The Survey of Recognition Concerning the Designations versus Shades of Color in Chinese Characters in the Year 2008

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Abstract：Besides the direct demonstration, the explanations and descriptions of colors have relied mostly on languages as the major media since ancient times. With the development of modern technology, the communication and expression of colors tend to be reached in systematic symbols and codes. However, in daily life, the use of language to express colors is inevitable. In Chinese culture, colors were given designations as means to express them, and this remained the major form of exposition. In the following study, Chinese textbooks of junior high schools and primary schools were utilized as the source of data base, and a sampling survey was carried out upon the common designations of color derived from the source. After some clarification regarding the semantics, a software, which was developed by me, called "Index and Filter of Colors and Shades"(IFCS) was run to check the recognition of designations in relation to shades of color. The survey was conducted on a total of 1564 senior and vocational high school students, whose command of language was supposed to reach maturity. The results are as follows: 1. The recognition of designations versus shades shows differences and overlaps to some extent, for instance Chi(赤) and Hong(紅), or Qing(青), Lu(綠), and Lan(藍). 2. The shades of color for the corresponding Chinese characters are indistinct. 3. The modifiers prior to the designations of color in the Chinese language affect the range of corresponding shades. 4. Familiarity of color designations affects the concentration of the range of shades. 5. Teaching materials employed in mandatory education exert influences over the corresponding relations between color designations and color shades. 6. Some color designations in Chinese tend to be classified as ancient characters, such as Chi(赤), Dan(丹), and Zhu(朱).

Keywords*：*Designations versus Shades of Color

1. Research Motivation

Language is a showcase of culture. Expressions of colors in languages evolve with culture in the course of history and reveal distinctive features in different eras. Consequently, meanings of color words do not always remain the same. In humans' everyday life, description and demonstration of colors rely on spoken or written languages. At the time when audio and visual reproduction techniques were not yet created, languages were definitely the best media. In Chinese culture, the interchangeability and uniformity between the spoken and the

written were attained through the development of vernacular Chinese as the Standard Written Chinese.

The designations of color in Chinese could be classified in three different ways. 1. Judging from structures: single-character, double-character, triple-character, and multi-character. 2. Seen from grammar: with adjectives before the stem or after the stem. 3. Based upon real objects: minerals, flora, fauna, events, areas, dialects, and so on. This thesis aims to keep track of the data concerning recognition of color in modern days. If any comparison is needed in the future, the data collected in this research can be utilized as a comparison basis. And meanwhile, with this study I seek to locate features of color recognition belonging to this era, or help identify distinctions of our time.

2. Research Objectives

Common expressions of color in Chinese characters include "Hong(紅, Red), Cheng(橙, Orange), Huang(黃, Yellow), Lu(綠, Green), Lan(藍, Blue), Dian(靛, Indigo), Zi(紫, Purple)", "Hong(紅, Red), Cheng(橙, Orange), Huang(黃, Yellow), Lu(綠, Green), Qing(青, cyan), Lan(藍, Blue), Zi(紫, Purple)", or "Hong(紅, Red), Cheng(橙, Orange), Huang(黃, Yellow), Lu(綠, Green), Qing(青, cyan), Zi(紫, Purple)." These variations are actually different versions of translation for spectrum , which was discovered by Newton. And inconsistency dwells upon them. For example, Qing(青) and Lan(藍) are hardly different. Ideas abut Dian(靛, Indigo) vary from person to person. What is even more perplexing, the corresponding shades of color should turn out differently. Hence, if we can clarify on semantics, and allow the end result to be consistent, we would be able to truly understand the meanings of Chinese designations for colors. By doing so, we might also retain social data for the possible construction of a system, in which designations and shades of Color in Chinese can be organized unequivocally.

3. Methodology and Limitations

The research focuses mainly on the designations versus shades of color in Chinese. Words of color which appear both in junior high school Chinese textbooks(國文) and in primary school Chinese textbooks(國語) in Taiwan were collected. Then a questionnaire was made to go with a new software called "Index and Filter of Colors and Shades"(IFCS) . Through this software, which was developed by me, the corresponding color sample was picked.

The subjects consists of Taiwan high school students with a total of 1564 participants. There are 563 male students and 1001 female students. These participants must meet the requirement of proper eyesight with the capability to distinguish colors, or they must attain the same ability after medical corrections.

