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A Study on Mandarin Color-Term Performance and Relevant Factors*

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Abstract

This paper investigates the effects of gender, age and profession on the performance of Mandarin color terms. Participants were divided into three groups according to three variables: gender, age and profession (art/color-related vs. non-art/color-related). These participants took on a free-listing task and a color-naming task, providing the color names in Mandarin. The results showed that, in terms of gender differences, women used significantly more elaborate color terms than men did in the color-naming task, especially in the category of modified terms. Taking the variable of age into consideration, younger participants made significantly more use of secondary terms, but significantly less use of modified terms than the middle and older groups in both tasks. As for profession, no significant difference appeared to exist between the participants with art/color-related and those with non-art/color-related backgrounds in both

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tasks. Task effect was additionally examined and discussed. Finally, this paper further elaborates the current usage of Mandarin color terms and offers some certain pedagogical implications.

Keywords: color-naming, color terms, free-listing, Mandarin

1. Introduction

Color naming, according to Alvarado (2013:1), is "the process of assigning color terms to refer to color appearances in the world." Color terms or names are used to designate the mental representations of color space, called color categories. As in the World Color Survey (Berlin and Kay 1969; Kay et al. 2009), the issues of color perception and categorization is frequently studied by using color terms to name color categories in different languages. Among them, there are comparatively fewer studies on the Mandarin color terms, and little attention is drawn to the relevant factors of Mandarin color-term performance.

This study investigates the effects of gender, age and profession on color-term performance in Mandarin based on the framework of Berlin and Kay (1969). This framework in color research consists of three main points. First, there are eleven basic universal perceptual color terms for humans, *white, black, red, green, yellow, blue, brown, purple, pink, orange* and *grey*. Second, they argued that every language should follow a fixed order of development. For example, *black* and *white* should be developed initially. On the other hand, the four categories, *purple, pink, orange* and *grey* would be the last to be developed. Third, they claimed that the temporal order is considered an evolutionary one. In a later publication, Kay and MacDaniel (1978) suggested that grey can lexicalize in a language as "a wild card" at any of the seven evolutionary stages, not in the last, seventh stage as originally claimed. Color lexicons with all eleven basic terms tend to be from highly developed cultures.

To examine the universal theory of Berlin and Kay (1969), an increasing number of color studies on different languages have been conducted (cf. Lu 1997; Stanlaw

1997; Lin et al. 2001a, 2001b; Alvarado and Jameson 2002; Mylonas and MacDonald 2014), especially on European and African languages (Davies et al. 1992 on Setswana; Davies, Corbett and Margalef 1995 on English; Uusküla, Hollman and Sutrop 2012 on Hungarian, Finnish and Czech; Paggetti, Menegaz and Paramei 2016 and Paramei, D'Orsi and Menegaz 2016 on Italian). Stanlaw (1997) observed that some English loanwords are replacing the native Japanese color terms such as the loanwords *pinku* 'pink' for the native term *momo-iro*, *orenji* 'orange' for *daidai-iro*, and *guree* 'green' for *nezumi-iro*. Lu (1997) compiled the color naming responses of 1,815 Mandarin speakers to refute the argument that Mandarin merely possesses six basic color terms instead of the full set of eleven terms addressed in the study of Berlin and Kay (1969). Further, Lin et al. (2001a, 2001b) attempted to use different methods, including the unconstrained approach (i.e., free-listing test) and the constrained approach (i.e., the mapping test), in two reports to compare the color naming categories of Mandarin and English. It was found that the eleven basic color terms addressed in Berlin and Kay (1969) were the most commonly used in both Mandarin and English; however, some differences do exist between these two languages. For example, *pink* and *grey* were adopted more by British than by Chinese participants, while *red* was used more by Chinese than by English participants. Besides, English *red* seemed to be yellower and lighter than Chinese *hóng* 'red', while English *green* was lighter than Mandarin *lǜ* 'green'. Focusing on cross-cultural comparison, these studies were, however, limited in that no detailed discussion of the effects of age, profession or task on color-term performance was provided.

Another comparative study was performed by Alvarado and Jameson (2002). They investigated the similarities and differences in color naming, especially the use of modifiers and secondary terms, between Vietnamese and English. For example, the modifier *pale* was only used by English speakers, which seemed to be a synonym of *light*. In terms of the modifier *light*, it was frequently used in both languages. With regard to Turkish, Ekici, Yener and Camgoz (2006) collected basic and non-basic color terms in Turkish, and investigated their appearance in the minds of Turkish native speakers. The results showed that the basic color names were mapped onto the

color stimuli which had equal values and chroma. However, most non-basic color names were mapped onto different color stimuli.

The variable *gender* in the performance of color terms has been widely studied (Nowaczyk 1982; Simpson and Tarrant 1991; Yang 1996, 2001; Wang 2012; Gao 2014; Gao and Sutrop 2014). The results of most studies reveal that females perform better in color naming than males, as they have a wider vocabulary of colors than males and tend to use more elaborate terms to name colors. Recently, Wang (2012) examined gender differences in Mandarin color terms by recruiting 38 female and 35 male university students in Taiwan whose ages ranged from 19 to 22 years old to take a color-naming test using 25 color cards. It was found that the female participants had a larger Mandarin color vocabulary than the males. The females used more elaborate color terms, while the males preferred using basic color terms. This study confirmed Lakoff's hypothesis (1975) that women have more extensive color vocabulary than do men, and further indicated that the nature of gender does indeed affect color-term performance. Most recently, Gao (2014) and Gao and Sutrop (2014) re-examined the framework of Berlin and Kay (1969) in a list task and a color-naming task of 65 color tiles with 60 Mandarin-speaking informants in Mainland China. They argued that there are nine basic color terms in Mandarin: *hóng* 'red', *huáng* 'yellow', *lǜ* 'green', *lán* 'blue', *hēi* 'black', *bái* 'white', *zǐ* 'purple', *fěn* 'pink'[2], and *huī* 'gray'. There were no gender differences for the basic color terms in their findings. These above-reviewed studies are, nonetheless, limited in that no older participants were invited to examine the possible age influence on color naming production across different age groups or generations.

