# A Study on the Cultural Changes of Chinese Traditional Five Colors Based on Kansei Engineering

## Lin Li[1,a,*] and Xinxiong Liu[1,b]

[1]*School of Mechanical Science & Engineering Huazhong University of Science and Technology, Wuhan, China*
*a. lilin070520@hust.edu.cn, b. 411320769@qq.com*
*\*Lin Li*

***Abstract:*** Different from the western color system, the Chinese Traditional Five Colors is inextricably interwoven with the ancient Yin Yang and Five Elements thought. And the cultural meaning of color has also undergone some changes in historical development and the integration of multiculture. In this paper, Kansei Engineering is used to study the cultural changes of Chinese Traditional Five Colors, so as to help designers to explore color schemes with national features and times characteristics.

## 1. Introduction

As our lives become more and more modern, the things we create become less and less purposeful, and the whole world is submerged in similarities. This phenomenon also makes us lose ourselves. Chinese design has been imitating and catering to western design styles and concepts for a long time. This kind of learning mentality is understandable, but the imitation of its vague form makes Chinese design lack artistic vitality which leads to homogenization of design. For the same reason, much of the other current works on design pay particular attention to Chinese tradition, they are also inadvisable to apply traditional elements inflexibly. However, we must have an objective attitude towards western or traditional culture. It is a widely held view that every culture has essence and dross. Therefore it is impossible to design good works by imitating or inherited inflexibly.

Color, like graphics, is also a kind of visual language, and it is the most direct, powerful and vivid design expression element. It plays an important role in modern design. Color can arouse people's emotions and even affect our physical feelings. When we stand far away from the product, the color of the packaging is undoubtedly the first element come into our sight before we can see the details. The proper use of colors can highlight the atmosphere of the entire product and bring strong visual impact to consumers, thereby it can increase the sales of products effectively. Many brands are recognized and remembered by consumers through the color which is the basic element of the brand image. If this color is particularly prominent or has some symbolic meaning, it will make consumers associate it with the brand much better. In modern design, the proper use of cultural connotation for traditional colors can make the works exude national charm and artistic personality.

The specific meaning of color is not universal in the world, it may vary with culture, tradition and customs. The emotional effect of color involves not only the color stimulation itself, but also the common physiological response of human beings. In order to help designers save time and energy in color and cultural research, this paper uses Kansei Engineering to study the cultural changes of Chinese Traditional Five Colors(CTFC), helping companies quickly obtain color schemes that meet the aesthetics of target consumer groups.

## 2. Literature Review

### 2.1. Chinese Traditional Five Colors

The CTFC is closely related to the Five Elements Theory. In other words, the "Five-Color" aesthetics is part of the Five Elements Theory. In China, traditional philosophy believes that all things in the world are composed of five basic substances: gold, wood, water, fire, and earth. The five colors correspond to the five elements, which are cyan, red, white, yellow, and black. They are the origin and the basic elements of all colors. "The Five Colors of China" by Professor De Peng of the Xi'an Academy of Fine Arts focuses on the cultural connotation of the "Five Colors View" and analyzes the relationship between the five colors and time, space, and other cultures. It is currently the most systematic interpretation of the cultural concept of "five-color view"[1]. And "Research on the Application of Chinese Traditional Color View in Modern Graphic Design" by Jing Yuan explores the relationship between traditional Chinese color concepts and modern graphic design, and then deeply analyzes the characteristics of traditional colors[2]. However, most of the studies did not thoroughly analyze the changes brought about by the development of society with the cultural connotation of the CTFC.

#### 2.1.1. Red——the Color of Bonfire Burning

Red corresponds to fire in the five elements, and it also corresponds to the south. Fire symbolizes warmth and enthusiasm. Red leaves a strong impression and stimulates people's emotions. Compared with other colors, it seems to be closer to the depths of human soul. For the Chinese people, red represents auspicious and joyous, and even becomes a cultural totem of the Chinese. For instance, the Chinese often say " hong hong huo huo", wedding invitations are also red, and so forth. Red often represents China on the international stage, known as "China Red", which symbolizes the national character of enthusiasm, forge ahead, and unity. After so many generations of subtle influences, China Red is deeply embedded in the soul of Chinese people. In order to resonate with consumers, some companies would use red appropriately based on the general public psychology.

