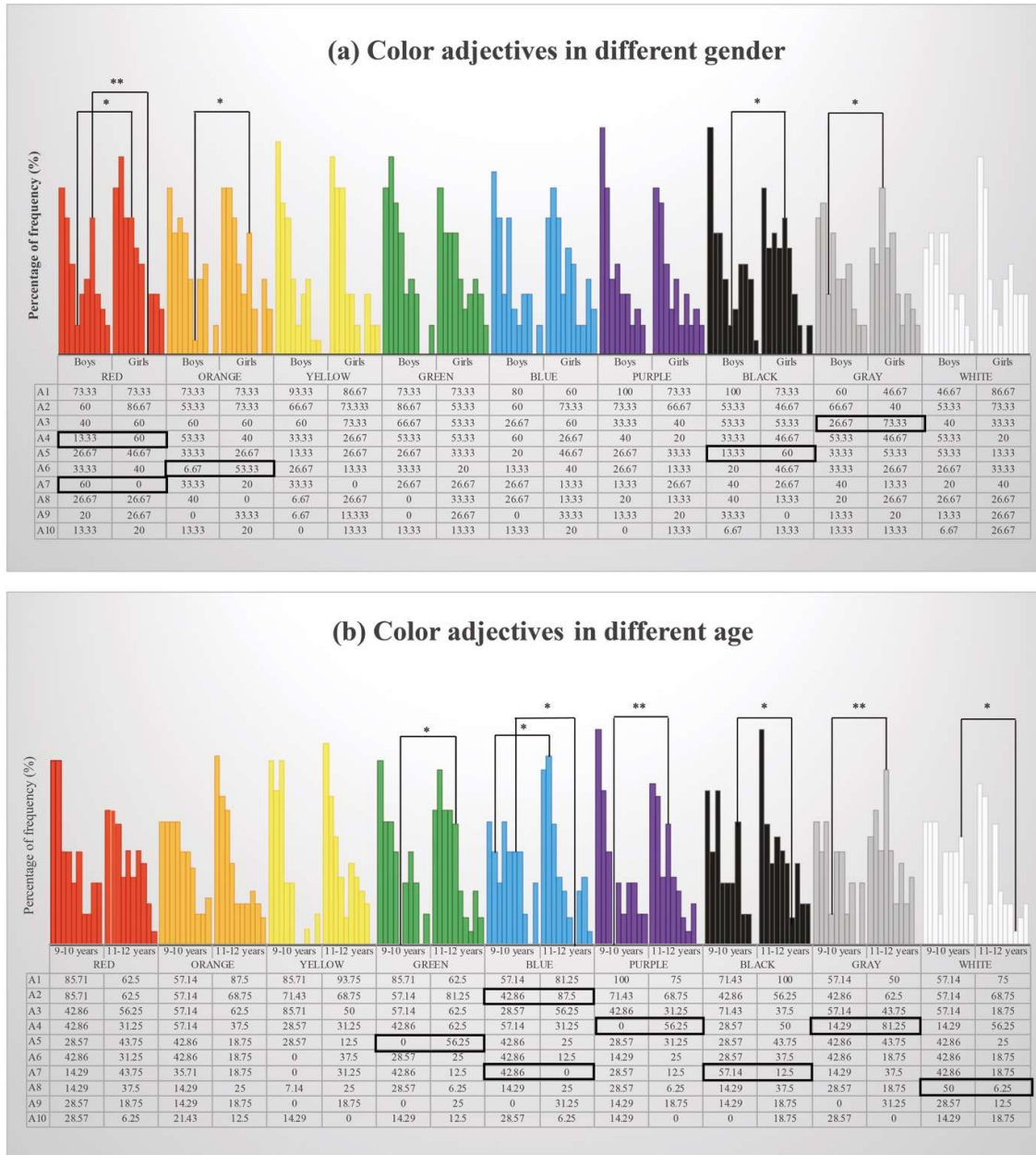
Figure 1 The color preferences in different gender and ages

(c) Color adjectives

Figure 2 presents the percentages of matching adjectives corresponding to the 9 colors in different gender and ages. The M-W test on color adjectives for different gender and ages is presented below.

According to the results of the M-W test (see Figure 2a), the adjectives corresponding to RED, ORANGE, BLACK, and GRAY colors exhibit significant differences in relation to gender (i.e., RED: Scorching and Bloody ($p=0.029$ and $p=0.004$, respectively); ORANGE: Joyful ($p=0.029$); BLACK: Handsome ($p=0.029$); GRAY: Discouraged ($p=0.029$)).