4. Sampling of Color Designations

To facilitate easy discussion, the color designations were classified according to the last character in the designation. There are seven major types with 43 designations (colors) in total. They are: Red Cluster, Orange Cluster, Yellow Cluster, Green Cluster, Blue Cluster, Purple Cluster, and Others. The Red Cluster includes Chi(赤), Hong(紅), Dan(丹), Zhu(朱), Xianhong(鮮紅), Dahong(大紅), Juhong(橘紅), Huohong(火紅),

Fenhong(粉紅), Yanhong(豔紅), and Zhuhong(朱紅). The Orange Cluster includes Cheng(橙), Ju(橘), He(褐), and Chihe(赤褐). The Yellow Cluster includes Huang(黃), Jinhuang(金黃), Jin(金), and Danhuang(淡黃). The Green Cluster includes Lu(綠), Bi(碧), Bilu(碧綠), Qinglu(青綠), Qingcui(青翠), Huanglu(黃綠), and Youlu(釉綠). The Blue Cluster includes Qing(青), Lan(藍), Dian(靛), Weilan(蔚藍), Shenqing(深青), and Daiqing(黛青). The Purple Cluster include Zi(紫). Others include Hei(黑), Wu(烏), Hui(灰), Bai(白), Jiao(皎), Su(素), Yin(銀), Huihei(灰黑), and Xuebai(雪白).

5. Research Instruments

5.1 Questionnaire

Designations of color were given codes, and then arranged in random order so that the respondents won't be affected by the correlations when answering the questions. By doing so, the accuracy is reached.

The questions for "Recognition Concerning the Designations versus Shades of Color in Chinese Characters" are as follows:

1.Familiarity with the designations of color: if you know and understand the meaning of the designation, please give the mark "○". If you have heard of the designation, but do not understand the meaning, please give the mark "△". If you have never heard of the designation before, please give the mark "╳".

2.Recognition concerning the designations versus shades of color in Chinese characters: if you know the designation and know what is the corresponding shade, please give the mark "○". If you do not know the corresponding shade, but the answer can be inferred from the designation, please give the mark "△". If you do not know the corresponding shade, nor can you infer it from the designation, please give the mark "╳".

3.Choose the corresponding match: subjects were invited to utilize the software "Index and Filter of Colors and Shades"(IFCS), and pick up the best matching shade for the designation. After that, they were required to record the code rendered by the software in the blanks given.

5.2 "Index and Filter of Colors and Shades"(IFCS):

To avoid the probability that respondents might not be able to choose the best matching color from paper-based color samples, I developed a software on the basis of Visual Basic. It was given the name "Index and Filter of Colors and Shades"(Chart 1). Through this software, respondents would be able to pick up the best matching color in accordance with his/her recognition. The software renders a total of 14600 colors in different combinations. IFCS's interface includes selection area (A), minor adjustment area (B), and display area (C). The respective functions are explained as follows:

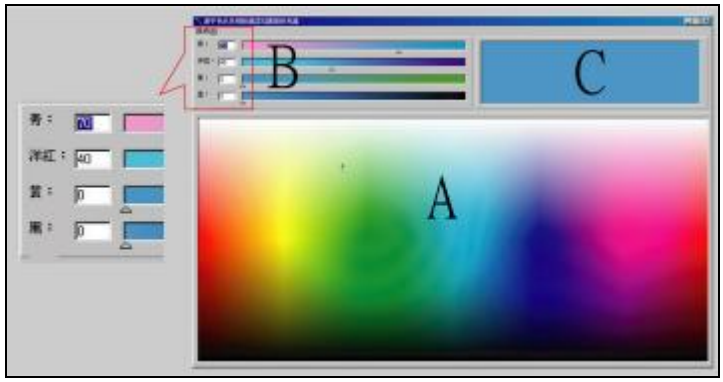


Chart 1 Interface of "Index and Filter of Colors and Shades"(designed in this project)

1.Area A is for selecting colors according to one's recognition: the area in the bottom is for choosing colors. After the respondents see the words for color, they can pick up the closest shade from this area with a click of the mouse. Respondents are free to move the cursor anywhere they want. The chosen color will be shown on the display area.