#### 2.1.2. Yellow——the Color of Vigorous Earth

Yellow corresponds to the earth in the five elements. It is the color of the center, symbolizing majesty and achievement, and it is dominant among the five elements. In addition to red, the Chinese people also admire yellow. Since ancient times, China has regarded it as the root color of heaven and earth,and it has the highest status in traditional Taoism, Buddhism and Confucianism. In ancient feudal society, yellow was the exclusive color of the emperor, and it was forbidden for ordinary people. China has been a country dominated by agriculture since ancient times. Except for major changes, people may never leave the land where generations live under normal circumstances. Therefore, the Chinese nation has a deep respect and attachment to this yellow land.

### 2.1.3. Cyan——the Color of Budding Leaves

Cyan corresponds to the wood in the five elements. It is a widely held view that "cyan is extracted from blue, but it is darker than blue ". Cyan is a special color in China which between blue and green, and it has an extremely important position in ancient Chinese society. Cyan symbolizes strength, hope, simplicity and dignity. Thus traditional utensils and costumes often use it to reflect the solemn beauty of bronze. Cyan is also the color corresponding to spring and the east. And it is a positive and energetic color which is crisp but not arrogant, smart but not smooth, refreshing but not monotonous.

### 2.1.4. White——the Color of Metallic Luster

White corresponds to the gold in the five elements. The white color is bright and clean, which gives people a kind of pure and noble feeling. White reflects light to make the surrounding colors appear vividly. So it is suitable for matching with every colors. Any dull color will become bright immediately after adding it. The large-scale use of white in the design will give people a sense of simplicity, transparency, classicism and ethereal.

### 2.1.5. Black —— the Color of Endless Abyss

Black corresponds to the water in the five elements. Black is the color with the lowest brightness, but at the same time it gives people a noble, fashionable, and trustworthy feeling. Since the use of black will imply that this is a well-built and reliable product that can convey a sense of depth and strength. Although black is not suitable for large-scale, it shows its flexibility when matched with other colors and can enhance the visual effects of other colors, so it has almost become an indispensable color.

## 2.2.　Kansei Engineering

Kansei Engineering was developed by Nagamachi in the 1970s[3]. It uses questionnaires to connect customers' feelings of products with image words, and transform consumers' emotions into actual design elements. The Kansei concept has been used widely in subsequent decades, and in the design of product form and color[4-6]. Numerous quantitative analysis tools are used in Kansei Engineering; these include multiple regression analysis[7], fuzzy theory logic[8], rough set theory[9], procrustes analysis[10], genetic algorithms (GAs) [11]and neural networks (NNs) [12].

## 3.　Study Process and Methods

In order to study the cultural changes of CTFC, the relevance between Kansei adjectives and colors should be established. And a variety of data were collected and classified. Finally, the correctness of the data was verified via questionnaires and expert interviews.

## 3.1.　Select Kansei Adjectives Representative of the Chinese Traditional Five Colors

Each color has its own personality, which could give people different psychological feelings. For example, red makes people feel warm, while yellow makes people feel bright. Therefore, the author chose 60 Kansei adjectives to describe
the color after consulting a lot of literature[13,14] and materials.( Table 1) In order to obtain Kansei adjectives that could describe the CTFC more accurately, questionnaire were divided into the following three groups: artists (20 people), designers (20 people) ,and the general public(20

people). Everyone chose the Kansei adjectives most relevant to each color from 60 adjectives, among which 4 are traditional meanings and 4 are modern. According to the closeness of correlation, finally, 40 Kansei adjectives representing traditional and modern meaning of the five colors were derived from the 60 valid questionnaires. (Table 2-3).

Table 1: 60 Kansei adjectives.

| Local | Profound | Erotic | Hopeful | Soft |
|---|---|---|---|---|
| International | Modern | Active | Solemn | Tough |
| Fashionable | Traditional | Aloof | Vibrant | Ominous |
| Simple | Advanced | Tenebrous | Exquisite | Amiable |
| Ancient | Masculine | Striking | Pure | Folk |
| Luxurious | Feminine | Steady | Safe | Festive |
| Harmonious | Implicit | Brisk | Emotional | Royal |
| Delightful | Aggressive | Elegant | Rational | Joyous |
| Flourishing | Relaxed | Concise | Noble | Divine |
| Natural | Pressing | Glamorous | Warm | Serene |
| Ebullient | Loyal | Conflicting | Sunny | Cute |
| Technological | Fresh | Clean | Mysterious | Violent |

Table 2: 20 Kansei adjectives representing traditional meaning of the ctfc.