The subsequent results of the M-W test (see Figure 2b) display that the adjectives corresponding to GREEN, BLUE, PURPLE, BLACK, and WHITE colors exhibit significant differences between these two age groups (i.e., GREEN: Alive ($p=0.008$); BLUE: Depressed and Light ($p=0.038$ and $p=0.047$, respectively); PURPLE: Domineering ($p=0.008$); BLACK: Horrible ($p=0.038$); GRAY: Vague ($p=0.001$); WHITE: Transparent ($p=0.043$)).



* $p < 0.05$ ** $p < 0.01$

Note: The color names of A1 to A10 as follows.

RED: (A1) Passionate, (A2) Flaming, (A3) Joyous, (A4) Scorching, (A5) Angry, (A6) Bright, (A7) Bloody, (A8) Dazzling, (A9) Warm, and (A10) Generous

ORANGE: (A1) Warm, (A2) Acidic and Sugary, (A3) Autumn, (A4) Evening, (A5) Soft, (A6) Joyful, (A7) Sweet, (A8) Comfortable, (A9) Naughty, and (A10) Cute

YELLOW: (A1) Sunny, (A2) Bright, (A3) Shining, (A4) Obvious, (A5) Desert, (A6) Arrogant, (A7) Free, (A8) Peaceful, (A9) Warm, and (A10) Hot

GREEN: (A1) Emerald, (A2) Relaxed, (A3) Fresh, (A4) Comfortable, (A5) Alive, (A6) Crisp, (A7) Refreshing, (A8) Clear, (A9) Equal, and (A10) Steady

BLUE: (A1) Cold, (A2) Depressed, (A3) Broad, (A4) Refreshing, (A5) Comfortable, (A6) Beautiful, (A7) Light, (A8) Weak, (A9) Deep, and (A10) Fluttering

PURPLE: (A1) Dreamy, (A2) Noble, (A3) Romantic, (A4) Domineering, (A5) Outstanding, (A6) Proud, (A7) Dancing, (A8) Beautiful, (A9) Weird, and (A10) Dynamic

BLACK: (A1) Mysterious, (A2) Dark, (A3) Dirty, (A4) Unfathomable, (A5) Handsome, (A6) Silent, (A7) Horrible, (A8) Scheming, (A9) Far, and (A10) Misanthrope

GREY: (A1) Dirty, (A2) Boring, (A3) Discouraged, (A4) Vague, (A5) Dim, (A6) Weird, (A7) Sad, (A8) Calm, (A9) Chaotic, and (A10) Lazy

WHITE: (A1) Pure, (A2) Clean, (A3) Unsuited, (A4) Empty, (A5) Bright, (A6) Kind, (A7) Calm, (A8) Transparent, (A9) Match Everything, and (A10) Vast

Figure 2 The color adjectives in different gender and ages

3) DISCUSSION

(a) Preference affects the association of adjectives in color

The degree of preference greatly affects children's perception and choice of colors. This study found that children's connections to adjectives of favorite colors were almost all positive. Conversely, children might associate negative adjectives with disgusting colors. Color preference is related to personal experience and depends on the adult's association of specific colors with physical objects [4]. EVT can indeed confirm the identity of certain things through color preference.

GREEN is the most unanimous favorite among all children in this study. Because people usually like colors that remind them of objects and entities (for example, GREEN, which was usually associated with positive objects such as health and alive) [7]. GRAY was generally unpopular among people of all ages and genders. YELLOW and PURPLE may be less common colors, but they do not necessarily link to negative images, perhaps because children's personal experience with color is less than that of adults [5], also the colors of the objects they have been in contact with differ from those of adults.

