The application of graphics creativity in product design

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Abstract. The development of society has led people to pay more and more attention to the quality of life and the details of the use of products. The application of graphic creativity in the product design makes the product can better meet people's needs. In order to make the relevant theories and technologies of graphic creativity in the product design further improved, the basic concepts of graphic creativity were summarized, and the influence of graphic creativity on product design was expounded. On this basis, the relationship between the graphic creativity and the product design popularity was analyzed by fuzzy evaluation method. The results show that graphic creativity can enhance the relevant characteristics of the product itself and can better meet people's needs, which can provide theoretical basis and scientific support for the development of product design industry in China.

Key words. Graphic creativity, product design, fuzzy evaluation, creative life, correlation analysis.

1. Introduction

After the reform and opening up, people's living standards have been a qualitative leap, under the leadership of the party, people's life has changed from the period that the food and clothing are difficult to be solved to the period that most people are comparatively well-off at present. Nowadays, people's life is changed, which is no longer as before that they are easy to be satisfied, and they have more pursuits. This is not only reflected in people who dare to pursue their own ideals, dreams and the "Chinese dream", but also in some small details, people become more demanding. For the product, the former people paid attention to the quality, and the appearance request of the products was relatively low, the practicability was the highest. However, now, the requirements of the peoples on the product are not only practicality and durability, the appearance requirements are also improved. Today's products should be not only good-looking but also creative, which can attract people's attention, and furthermore, they also need to combine with the functions. In order to make a breakthrough, simply relying on the colors and simple appearance

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of lines is not enough. So in this case, the design field introduces the concept of graphic design creativity.

The word "graph" in the graphic creative design is not just the so-called simple graphic or image, but also the abstract symbol in the plane media. Here, the "graphics" earliest originated in Latin and Greek, and then, it was directly translated by English. Its implication is to use specific visual graphics, graphics and special symbols to express a particular concept or meaning to the world, which contains author's intention [1]. Then, the characteristics of the graphic creativity are that its expression is very intuitive, because when people is perceiving this world, they firstly use their eyes, and the graphics can directly transfer the information, so as to give the most intuitive visual effects. In addition, the graphic creativity is usually derived from life but higher than life, and the ultimate goal of the combination of graphic creativity and products is to serve the human, so that people can enjoy the visual effects brought by the appearance of this product, at the same time, it does not affect the practical function of the product itself. Graphic creativity does not appear in modern times. In ancient times, people already had the latent consciousness of the graphic creativity, but it was not conceptualized and developed as a discipline [2]. Then, the image of Sphinx in ancient Egypt is a representative of the image of creativity, which embodies the authority of the Pharaoh and ancient Egyptian people's supreme respect to him. In addition, in fairy tales, people will also add the elements of graphic creativity, such as Medusa's image in the fairy tales. Medusa's hair is a state that a lot of snake wrap around each other, and the meaning is also derived from the background of the fairy tale, then, in the fairy tale, Pinocchio's nose will grow longer when lying, which are also typical examples. All of these graphic ideas leave us a deep impression, because although they originate from the life, they have their own unique creativity and thinking, which makes people feel refresh and hard to forget. In fact, in the absence of learning the concept of graphic creativity, the graphic ideas are already integrated into people's lives. Therefore, the graphic design can give the product a brand new look [3].

In order to explore the application of graphic creativity in the actual product design, in the paper, the related basic concepts of the graphic creativity in the second section was introduced; and the automatic synthesis holographic method of graphic creativity in the third section was studied, furthermore, the influence of graphic creativity on product popularity was analyzed by fuzzy evaluation method. And in the fourth section, the customer was interviewed and the data was analyzed. The results show that graphic creativity can enhance the popularity of the products, and the use of the actual products can enhance the value and sales of products.

2. State of the art

2.1. The influence of Chinese culture on figure creativity

If Chinese characters' expansion to graphic creativity is from the content and scope to the training methods, what the Chinese paintings bring to the creative graphics is the update in the frame of the picture.