2.Area B is for minor adjustment: on the upper-left corner, there are four bars: Cyan(C 青), Magenta (M 洋紅), Yellow(M 黃), and Black(K 黑). For any minor adjustment, users only need to drag the triangles of any of the four bars to the position they want. The color shown in the display area will be modified accordingly. Color rendering indexes will also be shown at the beginning of the bars. The range for adjusting the bars covers 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100. These eleven levels match the requirements for printing.

3.Area C is for display of the chosen color: on the upper-right corner, the matching color selected by the user is presented.

5.3 Setting and equipment:

The survey was conducted in standard computer rooms, with the lighting, computer systems, and monitors all in the same specifications. The 17-inch LCD monitors were set with a resolution of 1024 (pixels) × 768 (pixels), the frequency at 75Hz, and the quality at 32-bit. Before the administration of the survey, all the monitors were calibrated with "Color Vision Spyder2express." The color temperature of the surroundings was controlled so that it was close to D 50. The illuminance on the desktop was kept at 600 lux. Users could adjust the position of their chairs freely, and they were reminded that the distance between the eyes and the screen was best kept at 60 cm.

6. Results and Discussions

6.1 Analysis of familiarity

The 43 Chinese designations presented to the testees were given an analysis of familiarity. Judging from the rates of unfilled questions, these words were classified into five categories: high familiarity, high-intermediate familiarity, intermediate familiarity, low familiarity, and extremely low familiarity. As shown in Table 1.

Table 1 Analysis of familiarity

Categories	Designations(Unfilled rates)	Sum	Percentage
high familiarity 0%-20%	Hong(紅 7.7%)、Xianhong(鮮紅 11.3%)、Dahong(大紅 7%)、Juhong(橘紅 10.5%)、Fenhong(粉紅 5.6%)、Yanhong(豔紅 7.7%)、Cheng(橙 5.6%)、Ju(橘 7%)、Huang(黃 12%)、Danhuang(淡黃 10.5%)、Jinhuang(金黃 12%)、Lu(綠 2.8%)、Qingcui(青綠 19.7%)、Huanglu(黃綠 16.2%)、Qing(青 14.1%)、Lan(藍 7%)、Zi(紫 6.3%)、Hei(黑 2.7%)、Hui(灰 13.4%)、Bai(白 1.4%)、Xuebai(雪白 13.4%)	21	48.9%
high-intermediate	Chi(赤 37.3%)、Huohong(火紅 20.4%)、Zhuhong(朱紅 34.5%)、He(褐 28.1%)、	11	25.5%

familiarity 20%-40%	Jin(金 35.9%)、Bilu(碧綠 23.2%)、Dian(靛 28.8%)、Weilan(蔚藍 21.1%)、Shenqing(深青 27.4%)、Yin(銀 31.7%)、Huihei(灰黑 26%)		
intermediate familiarity 40%-60%	Zhu(朱 40.8%)、Chihe(赤褐 58.4%)、Bi(碧 54.9%)、Qingcui(青翠 42.3%)、Youlu(釉綠 51.5%)、Dianqing(靛青 47.1%)	6	14%
low familiarity 60%-80%	Dan(丹 71.2%)、Daiqing(黛青 76.7%)、Wu(烏 60.6%)、Su(素 71.1%)	4	9.3%
extremely low familiarity 80%-100%	Jiao(皎 83.8%)	1	2.3%

(Compiled by me)

6.2 Analysis for matching rates between designations and shades

For the 43 designations of color, shades with the highest rate of matching were classified as Red Cluster, Orange Cluster, Yellow Cluster, Green Cluster, Blue Cluster, Purple Cluster, and Others. As shown in Table 2.

