Parametric Design of Glaze Color and Texture Feeling of Painted Pottery of the Huaning Pottery

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Abstract. The protection, inheritance and innovative design of Yunnan Huaning pottery has attracted many scholars' research. However, the key to modern innovative design of Huaning pottery is to find the connection point between traditional craftsmanship and modern design by using parametric design method in design. On the basis of many field investigations, the parametric design method is applied to collect glaze patterns and analyze the information of classification, textual research, data standards, etc., so that the glaze color and other data of folk art ceramics can be changed and classified as a whole. Parametric design method is applied to the analysis and research of glaze color and texture of traditional pottery, which is the trend in the field of innovative design of pottery products in the future.

1. Introduction

Huaning pottery is made of clay with vivid shape and colorful glaze, which is also the embodiment of technology and art. From a series of strict techniques, such as selecting soil, slab withdrawing, glazing and firing, people have been studying and expanding the types and applications of materials. The spiritual expression of pottery is mostly through the surface glaze colour and the shape of utensils. Moreover, the glaze colour and texture have a great influence on pottery. The texture and glaze colour of pottery materials give different forms of expression to pottery and give people the most direct impression. At the same time, it is also the most direct media for people to experience. Compared with the traditional ceramic design, the operation of the diversity of glaze colour depends on the experience of designers, and the design changes of different combinations of glaze colour are imperceptibly and irregular. Therefore, this study can not only keep the beauty of the traditional craftsmanship, material and technique, but also use the modern design parametric method, which is helpful for designers to combine the scientific and technological parametric means to complete the modern extension of the traditional craftsmanship and technique, and create a new civil art parametric design system. The model and glaze colour of traditional ancient pottery were extracted, and the effective and long-term glaze colour database was established. Then, Rhino, GH and other software were used to model the parameters and build the model database, which can basically guarantee the excellent gene elements such as the glaze colour of the traditional pottery, and summarize the design elements of the later innovative design glaze colour reliable data, it aims to establish a modern design system and provide a reference path for other folk arts. What's more, we can find common characteristics of glaze colour change and texture in parametric comparison of different pottery works, so as to better let designers accurately convey the design concept. Parametric analysis of the composition of glaze surface and the
influence of texture on the surface of pottery is used. This method fully excavates the performance potential of different glaze colour and texture in modelling. Through the combination of a large number of ceramic glaze colour and texture data, this analyses its influence on the surface of pottery, and provides a certain basis for the future design innovation of Huanning pottery.

2. Study on the parametric analysis method of the glaze colour of Huanning pottery

2.1. Classification characteristics of traditional glaze color of Huanning pottery

Huanning pottery is a kind of high temperature glazed pottery. Its most outstanding achievement is colorful colored glaze [1]. It is to add iron, copper, manganese, cobalt and other oxide metal colorants in the basic glaze of ceramics. Under the corresponding sintering condition, the glaze surface produces different colours.

Classification of glaze colour: the glaze colour of Huanning pottery mainly includes moon white glaze, green glaze, blue glaze, bluish glaze, sauce glaze, bean green glaze, pink glaze, copper red glaze, black glaze, yellow glaze and glass glaze. The glaze materials used are mainly wood, ash white mud, glass, white sand, copper coin, etc. The kiln workers in Huanning add grass and wood ashes to all glazes, and add all kinds of metal minerals to form all kinds of glaze colours.

Moon white glaze: take the clarified mud, old sand and wood ash for preparation. It presents a satin like moon white, which is often used to lay the background colour, with a large amount of consumption.

Green glaze: use copper ore (malachite) or copper coin to heat and rolling grind to make glaze slurry, and then mix with slurry, old sand and wood ash.

Blue glaze: heat cobalt ore (blue and white material) to rolling grind, clarify into slurry, and add mud soil, old sand and wood ash to rice soup.

Glass glaze: grind white glass into powder, add sapphire blue, copper ore, etc. [2]

In addition, according to the ceramic production situation in the mainland, Yixing, Shiwan and other products and the kiln mouth in Huanning all began to imitate song dynasty jun kiln wares in the late Ming dynasty, the made enamel hypertrophy glaze are rich in color, there are kiln changed glazed pottery, known as "Yijun" or "Guangjun". Hua ning pottery also belongs to this category. The color is fresh and elegant, solid and steady, and the spots have obvious flowing traces and kiln changes, presenting elegant dynamic, the glaze color has the abstract effect of freehand brushwork, which fully reflects the subtle changes of glaze color, the colorful glaze has a high sense of art.