Not only graphic creativity, the concept of the whole modern designs originated from the modern design teaching units established by Weimar, Germany in 1919-Bauhaus school. The design school of Bauhaus is the pioneer of modern design art, and a large number of modern design theories are from the Bauhaus, such as point and line surface composition theory and the golden section theory. This design theory surly has a guiding significance for the creative design of the graphics, so which should be accurately grasped. But in the actual design process, especially when we are dealing with the traditional content of the subject matter, it can be found that the proportion of graphic appearance can be very coordinated, and the layout can also be arranged orderly, but at the same time, there is little "gas", so that the entire graphics or pictures are not consistent with the design theme. This is indeed a need to solve, and it is necessary to study the problem. In the research of traditional Chinese painting art, it can be seen that the unique aesthetic characteristics of the traditional Chinese painting and calligraphy art are equally applicable to graphic creative design, furthermore, the graphic design can be better after combining with Western theories [4].

Western aesthetics focus on point, surface, line and golden section (the beauty of mathematics), and then, there are many modern Western composition laws, taking into account the above rules, it can be found that the Western people focus on the mathematics of the rationality and design. This is very good, because it is very strict, but it also appears to be little mechanical, which cannot express the unique temperament of traditional themes. The fundamental principle of Chinese traditional painting and calligraphy art for distinguishing and judging the artistic level of the painting is to see whether the creator can fully achieve the requirements of the "Six Laws" [5]. "Six Laws" was first from the Southern Qi Dynasty Xiehe's Ancient Paintings Records. The Ancient Paintings Records said: the six laws include artistic conception, the two bone method with the pen, the pictographic shape, the conformity to type in applying colors, the business location and the writing of the shift mode. Although Xiehe did not explain the content of "Six Laws" more concretely, while because it involved the basic art problems of Chinese paintings, the basic framework of Chinese painting theory was initially established, which had a profound and lasting effect, and it also had an important position on the development history of Chinese painting. Moreover, the artistic conception is like this: gas is the carrier of the essence of everything, and is "the essence of life", which originated in the substance. The concept of gas contains Chinese understanding of the nature. Rhyme is the gas to inspire all things in the cosmos, the rhyme and cadence. The vivid is the state of the artistic conception that should be presented, which is dynamic rather static. At this point, it is more flexible and natural than the Western theory of composition. After using the golden section method to split the picture, the "real" elements of the point, line and plane are put into the sub-lattice units. And the Chinese aesthetics not only focuses on "real", but also pays more attention to "virtual", in addition, it also concerns about the blank space among entities. Then, while painting the mountains and lakes, characters and buildings, the movement of the artistic conception is concerned [6].

During the Olympic Games in Beijing, our Olympic logo vividly embodied this

feature, as shown in the Fig. 1.

Fig. 1. Graphic creativity in the use of products

2.2. The design idea and creative method of graphic creativity in product design

Creativity is the core of graphic design. In the practice of graphic creative design, the creative thinking is a result that is mainly based on the image thinking, it combines with intuitive thinking, logical thinking, divergent thinking and aggregation thinking and other forms of comprehensive application. Among them, the image thinking is the most important part of the human brain in image processing, which can be divided into association and imagination, both of two are also the basic ways and sources of our visual graphic design. First of all, through association and imagination, people have a perceptual image, and then, some specific images are obtained by rational thinking reasoning and judgment according to combine with some inspiration, this is a simple process of graphic creativity.

The associative method is used to think the thing from one thing to another. Starting from the around things, the pink spring is thought, and the lying falcon, and fighters and so on also can be thought, so that the imagination and creativity can be stimulated by this thinking method. Besides, the creativity starts from the life, so it is necessary to learn to observe things around.

Association and imagination is an inexhaustible motive force of graphic creativity. In real life, in addition to those inherent things in nature, all tools, such as archi-

tecture, art and so on, are created through association and imagination methods. We are very familiar with the Sydney Opera House's shape design, it is composed of three groups of huge white shell pieces, of which there are several spacious concert halls that are provided for people, someone say that it is like a huge white shell on the surface of water, while someone say that it is like a sail raised at sea. However, talking about its design, there is a little-known little story. Designer Joan Uzon was a little-known designer in Denmark, he gained the Pulitzer Architecture Award in 2003 because of his design of Sydney Opera House. However, his inspiration was not as people thought which was from shells or sails, but from a bunch of orange peel of the designers who conveniently peeled and placed it on the table. Thus, it can be seen that the association and imagination is so powerful. Similarly, Newton also discovered the gravitation because of a fall of the apple.