During the past decades, comparatively few studies have addressed the effect of *age* on the performance of color terms. Simpson and Tarrant (1991), for example, suggested that older English-speaking subjects of both sexes used more elaborate terms than younger subjects. Yang (1996) examined the gender- and college level-related differences in the Mandarin color terms. Participants were 40 male and

[2] It has been controversial that *fěnhóng* 'pink' may not be a basic color term in Chinese, because it is a compound. The current study refers to the color of pink as *fěn*.

40 female college students in Mainland China whose ages ranged from 19 to 24 years old. The results showed that, throughout the four levels of college, female college students used fewer basic color terms but more elaborate color terms than males. Additionally, females were more accurate in color naming, and left fewer colors unidentified. The influence of level and age varied for men and women. For male participants, major differences were observed between each pair of year levels and their use of elaborate color words. For female participants, a striking contrast between freshmen and seniors was identified for all four categories of color words, including basic words, modified basic words (i.e., modifier + basic color terms), basic-basic words (i.e., two basic color terms in a sequence) and elaborate words.

So far, few studies have examined the effect of *profession* on color naming. The Turkish study of Ekici, Yener and Camgoz (2006) found that people using color as a tool in their work, such as wool dying, carpet weaving and painting, used codes or numbers to refer to colored material. They never used a specific name for a color. To investigate if the effect of profession would obtain the same result as the Turkish report (Ekici et al. 2006), this present study collected Mandarin color names given by people from art/color-related backgrounds and those whose work was unrelated to art for comparison. It will be interesting to examine whether the people of art/color-related backgrounds with more experiences related to color will perform in a significantly different way from those without such experiences in the color naming tasks.

This study aims to investigate the color-term performance by Mandarin speakers in Taiwan. How the color stimuli are named is the issue of concern. In addition, the effects of gender, age and profession on color-term performance are examined. Specifically speaking, this paper addresses the following research questions:

1. To what extent and in what way do male Mandarin speakers differ from female speakers in Mandarin color terms?
2. To what extent and in what way do younger Mandarin speakers differ from middle and older speakers in Mandarin color terms?

3. To what extent and in what way do art/color-related participants differ from those whose professions are not related to art in Mandarin color terms?

2. Method

In this section, the design of the current research is introduced. Descriptions of the participants, instruments and data analysis are explicitly presented.

2.1 Participants

Bilingual speakers of Mandarin and Southern Min in southern Taiwan participated in the study. They were recruited volunteers, and further divided into three groups according to the three tested variables of *gender*, *age* and *profession*: (a) *Gender*: 15 males and 15 females[3], (b) *Age*: ten younger males and ten younger females ranging from 15 to 30 years old (average age: 25), ten males and ten females between 31 and 45 years old (average age: 35), and ten older males and ten older females above 50 years old (average age: 55), (c) *Profession*: ten participants with art/color-related backgrounds (e.g., art designers, painters, artists) and ten whose work was unrelated to art/color. It remained unclear whether those of art/color-related backgrounds were more sensitive to color and might produce more specific color terms than those of non-art/color-related backgrounds. All of the informants were tested with the blindness test (Ishihara 1972) beforehand.

2.2 Instruments

Instruments in the current study include the *Munsell Color Samples* (Munsell 1976) and two color-naming tasks. First, the *Munsell Book of Color* (1976) displays approximately 1,500 color samples arranged according to 40 different hues. In the study, 50 of these samples were collected as the color samples for the Mandarin color-naming tasks. Of these 50 selected chips, 11 were the basic colors addressed by Berlin and Kay (1969), *white, black, red, green, yellow, blue, brown, purple, pink, orange* and *grey*. The remaining 39 chips were selected randomly with different

[3] In each gender group, the age variable was also controlled with five participants in each range: 15 to 30 years old, 31 to 45 years old, and above 50 years old.

values and chroma of the eleven basic colors. Each color sample was stuck on a 10×13 paper to be identified by the participants. The color samples were shown at random under adequate lighting.

Two types of color naming tasks were included in the current study design: the free-listing task and the color-naming task. The former follows the unconstrained method, while the latter adopted the constrained method (Lin et al. 2001a, 2001b). Totally, there were three parts designed in the color-naming experiment. In Part I, also called biographical questionnaire, the information of gender and age of each participant was collected. In Part II, each participant was asked to produce exactly 50 color names they knew in Mandarin. This was the Mandarin free-listing task. In Part III, each participant named the 50 selected samples in Mandarin without omitting any. This was the Mandarin color-naming task. A further brief interview with the participants of the art/color-related profession was conducted in order to have a better understanding of their experiences related to color.

The color naming tasks were carried out individually with natural daylight. Instructions were given before the formal test. The color stimuli were presented at random. For the whole procedure, participants were tested individually for approximately 30 minutes each.