Table 2 The Highest Matching Rates of Shades

Type	Designation	Variations	Shade	Color rendering index C.M.Y.K	Percentage
Red cluster	Chi(赤)	34		000.100.100.000	16.2%
	Zhu (朱)	50		000.100.100.000	8%
	Dan (丹)	29		000.080.100.000	3.5%
	Hong (紅)	34		000.100.100.000	26.7%
	Xianhong(鮮紅)	42		000.100.100.000	17.6%
	Dahong (大紅)	32		000.100.100.000	31.7%
	Juhong (橘紅)	48		000.060.090.000	9.1%
	Huohong (火紅)	49		000.100.100.000	7.7%
	Fenhong (粉紅)	55		000.030.020.000	6.3%
	Yanhong (豔紅)	43		000.100.100.000	14.1%
	Zhuhong (朱紅)	55		000.080.100.000	4.2%
Orange cluster	Cheng (橙)	45		000.050.100.000	17.6%
	Ju (橘)	36		000.050.100.000	28.8%
	He (褐)	52		000.030.100.020	4.2%
	Chihe (赤褐)	40		000.060.100.030	3.5%
Yellow cluster	Huang (黃)	24		000.000.100.000	34.6%
	Danhuang (淡黃)	29		000.000.020.000	15.5%
	Jin (金)	43		000.000.090.000	7%
	Jinhuang (金黃)	35		000.000.100.000	24.6%
Green cluster	Lu (綠)	45		100.000.100.000	20.4%
	Bi (碧)	54		080.000.010.020	2.8%
	Bilu (碧綠)	64		100.000.100.010	5.6%
	Qinglu (青綠)	61		060.000.070.000	4.2%
	Qingcui (青翠)	61		050.000.050.000	4.2%
	Huanglu (黃綠)	40		030.000.080.000	8.5%
	Youlu (釉綠)	54		070.000.100.060	2.8%
Blue cluster	Qing (青)	66		100.000.000.000	12.7%
	Lan (藍)	40		100.100.000.000	30.2%
	Dian (靛)	61		080.100.000.000	7.7%
	Weilan (蔚藍)	57		100.040.000.000	4.9%
	Shenqing (深青)	68		090.000.100.050	5.6%
	Daiqing (黛青)	30		100.100.000.000	2.8%
	Dianqing (靛青)	58		050.100.000.000	2.8%
Purple cluster	Zi (紫)	62		050.100.000.000	5.6%
Others	Hei (黑)	55		000.000.000.100	29.6%
	Wu (烏)	36		000.000.000.100	24.7%
	Hui (灰)	47		000.000.000.050	21.8%
	Bai (白)	10		000.000.000.000	83.1%
	Jiao (皎)	8		000.000.000.000	8.5%
	Su (素)	16		000.000.000.000	14.8%
	Yin (銀)	27		000.000.000.010	27.5%
	Huihei (灰黑)	37		000.000.000.080	16.2%
	Xuebai (雪白)	13		000.000.000.000	71.1%

(Compiled by me)

From Table 2, we can discover that recognitions concerning the connections between designations and shades still hold great differences. The number of shades chosen for each designation reached an average of 43. The more common ones: red, orange, yellow, green , blue, indigo, purple, black, and white also reached an average number of 55 variations.

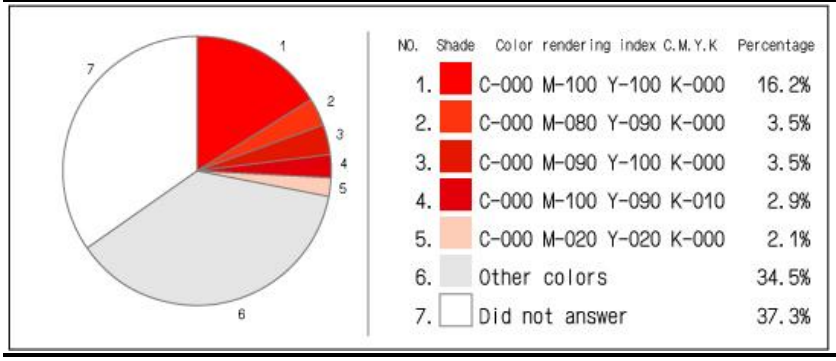
6.3 Differences and overlaps for the colors Chi and Hong

In literature before the Han Dynasty, "Chi"(赤) was the only designation for the color Red. For example, in the classic *Shi Jing*(詩經), "Odes of Bei"(邶風), "Chi" was used to describe the color of animals. There wasn't any "Hong"(紅) in the book. The word "Hong" wouldn't turn up often until *Hanfu*(漢賦), in which more examples of Hong were seen, such as Hongyan(紅顏) or Honghua(紅花). However, the frequency still remained much lower than that of "Chi". From the radical "糸", we know that the character "紅" is related to textiles. The other half of the word "工" means something about specialty.