The material selection of the product is also part of the product design, which can also be practical and ingenious. Previous people only concerned about the practical durability, but ignored whether the product was environmentally friendly, whether it was easy to clean such these problems. Sometimes, the materials of the product will make the appearance of this product a new look. For example, in recent years, the popular paper sofa, which uses the characteristics of the paper products that after layer folding, it can have a strong bearing capacity, and in addition, it can also be deformed and elongated randomly, and can be used as a table, anyhow, it has many functions, such as the environmental protection, besides, it does not account for local. And this is also adhering to the people-oriented design concept.

3. Methodology

3.1. Graphic creativity and synthetic holographic product design

The product design is not just the 2D graphic design, but the three-dimensional design. Compared with ordinary products, the appearance of the graphic design products will be more special, innovative, and there will also be a big difference. After the completion of the design, model product testing generally takes a long time, during this period, if it cannot be done well because of various reasons, we will allow the factory to modify, which will take a lot of time. Therefore, if we can adjust the model ourselves, it will be a great help to the whole design, which can also reduce a lot of time. Then, the synthetic holographic computer technology can be used to solve this problem better.

Synthetic holography can realize dynamic three-dimensional display of large field of view, extended depth of field, full color (or true color), which is an important technique for realizing holographic display. However, the traditional synthetic holographic technique is complicated, and it has many human intervention factors and long production cycle, which hinders the quality of the synthetic hologram and limits its application prospect. With the development of computer technology and optoelectronic technology, and in view of the disadvantages of the traditional synthetic holography, the computer graphics technology, photoelectric technology and com-

puter automatic control technology were introduced into the synthetic holography process. According to the use of computer graphics design software, the previous film camera or digital camera was replaced to obtain two-dimensional parallax picture, and then the liquid crystal spatial light modulator and the automation device of the main hologram recording constructed by automatic partition servo system were used to replace the traditional manual intervention, so that the entire process was completed automatically under the control of the computer, which optimized the recording process of the synthetic holography.

The recording of the synthetic hologram was finished in two steps. Firstly, a series of two-dimensional images with parallax were recorded on the same master hologram step by step. And each picture occupied a slit position on the master hologram, then, the image reproduction and rainbow hologram recording optical path of the master hologram was used to record the composite hologram of white light reproduction, as shown in Fig. 2.
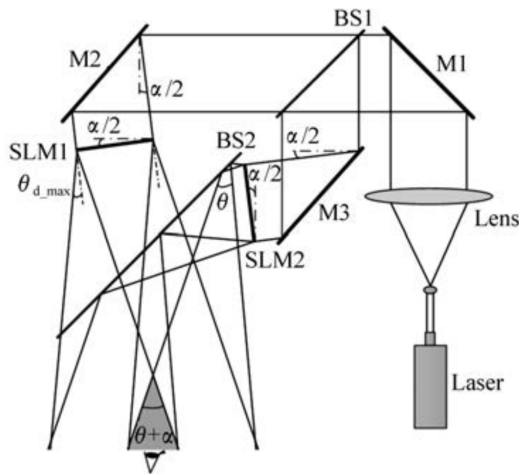

Fig. 2. Main holographic optical path

These two-dimensional pictures were orderly put into the system software platform, as shown in Fig. 3, and then, starting from the automatic monitoring program, the system automatically changed pages, and refreshed the two-dimensional pictures on the spatial light modulator orderly, at the same time, the slit was moved to a predetermined position, and the exposure time of each hologram was controlled. In the experiment, the slit width was 5 mm, the main hologram was divided into four interval exposures, and the static time was 6 s, moreover, the exposure time depended on the interference intensity of the recording plane and the sensitivity of the recording material, and the whole recording time did not exceed 20 min, then, a three-dimensional image was generated.