2.3 Data Analysis

All of the color names collected in the study were categorized into five types, including basic terms, compounds, modified terms, secondary terms and exceptions. **Basic terms** refers to the eleven basic universal color terms, *white, black, red, green, yellow, blue, brown, purple, pink, orange* and *grey* (Berlin and Kay 1969). **Compounds**, according to Lin et al. (2001a:41), include "any color name ending with a compound term", such as *yellowish green* and *blue green.* Mandarin speakers named a specific color as *purple grey*, *purple white*, *purple red* or *purple grey*, while British speakers only named it *grey* or *purple* in the study of Berlin and Kay (1969). **Modified terms** refer to the modifiers attached to basic color terms (e.g., an adjective + a color term). According to Lin et al. (2001b), there are nine frequently-used modifiers in English (i.e., *light, pale, deep, dark, bright, strong, vivid, mid* and *dull*)

and eight commonly-used modifiers in Mandarin (i.e., *qǐan* ‘light’, *dàn* ‘pale’, *shēn* ‘deep’, *ànn* ‘dark’, *lìang* ‘bright’, *zhòng* ‘strong’, *xīan* ‘fresh’, and *yàn* ‘vivid’).

According to Lin et al. (2001a:41), **secondary terms** include “any color name using a secondary term” (e.g., a noun + a color term). Examples of these terms are *sky blue* and *cherry red*. It is found that both English and Mandarin possess a number of secondary terms which are frequently used as color terms (Lin et al. 2001a). They are *mauve, lilac, turquoise, violet, sky, mustard, olive, cream, beige, flesh, lime*, and *salmon* in English, and *tǔ* ‘earth’, *nǎi* ‘milk’, *kā-fēi* ‘coffee’, *cǎo* ‘grass’, *fū* ‘skin’, *ròu* ‘flesh’, *mǐ* ‘rice’, *tǐe* ‘iron’, *shǔi* ‘water’, *chá* ‘tea’ and *jǐu* ‘wine’ in Mandarin. As for the category of **exceptions**, in the current investigation, we additionally found two color names *qīng* ‘blue, green or black’ and *qīng lù* ‘green’, which were not included in the eleven basic colors and which were interpreted differently by different speakers. Thus, these two colors were categorized as exceptions in this study.

In the present analysis, the total number and percentage of color names in each type (i.e., basic terms, compounds, modified terms, secondary terms, exceptions) were calculated. Besides, modified terms and secondary terms were further regarded as **the elaborate terms** (Nowaczyk 1982), describing more than a single basic color. The total number and percentage of basic terms and elaborate terms were also counted to examine the effects of gender, age and profession on Mandarin color naming by native speakers in Taiwan. Frequencies and percentages were computed for further referential analysis, for example, Chi-square tests and post-hoc analysis of Bonferroni correction in the statistical program of SPSS 19.0. The Chi-square tests were implemented to compare the frequencies of participants’ responses, and their results would indicate whether there was a significant difference between groups of participants in their color-term performance. Post-hoc analysis of Bonferroni correction was additionally conducted if some significant difference was identified in the result of the Chi-square tests.

3. Results

This section presents the statistical results of the color-term performance of the participants in this study. The frequency and percentage of the five types, basic terms, compounds, modified terms, secondary terms and exceptions, defined in the previous section, were calculated. In further analysis, the modified terms and the secondary terms were viewed as the elaborate terms to examine the effects of gender, age, and profession on Mandarin color naming by these participants.

3.1 Gender and the Performance of Mandarin Color Terms

This subsection reports the results of the color-term performance of different genders. The total number and percentage of Mandarin color terms in two tasks, the free-listing task and the color-naming task, were calculated and compared from the perspective of five types (i.e., basic terms, compounds, modified terms, secondary terms and exceptions).

Table 1: Color Terms in Mandarin Free-listing Task by Different Genders

Category/Gender	Male (N = 15)	Female (N = 15)
a. Basic terms	137 (18%)	136 (18%)
b. Compounds	50 (7%)	50 (7%)
c. Modified terms	169 (23%)	125 (17%)
d. Secondary terms	383 (51%)	429 (57%)
e. Exceptions	11 (1%)	10 (1%)
Total	750 (100%)	750 (100%)

Note: Each participant produced exactly 50 color names in Mandarin.

Table 1 reveals the results of the Mandarin free-listing task by the male and female participants. These results were also examined by the Chi-square tests, displaying a non-significant interaction between gender (male vs. female) and the overall usage of color terms in Task 1 [$\chi^2_{0.95,\ 4} = 9.242$, $p > .05$]. The overall distribution Mandarin color terms can be observed according to the percentage of each category. The male participants used secondary terms (51%) the most frequently, followed by modified terms (23%), basic terms (18%), and compounds (7%). The

type of exceptions (1%) was used the least.

For the female group, they made the most use of secondary terms (57%), followed by basic terms (18%), modified terms (17%), and compounds (7%). Exceptions (1%) were produced the least often. As in the male group, the category of secondary terms was used the most often and that of exceptions was used the least often in the female group. Exceptions, such as *qīng* 'blue, green or black' and *qīng lǜ* 'green', were offered with the least frequency in both groups. But, slightly different from the males, the female participants preferred the basic terms the second. It is noteworthy that these two groups, although similar in the most as well as the least favored type, differed moderately in the type that they preferred the second in the free-listing task.

Table 2: Color Terms in Mandarin Color-naming Task by Different Genders

Category/Gender	Male (N = 15)	Female (N = 15)
a. Basic terms	251 (33%)	219 (29%)
b. Compounds	57 (8%)	66 (9%)
c. Modified terms	169_a (23%)	205_b (27%)
d. Secondary terms	247 (33%)	253 (34%)
e. Exceptions	26_a (3%)	7_b (1%)
Total	750 (100%)	750 (100%)

Note: Each participant produced exactly 50 color names in Mandarin. Subscript indexes of a and b: the significant results of the Bonferroni correction.[4]

The frequency (F) and percentage of the Mandarin color-term task performed by different genders are displayed in Table 2. The results of the Chi-square tests further indicate a significant interaction between groups (i.e., gender: male vs. female) and the category of color names [$\chi^2_{0.95,\,4} = 17.314$, $^{**}p < .01$]. The post hoc analysis of the Bonferroni correction was conducted regarding these significant results. As shown in Table 2, the different subscript indexes of a and b are indicative of the significant result between the test groups. These two groups significantly differed in producing

[4] Instead of *p* values, different sub-scripts "a" and "b" indicate the significant results of the Bonferroni correction.

modified terms and exceptions. The female participants (F = 205) uttered significantly more modified terms than the male ones (F = 169) did. By contrast, significantly more exceptions were found in the male group (F = 26) than in the female group (F = 7).