The composition of the glaze is largely accidental and is the result of long experience, so the glaze color changes a lot, glaze color is not reliable and firing technology has a lot to do with, for example, kiln temperature, vessel type, after several hundred years of firing experience, form a variety of glaze color series hua-ning pottery.

2.2. Data acquisition and analysis of the glaze color parameterization of Huanning pottery:

Based on the archeological and historical remains of Huanning pottery, this paper introduces the parametric design research method of design, first reads the traditional artefacts' back to the "historical origin", then takes the unearthed objects and historical relics as the main basis, mainly combines the "objects" into the use environment, [3] the "operation" level of the use method should be considered to reveal the law and classification of glaze colour through the verification of "number".

By using the most general design modelling software to parameterize the illustration samples, and using the variability and adjustability of the auxiliary software glaze modelling, we can get the accurate, variable and adjustable glaze parameterized model group, get the complete glaze colour style, and according to the parameters, get the analysis report of the model group, find the glaze colour law and texture of ancient pottery and other data. Provide a solid foundation for the next step. Furthermore, we compare and classify the classified data such as picture proof sample, parametric model group and texture feeling degree, get the data that affect the appearance and visual feeling of the objects, and find the application law of visual beauty.
Select 20 pottery of the same colour system from late Qing Dynasty to modern times, compare the parameter colour system, and randomly select according to the computer standard colour library to get a model colour. According to the same method, extract 5 groups of comparison values, and carry out group comparison. Under the same kiln temperature and main glaze conditions, change the variables of auxiliary materials, so that after completion, you can get different feeling of glaze texture So as to achieve different aesthetic feelings from different perspectives and build a database.

Taking moon-white glaze as an example, five groups of formulas from the late Qing Dynasty to the modern times were selected by random analysis. One formula was prepared from the following weight parts of material: 40 parts of melilite, 12 parts of Benyao (a natural feldspar), 22 parts of quartz, 10 parts of copper ore, 12 parts of calcite, 2 parts of bovine bone powder and 2 parts of tin oxide. Mud, old sand and firewood ash are made into 2 parts of auxiliary materials.

The preparation method of the moon white glaze comprises the following steps:
1) The raw material is mixed with water, milled, sieved through 250 mesh to obtain glaze slurry;
2) Glazing;
3) Firing; the specific steps are as follows: ① oxidation period: put the glaze body into the kiln, and burn it in the oxidation atmosphere, so that the temperature can rise to 900 ℃ in 3 hours; ② in the reduction atmosphere, make the temperature rise to 1100℃ in 5 hours; ③ in the reduction atmosphere, keep it at 1100℃ for 3 hours; ④ cool it to room temperature, and be obtained

The main solvent for the constant method of the above main formula is feldspar, compared with other feldspars, such as white feldspar and red feldspar, the content of silicon and iron is higher, which can improve the luster of moon white glaze. Calcite helps to dissolve. Quartz can improve the fluidity of glaze. Benyao is a natural feldspar with high iron content. In addition to being used as a solvent, copper ore also has certain colouring effect. Bovine bone powder mainly contains calcium and phosphorus, which can improve the opacity and texture of glaze. Tin oxide is used with copper ore as colour aid. After the above raw materials are used together, the water in the glaze is removed under the oxidizing atmosphere, and then under the reducing atmosphere, the glaze begins to melt into glass shape, and the "kiln change" begins. When the firing temperature is reached, the glaze surface is bright and smooth [4].

The adjuvant formula (made of mud, old sand and firewood ash) is to strengthen the texture and increase the number of auxiliary materials, that is to say, it can strengthen the texture of glaze and obtain different texture levels. As shown in table 1:

| Auxiliary material formula: | moon white glaze | green glaze | blue glaze | bluish glaze | sauce glaze |
|---------------------------|-----------------|------------|------------|-------------|------------|
| 1 (2 recipes)             | smooth          | smooth     | semi smooth| smooth      | semi smooth|
| 2 (5 recipes)             | coarse          | coarser    | coarse     | coarse      | coarser    |
| 3 (9 recipes)             | rough           | rough      | rough      | very rough  | very rough |

In the above grouping experiment, it can be seen that when the glaze colour auxiliary material composition is more in the group, the glaze surface has a great texture change, become rough, the texture surface with less auxiliary material composition become smooth, so the amount of excipient composition completely affects the texture and smoothness of glaze.