This study's experiment did not control for the children's psychological state or in a certain background environment. Children's emotional responses to color were conducted without context [23]. All the children's color learning results from the same teaching environment. In addition to restricted age and gender conditions, children's attitudes and perceptions of color were based on the children's own experiences and cognition. As mentioned by [5], older children have increased personal experiences of color relative to younger children. Children's emotional descriptions of most colors (such as GREEN, BLUE, PURPLE, BLACK, and WHITE) have marked differences as they grow older. Among them, older children have different perceptions of adjectives for less common colors, such as PURPLE and GRAY

(b) Cultural differences affect the color perception

Another potential influence on color perception is cultural differences [4][7][8][26]. In this study, most children believed that RED was related to positive adjectives (such as Passionate and Flaming). Past studies have found that Chinese participants associate RED with "good luck", while American participants associate RED with Angry [7]. [5] explained that language associations are closely related to concrete physical objects and abstract symbolic concepts, at least in part, because people turn RED when they are angry. This is similar to cultural differences. In this study, most children describe YELLOW as positive adjectives (such as Sunny and Bright). Because YELLOW is related to high prestige and heroism in China, some people think that YELLOW is the color of the Chinese emperor. In the United States, YELLOW is associated with cowardice and fear, because YELLOW is usually associated with the color of urine [7]. It shows that there are cultural differences in the color vision association.

(c) Difference in the color preferences related to gender

RED and WHITE are the colors that describe the most different feelings between genders. Women like RED more than men do, and men even hate RED. This difference may be attributed to the adaptability of hunter-gathering societies in the past, where females preferred redder colors because their vision system is specifically designed to recognize ripe fruits, berries and green leaves [51][52]. Therefore, people's preference for color is fundamentally adaptive. If people are attracted to objects with colors, they are more likely to successfully survive and reproduce "looks good to them" and avoid objects whose colors "look bad" to them [4].

In addition, participants may associate the aircraft with WHITE because of the perception experience of WHITE aircraft around the world [30]. This is the color that tangible objects can correspond to. But abstract adjectives are the perception experience without direct tangible objects. WHITE adjectives (such as Pure, Clean, and Unsullied) may be an additional link for girls to the vocabulary they care about most in their lives, which is "Beautiful". Whether it is for faces or clothes, they always pay attention to the question of whether they look good. On the contrary, boys may not have a specific actual perception of WHITE.

(d) Difference in the color preferences related to age

GRAY color in this study was found to significantly differ in color preferences between different ages. Most children generally don't like GRAY, particularly the youngest children [6] because GRAY makes children think of expressing negative emotions (i.e., Dirty, Boring, and discouraged). Furthermore, both younger and older children in this study generally dislike RED. This result is inconsistent with [6] who found that children of all ages like RED. Interestingly, this study found a contradictory phenomenon: that children's favorite color does not mean that they think the color conveys a positive meaning. RED was used as a background with an expressive face, it was considered by children across all ages to convey a negative meaning [6]. This study speculates that some colors (especially RED) may easily trigger extreme feelings in children. In other words, children's color preference will not affect their perception of color.

4) CONCLUSIONS

This research focuses on children's associations between colors and abstract adjectives. Children aged 9 to 12 have the mature ability to match colors with adjectives and their perception mechanisms of colors. Children can recognize that the same color can have positive and negative emotions. Although limited by the small number of participants, there is a clear significant trend in the results. It is believed that with a sufficient number of participants, the results should have a

stronger significant effect. Future research on children's colors can be directed to the correspondence between objects and colors.

5) ACKNOWLEDGEMENTS

We are grateful to J. S. Dong and Y. Y. Luo students in Asia University of Taiwan for their questionnaire survey for this study.

6) FUNDING STATEMENT

This research was supported by grants from the National Science Council, Taiwan to Ching-Yi Wang (NSTC 111-2221-E-468-003-MY2 and NSTC 113-2221-E-468-010) and MOE Teaching Practice Research Program (PHA1122466 and PHA1133971).

7) DATA AVAILABILITY

Declare the availability of the data used in the manuscript

8) CONFLICT OF INTEREST: The authors declare that there is no conflict of interest.