| Red | Yellow | Cyan | White | Black |
|---|---|---|---|---|
| Festive | Royal | Folk | Ominous | Noble |
| Flourishing | Solemn | Vibrant | Clean | Mysterious |
| Loyal | Noble | Simple | Simple | Tenebrous |
| Solemn | Divine | Elegant | Serene | Solemn |

Table 3: 20 Kansei adjectives representing modern meaning of the ctfc.

| Red | Yellow | Cyan | White | Black |
|---|---|---|---|---|
| Feminine | Sunny | Traditional | Pure | International |
| Warm | Warm | Serene | Divine | Profound |
| Pressing | Luxurious | Profound | Elegant | Tough |
| Traditional | Striking | Rational | Modern | Steady |

## 3.2. Semantic Meaning Questionnaires to Determine Affective Responses

Each color has an evaluative question, which is to evaluate the proximity between eight Kansei adjectives and the CTFC. All questions use a scale from 1 to 10 (10 means the closest connection with the color, and 1 means the opposite). The questionnaire is published online. As a result,283 sets of Kansai evaluation data were obtained. Among them, 109 are men and 174 are women. There are 214 people with bachelor degree or above. And 108 people are under 20 years old, 122 people are between 20 and 40 years old, and 53 people are over 40 years old.

## 4. Results and Discussion

The objective function E can be defined according to equation (1), where X is the participant's score on the relevance of the CTFC to the Kansei adjective, n is the number of valid questionaires. And then the average value of the correlation between each Kansei adjective and CTFC can be obtained according to it.

$$E = \frac{\Sigma X_i}{n} \quad i = 1,2 \dots \dots n \quad (1)$$

The Table 4-5 show the correlation scores of Kansei adjectives and each color. In other words, we can clearly obtain the cultural changes of CTFC based on the above data. The details as follows:

Table 4: Statistical results for traditional meaning of ctfc.

| Red | Score | Yellow | Score | Cyan | Score | White | Score | Black | Score |
|---|---|---|---|---|---|---|---|---|---|
| Festive | 8.86 | Royal | 7.64 | Vibrant | 7.30 | Clean | 8.43 | Mysterious | 7.76 |
| Flourishing | 7.64 | Noble | 6.52 | Elegant | 6.20 | Simple | 7.41 | Tenebrous | 6.60 |
| Solemn | 7.16 | Solemn | 6.03 | Simple | 6.08 | Serene | 7.34 | Solemn | 6.58 |
| Loyal | 6.95 | Divine | 6.02 | Folk | 5.40 | Ominous | 4.19 | Noble | 5.75 |
| Average | 7.65 | Average | 6.55 | Average | 6.25 | Average | 6.84 | Average | 6.67 |

Table 5: Statistical results for modern meaning of ctfc.

| Red | Score | Yellow | Score | Cyan | Score | White | Score | Black | Score |
|---|---|---|---|---|---|---|---|---|---|
| Traditional | 7.60 | Warm | 7.32 | Serene | 6.51 | Pure | 8.28 | Profound | 6.98 |
| Warm | 6.47 | Sunny | 7.12 | Profound | 5.80 | Divine | 7.47 | Steady | 6.80 |
| Pressing | 5.67 | Luxurious | 6.84 | Rational | 5.48 | Elegant | 7.20 | Tough | 6.63 |
| Feminine | 5.13 | Striking | 6.37 | Traditional | 5.22 | Modern | 6.59 | International | 5.56 |
| Average | 6.22 | Average | 6.91 | Average | 5.75 | Average | 7.39 | Average | 6.49 |

1) In the red tones, the Kansai adjective "festival" has the highest correlation with it. The traditional meanings associated with red have high scores, which means that the cultural connotation of red has not changed dramatically. Among them, the interesting thing is that the score of "feminine" is lower than expected. Both men and women think that this word has a low association with red.

2) In the yellow tones, the Kansei adjective "royal"has the highest correlation with it. Although the royal family no longer exists, the cultural heritage of thousands of years has also allowed yellow to symbolize the "royal". In addition, the score of "warm"， "sunny", "Luxurious", etc are all very high.

3) In the cyan tones, the Kansei adjective "vibrant" has the highest correlation with it. Whether in ancient or modern society, cyan can make people associate it with nature,3)giving people a feeling of vibrant. And the score of "folk" is very low. In ancient society, cyan was the color used by people at the bottom of society, however, with the development of society, this meaning is missing.