The percentage of each category (Table 2) clearly demonstrates the overall distribution of Mandarin color terms in the color-naming task. For the male participants, they produced secondary terms (33%) and basic terms (33%) the most, followed by modified terms (23%) and compounds (8%). Exceptions (3%) were used the least often.

As in the male group, the category of secondary terms was produced the most frequently and the category of exceptions the least frequently in the female group. Slight differences were observed in the ranking of the other categories from the male participants. The ranking of distribution for the female group in the color-naming task was (1) secondary terms (34%), (2) basic terms (29%), (3) modified terms (27%), (4) compounds (9%) and (5) exceptions (1%). It is interesting to note that these two groups shared the top three categories they preferred the most: secondary terms, basic terms and modified terms.

Table 3: Mandarin Color Terms (Basic vs. Elaborate) by Different Genders

Free-listing Task		
Category/Gender	Male (N = 15)	Female (N = 15)
a. Basic terms	137 (20%)	136 (20%)
b. Elaborate terms	552 (80%)	554 (80%)
Total	689 (100%)	690 (100%)
Color-naming Task		
Category/Gender	Male (N = 15)	Female (N = 15)
a. Basic terms	251_a (38%)	219_b (32%)
b. Elaborate terms	416_a (62%)	458_b (68%)
Total	667 (100%)	677 (100%)

Note: Elaborate terms include modified terms and secondary terms. Compounds and Exceptions are excluded in this analysis. Subscript indexes of a and b: the significant results of the Bonferroni correction.

Among the types of color vocabulary analyzed in this study, the modified terms and the secondary terms are further seen as the elaborate ones (Nowaczyk 1982). Table 3 reports the frequency and percentage of Mandarin basic terms and elaborate terms in the free-listing task and the color-naming task by men and women. These results were further examined by the Chi-square tests, displaying a non-significant interaction between gender and the overall usage of color terms in the free-listing task [$\chi^2_{0.95,\,1} = 0.007$, $p > .05$]. The percentages of basic terms (20%) and elaborate terms (80%) in the free-listing task were exactly the same for these two groups. It can be argued that these Mandarin speakers, regardless of gender, preferred elaborate color terms to basic color terms in the free-listing task.

Different from the finding in the free-listing task, a significant distinction was identified in the color-naming task [$\chi^2_{0.95,\,1} = 4.123$, $^{*}p < .05$]. The post hoc analysis of the Bonferroni correction was carried out to test these significant results. In Table 3, the different subscript indexes of a and b indicate the significant result between the test groups. These two groups significantly differed in producing basic terms and elaborate terms. Males (F = 251) uttered significantly more basic terms than females (F = 219) did. As for the elaborate terms, females (F = 458) significantly outnumbered males (F = 416) did. The results of the color-naming test support the two previous studies by Nowaczyk (1982) and Simpson and Tarrant (1991), which found that women used more elaborate words than men did. Men tended to use more basic words to name a color.

3.2 Age and the Performance of Mandarin Color Terms

The results of the Mandarin color-term performance of different age groups, including the younger, middle and older groups, are presented in this subsection. These three age groups consisted of ten participants each. Statistical analysis of the free-listing task and the color-naming task was offered and compared to examine the effect of age on color-term in Mandarin.

Table 4: Color Terms in Mandarin Free-listing Task by Different Age Groups

Category/Age	Younger (N = 10)	Middle (N = 10)	Older (N = 10)
a. Basic terms	89 (18%)	87 (17%)	97 (19%)
b. Compounds	34 (7%)	39 (8%)	27 (5%)
c. Modified terms	67_a (13%)	89_a (18%)	138_b (28%)
d. Secondary terms	302_a (60%)	279_a (56%)	231_b (46%)
e. Exceptions	8 (2%)	6 (1%)	7 (2%)
Total	500 (100%)	500 (100%)	500 (100%)

Note: Each participant produced exactly 50 color names in Mandarin. Subscript indexes of a and b: the significant results of the Bonferroni correction.

Table 4 offers the results of the Mandarin free-listing task performed by the three age groups: the younger, the middle and the older age groups. The results of the Chi-square tests show a significant interaction among different age groups and the category of color terms [$\chi^2_{0.95,\,8} = 39.737$, $^{***}p < .001$]. The post hoc analysis of the Bonferroni correction was conducted with these significant results. As reported in Table 4, the different subscript indexes of a and b demonstrate the significant result between the test groups. These groups performed in a significantly different way in the categories of modified terms and secondary terms. The younger (F = 67) and middle (F = 89) groups produced significantly fewer modified terms than the older group (F = 138). An opposite pattern occurred in the secondary terms. Significantly more secondary terms were found in the younger (F = 302) and middle (F = 279) groups than in the older group (F = 231).