The application of this technology can better analyze the product structure and product color, etc., which has a very big help for the graphic creative product design.
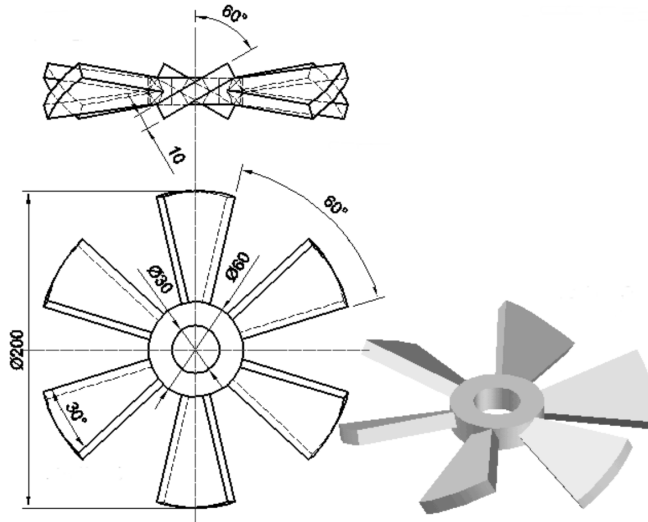
Fig. 3. 3D image of product

3.2. Research on the relationship between product popularity and graphic creativity design based on fuzzy evaluation method

The fuzzy evaluation method is a concrete application method of fuzzy mathematics, and it has a good effect on the multi-factors and multi-level complex problems. The fuzzy method is closer to the thinking habits in the evaluation process. Therefore, in this paper the fuzzy evaluation method was selected to evaluate the relationship between product popularity and graphic creativity, and then the multi-level evaluation model was adopted.

There are many factors for the popular products: product availability, aesthetics, durability and so on. This article built the index system only from the consumer's favorite degree of the products. According to the discussion, it was determined that the evaluation of each index was divided into four grades, and the evaluation scale set was V = very relevant, good, general, and poor = 0.9, 0.7, 0.4, 0.2. The evaluation matrix R' was determined. R' was a fuzzy relation, where each element r_{ij} was the membership degree of each index U_i to the evaluation scale V_j. Symbol V_1 denotes the first evaluation scale. In Table 1, N represents an evaluation of the index U_i, and N_i represents that the evaluation object F already reached the V_i level of the evaluation scale set.

Table 1. U_i score results

Opinion scale	V_1	V_2	$\dots$	V_n
Index U_i	N_1	N_2	$\dots$	N_n

As a result, the membership function was defined as:

$$r_{ij} = \frac{N_j}{\sum_{i=1}^{n} n_s}. \tag{1}$$

There is a comprehensive evaluation to the four indicators A, B, C, D, and then, the vector B was calculated and comprehensively evaluated as follows

$$B_i = W_i \circ R_i, \tag{2}$$

where $i = A, B, C, D$, and the symbol $\circ$ is defined as the compositional operation represented by the Zade operator $(\wedge, \vee)$.

Then any evaluation vector $B = (b_{ij})$ satisfies the relation.

$$bij = \vee k[W_{ik} \wedge r_{kj}]. \tag{3}$$

Here, W_i is the second level index weight, which is a 1×4 order weight vector, R_i is the 4×4 level single factor evaluation matrix of the evaluation object F obtained by second level index evaluation, therefore, B_i is the 1×4 resultant matrix of the first level comprehensive evaluation.

1. Second level comprehensive evaluation

The evaluation matrix R was determined. Then the four indicators A, B, C, D were respectively regarded as a single element, then, the B_i $(i = A, B, C, D)$ was regarded as a single factor evaluation of R, so the 4×4 level judgment matrix was obtained.

$$R = \begin{bmatrix} BA \\ BB \\ BC \\ BD \end{bmatrix}. \tag{4}$$

According to the calculated second-level evaluation result, the vector B was obtained.

2. Calculating the comprehensive evaluation value P.

$$P = B \bullet VT. \tag{5}$$

Quantity P not only made full use of the information brought by the secondary evaluation vector B, but also combined with the grade evaluation parameter of the evaluation scale V, so according to the size of P value, the order of evaluation objects was optimally arranged, and the information was provided for decision making.