9) REFERENCES

- [1]. Braun CC, Silver NC. Interaction of signal word and colour on warning labels: differences in perceived hazard and behavioural compliance. *Ergonomics* 1995; 38(11): 2207-2220.
- [2]. Boyatzis CJ, Varghese R. Children's emotional associations with colors. *The Journal of Genetic Psychology* 1994; 155 (1): 77-85.
- [3]. Karp EM, Karp H B. Color associations of male and female fourth-grade school children. *The Journal of Psychology* 2001; 122 (4): 383-388.
- [4]. Palmer SE, Schloss KB. An ecological valence theory of human color preference. *Proceedings of the National Academy of Sciences* 2010; 107 (19): 8877-8882.
- [5]. Schloss KB, Palmer SE. An ecological framework for temporal and individual differences in color preferences. *Vision Research* 2017; 95-108.
- [6]. Gil S, Le Bigot L. Seeing life through positive-tinted glasses: Color-meaning associations. *PLoS One* 2014; 9: e104291. doi:10.1371/journal.pone.0104291
- [7]. Palmer SE, Schloss KB, Guo T, Wung V, Peng K. Symbolic Effects on color preferences in China and the US. *Journal of Vision* 2015; 15 (12): 1312.
- [8]. Schloss KB, Poggesi RM, Palmer SE. Effects of university affiliation and “school spirit” on color preferences: Berkeley versus Stanford. *Psychonomic Bulletin & Review* 2011; 18: 498-504.
- [9]. Taylor C, Franklin A. The relationship between color-object associations and color preference: Further investigation of ecological valence theory. *Psychonomic Bulletin & Review* 2012; 19: 190-197.
- [10]. Pitchford N, Mullen K. Influence of saturation on colour preference and colour naming. *Perception* 2005; 34: 25.
- [11]. Pazda AD, Elliot AJ. Processing the word red can enhance women’s perceptions of men’s attractiveness. *Current Psychology* 2017; 36: 316-323.
- [12]. Lehmann GK, Elliot AJ, Calin-Jageman RJ. Meta-analysis of the effect of red on perceived attractiveness. *Evolutionary Psychology* 2018; 16: 1-27.
- [13]. Maier MA, Elliot AJ, Lichtenfeld S. Mediation of the negative effect of red on intellectual performance. *Personality and Social Psychology Bulletin* 2008; 34: 1530-1540.
- [14]. Mehta R, Zhu R. Blue or red? Exploring the effect of color on cognitive task performances. *Science* 2009; 323: 1226-1229.
- [15]. Fugate JMB, Franco CL. What color is your anger? Assessing color-emotion pairings in English speakers. *Frontiers in Psychology* 2019; 10: 1-17.
- [16]. Jonauskaitė D, Dael N, Chevère L, Althaus B, Tremea A, Charalambides L, Mohr C. Pink for girls, red for boys, and blue for both genders: Colour preferences in children and adults. *Sex Roles* 2019; 80: 630-642.
- [17]. Jonauskaitė D, Parraga CA, Qublier M, Mohr C. Feeling blue or seeing red? Similar patterns of emotion associations with colour patches and colour terms. *i-Perception* 2020; 11(1): 1-24.
- [18]. Kaya N, Epps HH. Relationship between color and emotion: A study of college students. *College Student Journal* 2004; 38: 396-406.
- [19]. Sutton TM, Altarriba J. Color associations to emotion and emotion-laden words: A collection of norms for stimulus construction and selection. *Behavior Research Methods* 2016; 48: 686-728.