Based on the percentage of each category, the overall distribution of Mandarin color vocabulary can be manifested. The younger participants used secondary terms (60%) the most frequently, followed by basic terms (18%), modified terms (13%), and compounds (7%). Exceptions (2%) were produced the least. For the middle group, the ranking of distribution was (1) secondary terms (56%), (2) modified terms (18%), (3) basic terms (17%), (4) compounds (8%) and (5) exceptions (1%). As for the older group, the highest frequency was found in secondary terms (46%), followed by modified terms (28%), basic terms (19%), and compounds (5%). The least frequency

was found in the type of exceptions (2%).

It is interesting to note that these three groups shared the pattern that they favored the secondary terms the most and the exceptions the least. Significant differences, however, were identified in that the younger and middle participants used significantly more secondary terms and fewer modified terms in the free-listing task than the older ones. The older participants, by contrast, adopted significantly more modified terms to name a color than the younger and middle ones.

Table 5: Color Terms in Mandarin Color-naming Task by Different Age Groups

Category/Age	Younger (N = 10)	Middle (N = 10)	Older (N = 10)
a. Basic terms	119_a (24%)	191_b (38%)	160_b (32%)
b. Compounds	45 (9%)	42 (9%)	36 (7%)
c. Modified terms	111_a (22%)	$117_{a,b}$ (23%)	146_b (29%)
d. Secondary terms	214_a (43%)	146_b (29%)	140_b (28%)
e. Exceptions	$11_{a,b}$ (2%)	4_b (1%)	18_a (4%)
Total	500 (100%)	500 (100%)	500 (100%)

Note: Each participant produced exactly 50 color names in Mandarin. Subscript indexes of a and b: the significant results of the Bonferroni correction.

The frequency and percentage of the Mandarin color-naming task performed by the participants of different age groups are revealed in Table 5. A significant interaction among different age groups and the category of color terms was identified in the results of the Chi-square tests [$\chi^2_{0.95,\ 8} = 52.477$, $^{***}p < .001$]. The post hoc analysis of the Bonferroni correction was implemented regarding these significant results. According to Table 5, the different subscript indexes of a and b are indicative of the significant result between the test groups. These groups performed in a significantly different way in the categories of basic terms, modified terms, secondary terms and exceptions. Concerning the basic terms, the younger (F = 119) group produced significantly fewer terms than the middle (F = 191) and older (F = 160) groups. A different pattern was identified in the secondary terms. Significantly more secondary terms were found in the younger group (F = 214) than in the middle (F = 146) and older (F = 140) groups. As for the modified terms, the older group (F = 146)

significantly outnumbered the younger one (F = 111). Also, significantly larger number of exceptions was found in the older group (F = 18) than in the middle one (F = 4).

The overall distribution of Mandarin color terms can be observed according to the percentage of each category. For the younger participants, secondary terms (43%) were produced the most often, followed by basic terms (24%), modified terms (22%) and compounds (9%). Exceptions (2%) were found the least often. Obvious differences were found in the ranking of color term distribution for the other two groups. In the middle group, they used basic terms (38%) the most frequently, followed by secondary terms (29%), modified terms (23%) and compounds (9%). They made the least use of exceptions (1%). As for the older group, basic terms (32%) were made the most often, followed by modified terms (29%), secondary terms (28%) and compounds (7%). Again, exceptions (4%) were produced the least.

Judging from the statistical results, it is clear that the younger participants used significantly more secondary terms, but less modified terms than the other two age groups, to describe a color. As for the older participants, they significantly produced more modified terms than the younger participants. It is interesting to note that this pattern found in the color-naming task resembled that in the free-listing task. In brief, the younger participants performed the best for the secondary terms, while the older participants were better at using modified terms.

Table 6: Mandarin Color Terms (Basic vs. Elaborate) by Different Age Groups

Free-listing Task			
Category/Age	Younger (N = 10)	Middle (N = 10)	Older (N = 10)
a. Basic terms	89 (19%)	87 (19%)	97 (21%)
b. Elaborate terms	369 (81%)	368 (81%)	369 (79%)
Total	458 (100%)	455 (100%)	466 (100%)
Color-naming Task			
Category/Age	Younger (N = 10)	Middle (N = 10)	Older (N = 10)
a. Basic terms	119_a (27%)	191_b (42%)	160_b (36%)
b. Elaborate terms	325_a (73%)	263_b (58%)	286_b (64%)
Total	444 (100%)	454 (100%)	446 (100%)

Note: Elaborate terms include modified terms and secondary terms. Compounds and Exceptions are excluded in this analysis. Subscript indexes of a and b: the significant results of the Bonferroni correction.

Table 6 reports the frequency and percentage of Mandarin basic terms and elaborate terms in the free-listing task and the color-naming task by the participants of different age groups. In the free-listing task, the percentages of basic terms (19~21%) and elaborate terms (79~81%) were roughly the same for these three groups. These results were further examined by the Chi-square tests, displaying a non-significant interaction different age groups and the overall usage of color terms in the free-listing task [$\chi^2_{0.95,\,2} = 0.474$, $p > .05$]. It can be argued that Mandarin speakers, despite their age differences, preferred elaborate color terms to basic color terms in the free-listing task. Such differences, nonetheless, did not reach a significant level.

A significant distinction, however, was identified in the color-naming task [$\chi^2_{0.95,\,2} = 23.252$, $^{***}p < .001$]. The post hoc analysis of the Bonferroni correction was conducted regarding these significant results. As shown with different subscript indexes of a and b in Table 6, these groups significantly differed in producing the basic terms and elaborate terms in the color-naming task. The younger group (F = 119) made significantly fewer use of basic terms than the middle (F = 191) and older (F = 160) groups. In terms of percentages, the middle (42%) and older (36%) groups made significantly more use of basic terms than the younger group (27%) in the

color-naming task. By contrast, the younger group (F = 325) produced significantly larger number of elaborate terms than the other two groups (F = 263 for the middle group; F = 286 for the older group). Judging from the percentages of each category, the younger group used the most elaborate color terms (73%) compared with the other two groups (58% for the middle group and 64% for the older group).