3. Redesign of the glaze colour and texture of Huaning pottery
In China, Japan, South Korea and other Eastern countries, the importance of ceramics in the field of art and culture is self-evident. Ceramics is a deep complex in the hearts of Oriental people. To some extent, it has the deepest connection with our lives [5]. The highest feeling of ceramic art is whether it has a profound oriental philosophical mood, which is also the lifetime spiritual pursuit of designers. In order to obtain this artistic conception, it is very important to redesign the expression of glaze colour and texture feeling.
If we strengthen some configurations of the main formula and the number of auxiliary materials, we can get different colour glaze and more exaggerated texture effect, which is convenient for designers to get richer visual design effect. The control of glaze colour and texture feeling is arbitrary, and it also improves the cultural context of coloured pottery, so as to obtain the Oriental meaning with high Zen meaning, such as visual feeling of materials such as residual, dry and lonely. It's beautiful to be able to have weathered materials, because with the change of time, there will be a sense of loneliness, which can re show the beauty of nature, The idea that "the material that will never change is not beautiful" is the same [6]. As shown in figure 1 – 2:

![Figure 1. Glaze of traditional hua-ning pottery](image1)

![Figure 2. Glaze of parameterized hua-ning pottery](image2)

Through comparison, we can see the traditional ceramic glaze is smooth, and rich in layers. The glaze texture of parameterized Huaning pottery is strong, with deep texture, glaze hypertrophic, multiple layers of gracked glaze, with strong visual and tactile feelings, through texture show the vision feeling of dry, rough, silent and deep, at the same time, it retains the abstracted beauty of traditional colour pottery, which is rich in glaze colour. This is the Oriental temperament pursued by modern designers, which is also the aesthetic pursuit of Oriental culture.

The research of visual language, such as glaze colour, texture feeling and so on, will have positive significance for modern ceramic art design. It is also a diversified supplement to ceramic design language. Traditional crafts will integrate the production and design methods of modern science and technology, and will solve the dilemma of the transition period from traditional crafts to modern life. It will also actively promote the production of innovative products and parametric data analysis. Meanwhile, it will provide more choice of material language for ceramic art, and it will create the era fashion led by science and technology.

4. Conclusion

The glaze firing process is not only dominated by human power, but also by the contingency of the same natural laws of the universe. The fire test in the kiln is the life and death process of the work accepting the natural mutation [7]. In short, pottery is the art of using clay to express itself. Sometimes the taste of a piece of work is difficult to judge by the naked eye. It is easy to attract attention. At first
glance, new and beautiful utensils usually pursue the surface texture and the shape of innovation, but
the fashion will become obsolete one day, and beauty will become vulgar in the twinkling of an eye. What kind of utensils can pass the test of time? [8]

The colour of coloured pottery is related to the main glaze component, auxiliary material component and kiln temperature. Assuming that the main glaze is a constant change auxiliary material, the more ingredients are added, the texture of the glaze will change, and become rough. This kind of material characteristic allows us to find a way to control the glaze mechanism, and through the parametric control of the quantity, we can get the data of different variables. Today, ceramic design is not only limited to the traditional design concept and traditional design system, but also to pay attention to the use of parametric technology. Through the parametric design of the glaze colour and texture details of the glaze material, the innovation of the production form is realized, which greatly enriches the modern ceramic design methods.

The subject range of ceramic technology includes art, design, material science and technology and other multi-disciplinary fields. The establishment of multi-disciplinary tree structure is convenient for classification and problem-solving, obtaining accurate parametric objectives, laying the foundation for the later parametric design, for the intersection of subjects, and obtaining the later research focus for the intersection of disciplines, It can orderly promote the design idea of ceramic design and the innovation direction of modern ceramic design, integrate the advantages and methods of various disciplines, and promote the inheritance of traditional ceramic and the innovation and development of modern ceramic art.

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