- [20]. Young SG, Elliot AJ, Feltman R, Ambady N. Red enhances the processing of facial expressions of anger. *Emotion* 2013; 13(3): 380-384.
- [21]. Ikeda S. Influence of color on emotion recognition is not bidirectional: an investigation of the association between color and emotion using a stroop-like task. *Psychological Reports* 2020; 123(4): 1226-1239.
- [22]. Pravossoudovitch K, Cury F, Young SG, Elliot AJ. Is red the colour of danger? Testing an implicit red-danger association. *Ergonomics* 2014; 57(4): 503-510.
- [23]. Elliot AJ, Maier MA. Color-in-context theory. *Advances in Experimental Social Psychology* 2012; 45: 61-125.
- [24]. Elliot AJ, Maier MA. Color psychology: Effects of perceiving color on psychological functioning in humans. *Annual Review of Psychology* 2014; 65: 95-120.
- [25]. Elliot AJ. Color and psychological functioning: a review of theoretical and empirical work. *Frontiers in psychology* 2015; 6: 1664-1078.
- [26]. Burkitt E, Tala K, Low J. Finnish and English children's color use to depict affectively characterized figures. *International Journal of Behavioral Development* 2007; 31(1): 59-64.
- [27]. Chang HW, Yeh TM. Analyzing textbook of Chinese as second language for foreign primary students by development of language and cognition. Unpublished master's thesis. Taiwan: National Taiwan Normal University; 2009.
- [28]. Sandhofer CM, Smith LB. Learning color words involves learning a system of mappings. *Developmental Psychology* 1999; 35: 668-679.
- [29]. Graham SA, Cameron CL, Welder AN. Preschoolers' extension of familiar adjectives. *Journal of Experimental Child Psychology* 2005; 91 (3): 205-226.
- [30]. Goodhew SC, Kidd E. Language use statistics and prototypical grapheme colours predict synaesthetes' and non-synaesthetes' word-colour associations. *Acta Psychologica* 2017; 173: 73-86.
- [31]. Kawai C, Lukács G, Ansorge U. Polarities influence implicit associations between colour and emotion. *Acta Psychologica* 2020; 209: 103143.
- [32]. McMenamin BW, Radue J, Trask J, Huskamp K, Kersten D, Marsolek CJ. The diagnosticity of color for emotional objects. *Motivation and Emotion* 2013; 37(3): 609-622.
- [33]. Meier B, Rothen N, Walter S. Developmental aspects of synaesthesia across the adult lifespan. *Frontiers in Human Neuroscience* 2014; 8: 129.
- [34]. Palmer SE, Schloss KB, Xu Z, Prado-León LR. Music-color associations are mediated by emotion. *Proceedings of the National Academy of Sciences* 2013; 110 (22): 8836-8841.
- [35]. Labrecque LI, Patrick VM, Milne GR. The marketers' prismatic palette: A review of color research and future directions. *Psychology & Marketing* 2013; 30: 187-202.
- [36]. Goodhew SC, Kidd E. Bliss is blue and bleak is grey: Abstract word-colour associations influence objective performance even when not task relevant. *Acta Psychologica* 2020; 103067.
- [37]. Fenko A, Hendrik NJ, Schifferstein PH. Looking hot or feeling hot: What determines the product experience of warmth? *Materials and Design* 2010; 31(3): 1325-1331.
- [38]. Sivik L, Taft C. Semantic variables for judging color combinations: An analysis of semantic dimensions. *Göteborg Psychological Reports* 1989; 19 (5): 1-31.
- [39]. Schifferstein HN, Tanudjaja I. Visualizing fragrances through colours: The mediating role of emotions. *Perception-London* 2004; 33 (10): 1249-1266.
- [40]. Fres FO, Rothen N. Development of synaesthetic consistency: Repeated autonomous engagement with graphemes and colours leads to consistent associations. *Consciousness and Cognition* 2019; 73: 102764.
- [41]. Meier BP, Robinson MD, Clore GL. Why good guys wear white: Automatic inferences about stimulus valence based on brightness. *Psychological Science* 2004; 15: 82-87.
- [42]. Simner J, Bain AE. A longitudinal study of grapheme-color synesthesia in childhood: 6/7 years to 10/11 years. *Frontiers in Human Neuroscience* 2013; 7: 153-161.
- [43]. Simner J, Harrold J, Creed H, Monro L, Foulkes L. Early detection of markers for synaesthesia in childhood populations. *Brain* 2009; 132: 57-64.

- [44]. Simner J, Mulvenna C, Sagiv N, Tsakanikos E, Witherby SA, Fraser C, Scott K, Ward J. Synaesthesia: The prevalence of atypical cross-modal experiences. *Perception* 2006; 35: 1024-1033.
 - [45]. Doise W, Clémence A, Lorenzi-Cioldi F. *The quantitative analysis of social representations*. London: Harvester Wheatsheaf; 1993.
 - [46]. Schmitt N. Quantifying word association responses: What is native-like? *System* 1998; 26: 389-401.
 - [47]. Ares G, Deliz R. Studying the influence of package shape and colour on consumer expectations of milk desserts using word association and conjoint analysis. *Food Quality and Preference* 2010; 21: 930-937.
 - [48]. Wagner W, Valencia J, Elejabarrieta F. Relevance, discourse and the hot stable core of social representations and structural analysis of word associations. *British Journal of Social Psychology* 1996; 35: 331-351.
 - [49]. Piaget J. *The Psychology of Intelligence*. Abingdon: Taylor and Francis; 1947.
 - [50]. Powell KC, Kalina CJ. Cognitive and social constructivism: developing tools for an effective classroom. *Education* 2009; 130: 241-250.
 - [51]. Hurlbert AC, Ling YL. Biological components of sex differences in color preference. *Current Biology* 2007; 17: 623-625.
 - [52]. Ling Y, Hurlbert A, Robinson L. Sex differences in colour preference. *Progress in Colour Studies 2: Cognition*, eds Pitchford NJ, Biggam CP (John Benjamins, Amsterdam); 2006.
-