Based on the results in Table 6, it can be argued that different methods (constrained vs. unconstrained) (Lin et al. 2001a, 2001b) played an essential role in these participants' color-term performance. Compared to the free-listing task (also the unconstrained method), a greater distinction was found in the color-naming task, which the constrained method employed. The results of the color-naming task were indicative of group differences among these three age groups. It is noteworthy that the younger participants made significantly more use of elaborate terms than the other two groups.

3.3 Profession and the Performance of Mandarin Color Terms

This subsection summarizes the results of Mandarin color-term performance by ten art/color-related and ten non-art/color-related participants. Statistical analysis of the free-listing task and the color-naming task is reported and compared to examine the effect of profession on color naming in Mandarin.

Table 7: Mandarin Color Terms in Free-listing Task by Different Professions

Category/Profession	Art/Color-Related (N = 10)	Non-Art/Color-Related(N = 10)
a. Basic terms	89 (18%)	90 (18%)
b. Compounds	45 (9%)	31 (6%)
c. Modified terms	95 (19%)	75 (15%)
d. Secondary terms	270 (54%)	297 (60%)
e. Exceptions	1_a (0.2%)	7_b (1%)
Total	500 (100%)	500 (100%)

Note: Each participant produced exactly 50 color names in Mandarin. Subscript indexes of a and b: the significant results of the Bonferroni correction.

The results of the Mandarin free-listing task by the two groups of different professions: art/color-related vs. non-art/color-related, are shown in Table 7. The results of the Chi-square tests display a significant interaction between groups of professions and the category of color names [$\chi^2_{0.95,\,4} = 10.723$, $^{*}p < .05$]. The post hoc analysis of the Bonferroni correction was further conducted regarding these significant results. As presented in Table 7, the different subscript indexes of a and b are indicative of the significant result between the test groups. These two groups significantly differed in producing the exceptions. The art/color-related group (F = 1) uttered significantly fewer exceptions than the non-art/color-related group (F = 7) did.

The overall distribution of Mandarin color terms can be demonstrated on the basis of the percentage of each category. The art/color-related participants used secondary terms (54%) with the highest frequency, followed by modified terms (19%), basic terms (18%) and compounds (9%). Exceptions (0.2%), by contrast, were produced with the least frequency.

As in the art/color-related group, the category of secondary terms was used the most often and the category of exceptions the least often in the non-art/color-related group. Exceptions, such as *qīng* 'blue, green or black' and *qīng lǜ* 'green', were provided with the least frequency in both groups. But, moderately different from the art/color-related participants, the non-art/color-related respondents preferred the basic terms the second. For the non-art/color-related group, secondary terms (60%) were produced the most often, followed by basic terms (18%), modified terms (15%), and compounds (6%). Exceptions (1%) were used the least often. It is interesting to note that these two groups, although similar in the most as well as the least favored type, differed slightly in the type that they preferred the second in the free-listing task.

Table 8: Mandarin Color Terms in Color-naming Task by Different Professions

Category/Profession	Art/Color-Related (N = 10)	Non-Art/Color-Related (N = 10)
a. Basic terms	136 (27%)	139 (28%)
b. Compounds	44 (9%)	41 (8%)
c. Modified terms	109 (22%)	102 (21%)
d. Secondary terms	206 (41%)	211 (42%)
e. Exceptions	5 (1%)	7 (1%)
Total	500 (100%)	500 (100%)

Note: Each participant produced exactly 50 color names in Mandarin.

Table 8 displays the results of the color-naming task for the two groups divided by their art/color-related backgrounds. These results were examined by the Chi-square tests, revealing a non-significant interaction between professions and the overall usage of color terms [$\chi^2_{0.95,\,4} = 0.764$, $p > .05$].

The percentage of each category clearly manifests the overall distribution of Mandarin color terms in the color-naming task. For the art/color-related participants, they made the most use of secondary terms (41%), followed by basic terms (27%), modified terms (22%) and compounds (9%). Exceptions (1%), however, were used the least.

As in the art/color-related group, the category of secondary terms was produced the most frequently and that of exceptions the least frequently by the non-art/color-related group. The same ranking of the other categories was also found in the non-art/color-related group, that is secondary terms (42%), basic terms (28%), modified terms (21%), compounds (8%) and exceptions (1%). In brief, the participants, regardless of their job orientation, shared the patterns of color-term usage.

Table 9: Mandarin Color Terms (Basic vs. Elaborate) by Different Professions

Free-listing Task		
Category/Profession	Art/Color-Related (N=10)	Non-Art/Color-Related (N=10)
a. Basic terms	89 (20%)	90 (19%)
b. Elaborate terms	365 (80%)	372 (81%)
Total	454 (100%)	462 (100%)
Color-naming Task		
Category/Profession	Art/Color-Related (N=10)	Non-Art/Color-Related (N=10)
a. Basic terms	136 (30%)	139 (31%)
b. Elaborate terms	315 (70%)	313 (69%)
Total	451 (100%)	452 (100%)

Note: Elaborate terms include modified terms and secondary terms. Compounds and Exceptions are excluded in this analysis.

The results of the basic terms and elaborate terms in the Mandarin free-listing and color-naming tasks for the two groups divided by their art/color-related backgrounds are reported in Table 9. These results were examined by the Chi-square tests, displaying a non-significant interaction different professions and the overall usage of color terms in the free-listing task [$\chi^2_{0.95,\ 1} = 0.002$, $p > .05$] and in the color-naming task [$\chi^2_{0.95,\ 1} = 0.038$, $p > .05$].