"Hong"(紅) referred to very light pink in the early period of the Han Dynasty, and its use was only limited to the profession of textile dyeing. In the explanation of Shuowenjieae(說文解字), "Hong"(紅) means "帛赤白色", which, in terms of vernacular Chinese, is a mixture of red and white. In other words, the color we know as peach color or pink today.

Regarding the designation "Chi", 37.3% of the respondents failed to choose any matching shade, as shown in Table 3. This shows a tendency, suggesting that "Chi" is not employed to express color as often as it used to be. Besides, its corresponding shades picked up by the respondents tend to be the same as Hong's. The shade with the highest chosen rate Y100+M100(16.2%) is identical with Hong's highest chosen color (M100+Y100).

Table 3 Statistics for the matching shades of "Chi"



Familiarity

Category	The Number of Respondents	Percentage
○	848	54.2%
△	298	19.1%
×	418	26.7%

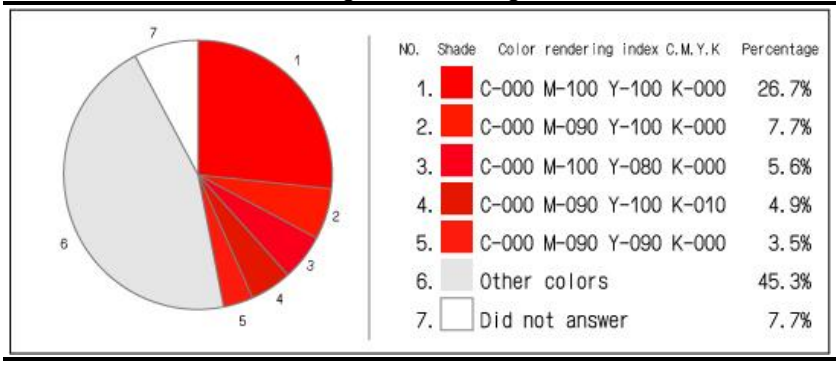
Recognition

Category	The Number of Respondents	Percentage
○	672	43%
△	309	19.7%
×	583	37.3%

(Compiled by me)

The statistics of corresponding colors to "Hong" is listed below in Table 4. 92.3% among the testees gave their answers, which suggests that "Hong" as an expression of color is very common. M100+Y100(26.7%) is the choice with the highest rate, and not many variations were given. That is, a consistency exists among the respondents as regard to what a "Hong" color should be like. The various shades selected by the respondents are unlike pink or peach color recorded in the ancient literature. The only one which is closer is M100, with a percentage of 15%.

Table 4　Statistics for the matching shades of “Hong”



Familiarity

Category	The Number of Respondents	Percentage
○	1465	93.7%
△	88	5.6%
×	11	0.7%

Recognition

Category	The Number of Respondents	Percentage
○	1300	83.1%
△	144	9.2%
×	120	7.7%

(Compiled by me)

6.4 Qing(青), Lu(綠), and Lan(藍) — Differences and overlaps

“青” (Qing) , written as「 」in Oracle bone script(甲骨文), referred to the color of the grass around wells, that is, green. Yet during the Spring and Autumn Period (春秋戰國時代), in the classic *Xunzi*, “Quanxuepian”, there was a quotation, “Qing is taken from Lan[1], yet more Qing than Lan.” Which enlightens us that Qing is the dye produced from the plant “Lan.” Later in the passage of time, Qing evolved to cover both green and blue.

Besides, Qing was also used to refer to the black color. For instance, in the Tang Dynasty, the great poet Li Bai wrote this verse, “君不見高堂明鏡生白髮，朝如青絲暮如雪.” The phrase “青絲”(qingsi) refers to “black hair.” Another daily example was “青瓦”(qingwa) . It means “black walls.”