4) 4)In the white tones, the Kansei adjective "clean" has the highest correlation with it, both in traditional and modern meanings. Among them, the score of "ominous" is the lowest. In ancient society, white represents funerals, but nowadays, with the integration of Chinese and Western cultures, the ominous meaning of white has been gradually lost, replaced by the

meaning of divine and pure. Now wedding dresses are all in white, which shows the cultural changes.

5) 5)In the black tones, the Kansei adjective "mysterious" has the highest correlation with it. In ancient society, in addition to yellow, the royal family would also wear black clothing. The ancients seemed to have a cult of the mysterious black. In addition, the score of "profound"，"steady", " tough", etc are all very high.

## 5. Conclusions

This study can help designers and companies save time and energy with color research in this fast-paced era. There are five major distinctive features:

1) In this paper, an association has been established between Kansei adjectives and CTFC.
2) Most of the traditional meanings of CTFC have not changed dramatically in modern society. Among them, the red traditional group has the highest average score, which means that the cultural change of red is the least. Meanwhile, the cyan group has the lowest score, which may be due to unclear definition of cyan. Moreover,a few meanings of CTFC have changed because of the social development and the integration of multiculture. For example, the ominous meaning of white and the folk meaning of cyan are gradually fading.
3) In the modern group, the score of white is the highest, which means that cultural integration has the greatest impact on it. For example, in ancient society, white represents funerals, but nowadays, the ominous meaning of white has been gradually lost, replaced by the meaning of divine and pure.
4) The author studied the cultural changes of CTFC in detail which can be used as a basis for designers when matching colors.
5) The method can also be applied in the research of other colors.

## Acknowledgements

## References

[1] De Peng. The Five Colors of China[M]. Nanjing: Jiangsu Fine Arts Publishing House, 2008.
[2] Jing Yuan. Research on the Application of Chinese Traditional Color View in Modern Graphic Design[D]. Nanchang: Jiangxi Normal University. 2009.
[3] Nagamachi, M.; Senuma, I.; Iwashige, R. A study of emotion-technology. Jpn. J. Ergon. 1974, 10, 121–130.
[4] Hsiao, S.W.; Chiu, F.Y.; Lu, S.H. Product-Form design model based on genetic algorithms. Int. J. Ind. Ergon. 2010, 40, 237–246
[5] Huang, Y.; Chen, C.H.; Khoo, L.P. Products classification in emotional design using a basic-emotion based semantic differential method. Int. J. Ind. Ergon. 2012, 42, 569–580.
[6] Lai, H.H.; Lin, Y.C.; Yeh, C.H.; Wei, C.H. User-Oriented design for the optimal combination on product design. Int. J. Prod. Econ. 2006, 100, 253–267.
[7] Han, S.H.; Hong, S.W. A systematic approach for coupling user satisfaction with product design. Ergonomics 2003, 46, 1441–1461.
[8] Lin, Y.C.; Lai, H.H.; Yeh, C.H. Consumer-Oriented product form design based on fuzzy logic: A case study of mobile phones. Int. J. Ind. Ergon. 2007, 37, 531–543.
[9] Shieh, M.D.; Yeh, Y.E.; Huang, C.L. Eliciting design knowledge from affective responses using rough sets and Kansei engineering system. J. Ambient Intell. Humaniz. Comput. 2016, 7, 107–120.
[10] Wang, T.H.; Yeh, Y.E. A study on extraction of consumer affective factor for Kansei engineering. J. Interdiscip. Math. 2015, 18, 667–679.

[11] Lee, J.H. Optimization of indoor climate conditioning with passive and active methods using GA and CFD. Build. Environ. 2007, 42, 3333–3340.

[12] Hsiao, S.W.; Tsai, H.C. Applying a hybrid approach based on fuzzy neural network and genetic algorithm to product form design. Int. J. Ind. Ergon. 2005, 35, 411–428.

[13] S.W. Hsiao, M.F. Wang, D.J. Lee, C.W. Chen, A study on the application of an artificial neural algorithm in the color matching of taiwanese cultural and creative commodities, Color Res. Appl. 40 (2015) 341–351.

[14] Mengshan Li, Suyun Lian, Fan Wang, Yanying Zhou, Bingsheng Chen, Lixin Guan, Yan Wu,A decision support system using hybrid AI based on multi-image quality model and its application in color design,Future Generation Computer Systems,Volume 113,2020,70-77.