The percentages of basic terms (19~20%) and elaborate terms (80~81%) in the free-listing task were approximately the same for these two groups. There is no discernable tendency of basic or elaborate use for the two groups. The results of the color-naming task resembled those of the free-listing task. In the color-naming task, these two groups produced roughly the same percentages of basic terms (30~31%) and elaborate terms (69~70%). No obvious tendency was identified in the basic or elaborate use for the art/color-related participants and the participants whose work was unrelated to art. It can be argued that these Mandarin speakers, regardless of their professions, preferred elaborate color terms to basic color terms in both the free-listing task and the color-naming task. But, such differences with regard to professions were not significant enough.

4. Discussion

This study examines the color-term performance of Mandarin speakers in Taiwan. The effects of gender, age and profession on the color-term performance are discussed in this section.

Concerning the gender effect, the results of the color-naming task in the current analysis show that women used significantly more elaborate terms to describe colors than men did (Table 3). These results are in agreement with those of the majority of studies on gender differences in color naming. It has been widely confirmed that females perform better in specifying color than males. Specifically, the female participants in this study made significantly more use of modified terms than the male ones did (Table 2). These findings confirm that females excel males in terms of the richness of the color terms they use as well as in the variety of elaborate color lexicon (Rich 1977; Nowaczyk 1982; Simpson and Tarrant 1991; Yang 1996, 2001; Arthur et al. 2007; Wang 2012).

Besides, the results of the free-listing task and the color-naming task in the present investigation further show that some specific categories of color terms were used by men and women separately. For example, words concerning 'cars' were used by the younger and middle age group male subjects, such as *bīnshì yín* 'Benz silver' and *fǎlālǐ hóng* 'Ferrari red'. On the other hand, females used more words concerning 'flowers' than males did. For example, *zǐlúolán* 'violet', *xūnyīcǎo* 'lavender', and *bǎihē* 'lily' were used as color words by women. Additionally, the female participants tended to use *fěn* 'powder white' and *nèn* 'tender or light' to modify a basic color term. They, for instance, made specific use of *fěn lù* and *nèn lù* to describe 'light green'. In brief, these results empirically confirm Lakoff's hypothesis (1975) that the nature of gender strongly influences color-term performance.

As far as the age effect is concerned, the younger participants in the current analysis produced significantly more elaborate terms than the middle and older participants in the color-naming task (Table 6). To be specific, they used significantly more secondary terms, but significantly less basic terms than the others (Table 5). The issues of getting old and naming color, however, need further investigation in the

future study. Old age has been observed to be highly related to increasing cognitive decline (Skoog et al. 1993) and visual disturbance (Bergman and Sjostrand 1992). As Wijk (2003) further argues, cognitive function has a strong impact on the results of the discrimination and naming of colors. The complexity of declining function regarding vision, cognition and psychomotor speed altogether might influence the performance of color discrimination and naming to some extent.

Looking into both gender and age, the younger female participants in the present investigation used more elaborate terms than the others. In addition, the notable differences in the variables of gender and age appear in the color-naming task rather than in the free-listing task. It can be argued that younger females outperformed their counterparts in the constrained task rather than in the unconstrained task (Lin et al. 2001a, 2001b). It is also interesting to note another pattern of interaction between age and gender. The present analysis shows that 'countries' or 'cities' were commonly tagged with the expressions of colors in the collected secondary terms. To illustrate, *Yīng-Lún hūi* 'London grey' for the middle age group males, *Rì-Běn hóng* 'Japanese red' for younger females, and *Zhōng-Gúo hóng* 'Chinese Red' for older males were given to describe certain colors. In addition, political parties were used in the color names, for example, *Gúo-Mín-Dǎng lán* 'KMT blue' for younger males and *Mín-Jǐn-Dǎng lù* 'DPP green' for younger males and females. On the other hand, the older participants used more modified terms as color names than the younger ones did, for instance, *qǐan-hēi* 'light black', *shēn-hēi* 'deep black', *shēn-hóng* 'deep red' and *ànn-hóng* 'dark red'.

These findings concerning the discernable gender and age differences in the color-naming task further highlight the task effect (Tables 3 and 6). In the free-listing task in the current investigation, also the unconstrained method (Lin et al. 2001a), no obvious distinction was discerned among these participants, who produced color terms with approximately the same percentages. Free listing may be constrained by the available vocabulary in the language. Significant differences, however, were found in the result of the color-naming task, also the constrained method (Lin et al. 2001b). In terms of gender, females significantly outperformed males in the category

of elaborate terms, while males significantly excelled in the category of basic terms (Table 3). Among the three age groups, the younger participants used significantly more elaborate words, but significantly fewer basic terms, than the middle and older ones in the color-naming task. It can be argued that different methods (color-naming/constrained vs. free-listing/unconstrained) play a crucial role in these participants' color-term performance. Compared to the free-listing task (also the unconstrained method), a significantly greater amount of distinction was found in the color-naming task, that is, the constrained method. The results of the color-naming task were indicative of the gender and age differences, manifesting that the younger female participants made significantly more use of elaborate terms than the others.

As for the effect of art/color-related profession on the performance of color terms, the results of the free-listing and color-naming tasks in this study indicated that no notable difference appeared between people with art/color-related backgrounds and those whose work was unrelated to art (Tables 7, 8 and 9). The insignificance of the comparison was discussed in further interviews with the art/color-related participants who indicated that the Pantone color matching system (1963), in which the color chips are tagged with a corresponding number, is commonly used by most designers, painters or artists. To avoid the ambiguity or confusion of language in their work, they adopt the number to name a specific color, instead of color terms. The replacement of these numbers with color terms outside of their work may help account for the insignificant effect of profession on the performance of color terms. This finding corresponds to the report in Ekici et al. (2006), in which people using color as a tool in their work used codes or numbers to refer to the colored material in Turkish. Similarly, in the current study, no advantage in color-term performance was found for people whose work was highly related to color.