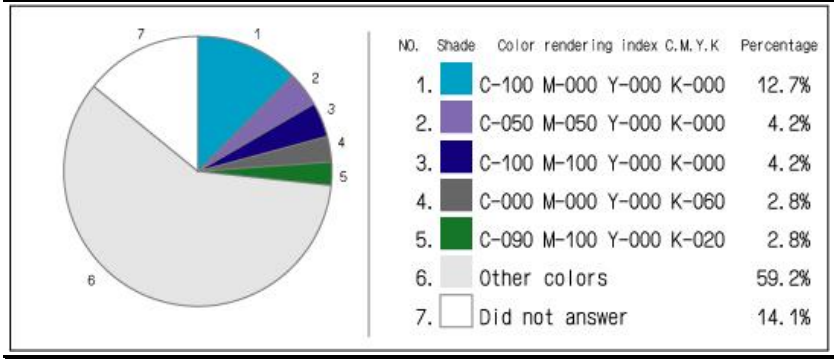
In the classic *Shi Jing*(詩經), the word “藍”(Lan) , which at that time was not a word for color, was recorded in the phrase ”終朝採藍.” Instead, it was a plant. Later on in the dictionaries like *Shuowenjieae*(說文解字), *Guangya*(廣雅), *Yupian*(玉篇), *Guangyun*(廣韻), and *Zhengzitong*(正字通), it was also recorded as a plant for producing dye, not for expressing color.

The only exception came from Erya(爾雅), Chapter “Shiniao” (釋鳥), there was a description: “秋鳩，竊藍”, in which “藍”(Lan) was used to refer to color. The modifier “竊”(Qie) before “藍” means light color. As a result, the term “竊藍” means light cyan.

In my survey, 14.1% of respondents failed to pick up any matching color for “青”(Qing). See Table 5. Judging from this figure, we can discern that ambiguity exists concerning the identity of Qing. Moreover, the color Qing also demonstrated the tendency to be replaced by Lan. C100 (12.7%) was the choice of the highest rate. A lot more variations were selected by the respondents, including C100+M100(4.2%), C50+M50(4.2%), C90+Y100(2.8%), and K60(2.8%). Perhaps we might draw the conclusion that the true colors of Qing are turning shaky in the course of history.

[1] In ancient China, people called the plant “Indigofera” “Lan”(藍).

Table 5　Statistics for the matching shades of “Qing”



Familiarity		
Category	The Number of Respondents	Percentage
○	1124	71.9%
△	374	23.9%
×	66	4.2%

Recognition		
Category	The Number of Respondents	Percentage
○	849	54.3%
△	495	31.6%
×	220	14.1%

(Compiled by me)

6.5 Ambiguity exists among the corresponding colors

When presented with a Chinese designation for color, respondents would interpret its meaning according to their personal experiences. Next, they turn the meaning into a corresponding color based upon their impressions. Findings of this research show that the recognition process from the input of designations to the output of corresponding shades contains ambiguity in every step. Therefore, different end results were created. For instance, the corresponding shades for the color “Qing” include (C100), (C100+M100), (C50+M50), (C100+Y100), and (K60). A variety of shades, such as (Y100+M100) or (M100+Y90 +K10), were given for the word “Chi.”

6.6 Degrees of concentration for corresponding shades depend on familiarity with the designations

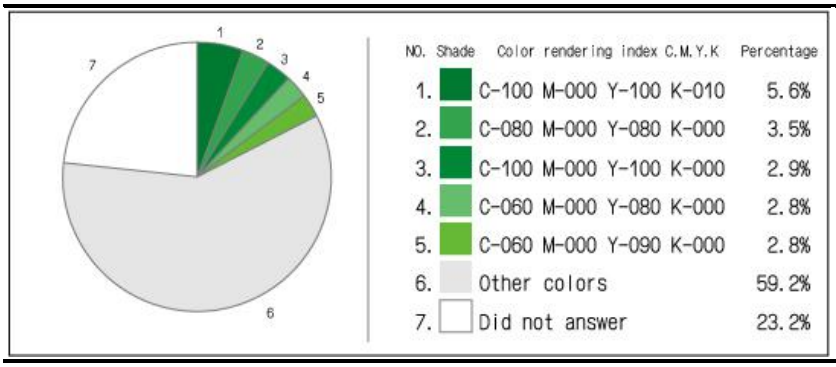
Recognition of colors in Chinese involves familiarity. If the respondents were familiar with the words of color, the responding colors demonstrated a higher degree of concentration. Colors belonging to this category include Hong, Cheng, Huang, Lu, Lan, and Zi. They are commonly seen in daily lives, and they form the basis of colors accepted by the entire society. On the contrary, some characters like “丹” (Dan) or “烏” (Wu), possibly due to the unfamiliarity, did not concentrate closely. “Bilu” (碧綠) may share the same problem. Its degree of concentration is lower than that of “Huanglu” (黃綠) or “Jinhuang” (金黃). So it is also less known in terms of popularity.