The consumers who participate in the experiment were divided into three groups, and they were composed of three age groups, namely, 10–20 years old, 20–35 years old, 35–45 years old, men and women were in half, and there were 10 people in each group. The experimental method is as follows. Three groups of people scored the ten products that did not carry out graphic design and the ten same types of products that the graphs were already designed, and the score was 0~10, then, the evaluation data were tested and analyzed.
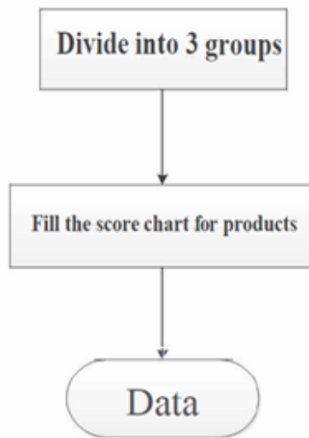
Experimental process is shown in Fig. 4.

Fig. 4. Flow chart of survey

4. Result analysis and discussion

As can be seen from Table 2, in the questionnaire survey of consumers in three groups of different age stages, the total average score of the appearance of common products was lower than the average score of products designed by graphs. Among them, 10 to 35-year-old crowd had a high evaluation to the graphic creative design products, which proved that young people prefer the products with new appearance design, while the elders pay more attention on product quality. The voting results are depicted in Fig. 5.

Table 1. U_i score results

Content	Average of the common products	Average of the products designed by graphs
10∼20 years old	5	8
20∼35 years old	6	9
35∼45 years old	4	8
Total average	15	23

There was one more time of a total vote, at this time, the groups were not divided, and there was a voting test for the 30 consumers to their favorite products in the two groups of products. Finally, as can be seen from the results that the products after the graphic design have higher votes than the ordinary products.

Finally, according to the survey results of a consumer questionnaire, the fuzzy evaluation method was used to calculate the correlation between the graphic creative
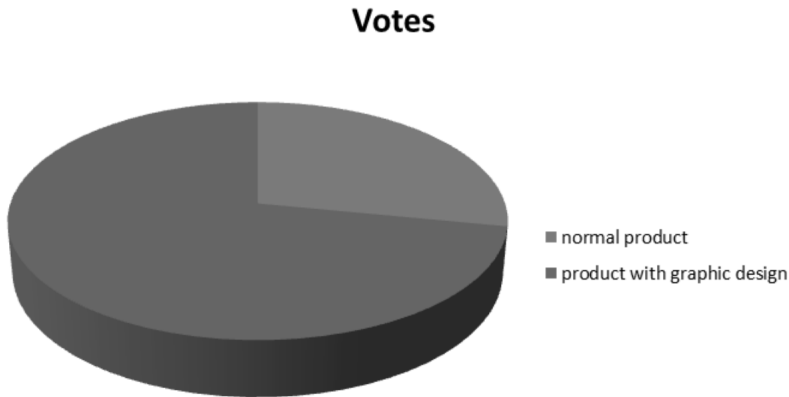
Votes

■ normal product
■ product with graphic design

Fig. 5. Voting results

design and the popularity, then, according to the relevant calculation method in Section 3, the result of $B_{\mathrm{b}} = (0.78, 0.62, 0.1, 0.02)$ was obtained. Based on the standard of the evaluation scale set, $V =$ very relevant, good, general, bad $= 0.9$, 0.7, 0.4, 0.2, it can be concluded that the graphic creative design is closely related to the popularity of the products.

5. Conclusion

With the development of society, the improvement of economic level has made people's quality of life higher and higher, people have begun to pay more attention to the details of the use of the product. In order to further arouse people's desire for the purchase of products, and better promote the further development of the design industry in the present age, graphic creativity began to be used in product design and provided a positive impact on the development of the design industry. In order to further analyze the influence of graphic creativity on the development of the design industry in China, through the reading and summary of relevant information, the related concepts of graphic creativity were recognized in this paper; on this basis, the influence of Chinese culture on graphic creativity and how to carry on the graphic creativity design were expounded; at the end of the study, the importance of graphic design industry in product design was further determined by using fuzzy comprehensive evaluation analysis and questionnaire. The results show that the product which uses graphic creativity design is more popular in the consumer crowd, which proves that the graphic creative design has a high correlation with the popularity of the product. The purpose of this study is to provide some driving force and positive influence for the development of the design industry in China.

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