Besides the eight modifiers stated by Lin et al. (2001b), we additionally found that Mandarin-speaking participants used the modified terms, *sǐ bái* 'dead white', *dà hóng* 'strong red', *lǔo fū* 'nude skin', and *zhǔo lù* 'turbid green', as color terms. Also, descriptive words concerning nature, such as sky, sun, moon, sea, lake, minerals and plants, were commonly found in all groups in the present analysis. Secondary terms

like *tīan lán* ‘sky blue’, *shǔi lán* ‘water blue’, *xǐyáng jyú* ‘sunset orange’, *zúmǔlù* ‘emerald’ and *méigūi hóng* ‘rose red’ were frequently adopted as color terms in Mandarin.

Findings in the present study reflect the current usage of color terms in Mandarin and offer insight into future color vocabulary teaching and learning in Mandarin. To begin with, it is found that female participants used significantly more modified terms and were more sensitive to color terms. Gender differences and preference should be considered to enhance future color-term teaching and learning. Moreover, local culture in Taiwan is clearly manifested in the present investigation of color terms. For example, color names regarding political parties *Gúo-Mín-Dǎng lán* ‘KMT blue’ and *Mín-Jǐn-Dǎng lù* ‘DPP green’ are used. Additional findings relating to modifiers and descriptive words concerning nature can also be taken into consideration in the future Mandarin teaching materials to improve the richness of Mandarin teaching and to enhance Mandarin learners’ learning motivation.

5. Conclusion

This study aims to investigate the performance of color terms by Mandarin speakers in Taiwan. The effects of gender, age and profession on color-term performance are examined. There are a number of findings. First, the results of the color-naming task showed that the female participants used significantly more elaborate terms, such as the modified term *shēn lù* ‘deep green’ and the secondary term *cǎo lù* ‘grass green’, than the males did. Second, in terms of the age effect on the color-term performance, the younger participants produced significantly more elaborate terms than the older ones. Investigation of both effects of gender and age displayed that younger female participants used more elaborate terms than other participants. The third finding is related to the effect of art/color-related professions on the color-term performance. In both color naming tasks, no obvious difference appeared between the participants with and without art/color-related backgrounds. Further interviews with the art/color-related participants revealed that they referred to the Pantone color matching system (1963), in which the color chips are tagged with a

corresponding number, in their work. This system is commonly used by most designers at present. To avoid the ambiguity of language usage, they adopt the number to name a specific color in their work, but not outside of work, which may account for the insignificant effect of professions on the color-term performance.

This paper makes some theoretical and pedagogical contributions. Theoretically, the findings basically support Berlin and Kay's hypothesis (1969) that there are eleven basic universal color terms for humans, namely white, black, red, green, yellow, blue, brown, purple, pink orange and grey. Additionally, this paper agrees with the majority of studies on gender differences in color naming (Rich 1977; Nowaczyk 1982; Simpson and Tarrant 1991; Yang 1996; 2001; Arthur et al. 2007; Wang 2012), revealing that women perform better in specifying color than men. Furthermore, this study clearly demonstrates the task effect on Mandarin color-term performance Pedagogically, this paper offers the empirical data of Mandarin color-term performance by native speakers in Taiwan, and provides directions for future teaching and learning of Mandarin color terms, especially for Chinese as a second language (CSL) learners, as highlighted in Wu (2012).

In addition to the suggestions for teaching and learning Mandarin color terms, this study also sheds some light on marketing. The findings indicate that young people, especially young females, are more sensitive to color, and manifest how the basic colors are named in Mandarin. Color naming should be considered well when the target consumers of a product are young women. Finally, many Mandarin color terms have been collected in the color-naming tasks of this study. The collection of this color vocabulary may help to establish an online color database like the Japanese one made by Takehiko (2015). Since few well-established databases of color are available in Mandarin at present, it would be of great value and significance to build more Mandarin color databases online for teaching and learning Mandarin color vocabulary. Despite the above-mentioned contributions and implications, the present study is somewhat limited. For example, there were probably too few participants for each of the three groups in order to make fundamental conclusions about the data in the current analysis. Hence, it is highly suggested that the sample size be increased in

future research.

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華語顏色詞彙表現與相關因素之研究

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摘要

本研究旨在探究華語顏色詞彙表現，並討論性別、年紀與職業相關因素之可能影響。研究參與者依此三變數分為三大組：性別（男 vs.女）、年紀（青年、壯年與老年）與職業（藝術／顏色相關與否），參加兩項華語顏色詞彙測驗：一為自由提列測驗，另一為色卡命名測驗。研究分析將華語顏色詞彙表現分為數類別加以比較與討論，並透過統計分析檢驗各組於顏色詞各類別表現是否達顯著差異。研究結果顯示：性別差異方面，女性參與者於色卡命名測驗中，顯著使用較多精細顏色詞與修飾詞。考量年紀因素，青年參與者於兩項華語顏色詞彙測驗中，顯著使用較多的次要詞，但較少的修飾詞。至於職業因素，兩組（藝術／顏色相關與否）表現並無顯著差異。測驗題型效應也列入結果討論。最後，本文闡述現今當代華語顏色詞彙表現使用趨勢與相關因素，並提出未來相關教學啟示。

關鍵詞：自由提列　色卡命名　華語　顏色詞彙