6.7 The modifiers prior to the designations of color affect the corresponding range of shades.

Modifiers prior to the designations of colors exert certain influence over the matching process. Mostly, modifiers play the roles of categorizing color tones. And the majority of modifiers are actually translated from foreign languages. However, there are some distinctive modifiers native to the Chinese language, which were passed on from the ancient times, for example, “大”(Da), ”粉”(Fen), ”鮮”(Xian), or ”豔”(Yan). They can change brightness and colorfulness of the words they modify.

When these modifiers were strung together with color words, respondents’ familiarity with these modifiers would affect their choices of corresponding colors. “Bilu”(碧綠) is a good example of these. See table 6. Besides (C100+ Y100+ K10), several versions were picked, such as (C60+Y80), (C80+Y80), and (C60+ Y90), due to respondents’ different interpretations.

Table 6　Statistics for the matching shades of “Bilu”(碧綠).



Familiarity		
Category	**The Number of Respondents**	**Percentage**
○	782	50%
△	595	38%
×	187	12%
Recognition		
Category	**The Number of Respondents**	**Percentage**
○	727	46.5%
△	474	30.3%
×	363	23.2%

(Compiled by me)

6.8 Teaching materials employed in mandatory education exert influences over the corresponding relations between color designations and color shades.

The mandatory 6-year primary school education was implemented in 1945. In 1968, another 3-year’s mandatory junior high school education was added. During this period, unification of teaching principles created a deep impact upon the instruction of colors. It was also at this time that Newton’s analysis of sunlight with a prism was introduced to the local students. For the first time in history, a consistent standard was set up for the education of colors. Yet due to the translation variations, students would find ”紅橙黃綠藍靛紫”, “(赤)橙黃綠藍靛紫”, or even “(赤)橙黃綠(青)靛紫” in the textbooks for the same spectrum discovered by Newton. In the year 1985, National Institute for Compilation and Translation published a teachers’ manual for instructing third-grade fine arts, in which the RGB color model was translated sometimes as “赤黃青”(Chihuangqing), or sometimes as “紅黃青”(Honghuangqing). Even if the teachers did present the colors with real objects, they would not be able to give accurate designations. In a lot of cases, the teaching was just done equivocally. For the chaos and confusion concerning the instructing of colors, a thorough research project can be very helpful. It will help clarify the perplexity, and shed light on the establishment of color instructions. Other countries with the same problem may benefit from it.

6.9 Some color designations in Chinese tend to be classified as ancient characters

In the ancient literature of the Chinese language, we discover many words of color coined by people to express and distinguish what they saw in their daily lives. But in the course of history, Chinese characters evolve with culture, education, and environment. As a result, some of them are no longer in use today. Findings of this research show that “赤” and “青” both made their first appearance in Oracle bone script. In ancient writings, they were used very commonly to express colors. But in today’s written and spoken languages, they are showing the tendency to be replaced by “Hong”(Red) and “Lan”(Blue) respectively. In this research, the phenomenon was called “Ancientization of Chinese designations for colors.”

7. Conclusion

The traditional denomination of colors in Chinese shows not only the ancient people’s observations of the universe, but also the patterns and features of the language. Sociology, anthropology, ethnology, and linguistics are all involved. Cultural and emotional feelings are evident. All these make the words of color capable of

generating vivid images in people's minds and arousing deep feelings inside.

After my research of recognition concerning the designations versus shades of color, I discover the following phenomena: 1. The recognition of designations versus shades shows differences and overlaps to some extent, for instance Chi(赤) and Red(紅), or Qing(青), Green(綠), and Blue(藍). 2. The shades of color for the corresponding Chinese characters are indistinct. 3. The modifiers prior to the designations of color in the Chinese language affect the range of corresponding shades. 4. Familiarity of color designations affects the concentration of the range of shades. 5. Teaching materials employed in mandatory education exert influences over the corresponding relations between color designations and color shades. 6. Some color designations in Chinese tend to be classified as ancient characters, such as Chi(赤), Dan(丹), and Zhu(朱).

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