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COLOR CHARACTERISTICS IN YANG'S CLAY SCULPTURE: A NATIONAL INTANGIBLE CULTURAL HERITAGE OF CHINA

Wang Qinqin[1*], Syed Alwi Syed Abu Bakar[2], Niu Ruilin[3]

[1] Collage of Creative Arts, Universiti Teknologi MARA, Perak Branch, Seri lskandar Campus, Malaysia
Email: 15595105968@163.com
[2] Collage of Creative Arts, Universiti Teknologi MARA, Perak Branch, Seri lskandar Campus, Malaysia
Email: syeda214@uitm.edu.my
[3] Collage of Creative Arts, Universiti Teknologi MARA, Perak Branch, Seri lskandar Campus, Malaysia
Email: 15595105958@163.com
[*] Corresponding Author

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Abstract:

This study aims to explore the color patterns of Yang's clay sculpture, recognized as a national intangible cultural heritage of China. It analyzes and elucidates the color characteristics of Yang's clay sculptures and investigates the intrinsic connections between their color origins and regional styles, pigment materials, and production techniques. Using the representative work "Sixty Daoist Deities" as a sample, this paper employs a combination of field investigations, expert interviews, literature review, and quantitative data analysis. Utilizing the NCS color system, RGB color system, and K-means clustering algorithm, an in-depth analysis of the sculpture's color data was conducted, resulting in the construction of a commonly used color palette for Yang's clay sculptures. The findings indicate that Yang's clay sculptures exhibit rich and vibrant colors, predominantly in green and blue hues, characterized by medium brightness and purity. A local high-contrast strategy is employed to highlight the main figures. This study not only reveals the principles of color application but also explores their origins from multiple perspectives, including regional culture and material techniques. It provides digital evidence and practical guidance for the preservation of intangible cultural heritage, cultural relic restoration, and the inheritance of traditional crafts.

Keywords:

Aesthetics; Application; Color; Cultural Heritage; Data Analysis; Folk Art

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Introduction

Chinese traditional folk art, with its long and rich history, embodies the spiritual and aesthetic essence of the Chinese people. Among various forms, clay sculpture stands out for its unique material, form, and visual language, combining manual molding, air-drying, and surface coloring. Over centuries of transmission, this art form has not only documented social and historical evolution but also preserved regional identity and symbolic values (Liu, 2021).

As a prominent representative of northern Chinese clay sculpture, Yang's clay sculpture from Ningxia is particularly notable for its distinctive color usage and artistic expressiveness. Originating in Yangpo Village, Longde County, Ningxia Hui Autonomous Region, the Yang family tradition spans nearly 200 years. In 2008, it was included in China's National Intangible Cultural Heritage List (Clay sculpture (Yang family clay sculpture China Intangible Cultural Heritage Digital Museum, 2008) . In 2017, it was further recognized as part of the first batch of the National Traditional Craft Revitalization Directory, alongside other significant Ningxia crafts such as Guyuan Brick Carving and Helan Inkstone (Ningxia multi-measures and measures to continue to increase the protection of intangible cultural heritage work, 2019)). These recognitions underscore its cultural significance and revitalization potential within China's broader heritage strategy.

Despite Yang's clay sculpture being renowned for its vivid and emotionally resonant color aesthetics, existing research on its color system remains fragmented. Most literature emphasizes either symbolic meanings or stylistic traditions but lacks comprehensive analysis of the technical logic, pigment materials, and regional influences behind color application (Ding, 2024). Moreover, as Yang's clay sculpture continues to evolve in contemporary practice, there is a growing need to understand how its traditional color philosophy interfaces with restoration practices and aesthetic innovation.

To address these gaps, this study selects representative Yang's clay sculpture works as primary research samples and adopts a mixed-methods approach, including field investigations, expert interviews, literature review, and data analysis. By analyzing color matching strategies, pigment selection, and stylistic integration in both creative and restorative contexts, the study aims to reconstruct the inner logic of Yang's color usage. Ultimately, this research provides new insights into the color heritage of Chinese folk art, offering both practical references for conservation and theoretical contributions to the transmission of intangible cultural heritage.

Literature Review

In recent years, as research on intangible cultural heritage has deepened, color—an expressive element in traditional crafts—has increasingly attracted scholarly attention for its cultural value and aesthetic characteristics (Liu, 2021). As a nationally recognized intangible cultural heritage from Ningxia, Yang's clay sculpture has been noted for its distinctive color style, solid modeling foundation, and deeply localized cultural context. Although previous studies have touched on its artistic features and modes of transmission, research on its color system has largely focused on symbolic interpretation and visual description, lacking systematic technical and structural analysis (Ding, 2024).

From the perspective of color perception theory, individuals' reception and evaluation of color are not only based on visual mechanisms but also shaped by cultural backgrounds and experiential patterns. The dominant use of mid-brightness, mid-saturation green-blue tones in

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Yang's clay sculptures aligns with the aesthetic tendency of "stability and solemnity" common in northern Chinese folk art. This preference not only reflects an understanding of visual comfort but also conveys regional cultural psychological tendencies (Dong & Gao, 2023). In practice, high-brightness colors such as golden yellow and orange-red are strategically applied to highlight key areas—such as deity robes, ritual objects, and auspicious clouds—thereby achieving both visual emphasis and symbolic meaning. This approach embodies the typical effect described in color perception theory, where "color contrast enhances emotional memory."

On the other hand, color symbolism theory emphasizes the relationship between color and social symbols, belief systems, and national character. In The Sixty Jiazi Gods series, black is often used for underworld deities to symbolize severity and boundaries, red for female deities to convey passion and vitality, and gold for Buddha statues to represent sanctity and grandeur. These color choices are not arbitrary but the result of long-term experiential accumulation and culturally encoded conventions g (Yang, 2018). For example, the traditional "Color Matching Songs" such as "Red overcomes purple, purple overcomes yellow, yellow gives rise to green, green gives rise to red," reflect an informal system of color rules rooted in experiential and symbolic logic. This reflects folk art's nuanced understanding and emotional coding of color over generations.

Although such color-matching experiences have primarily been orally transmitted, some researchers have attempted to standardize them. For instance, (Kan & Nenghui, 2023)., in their analysis of the color characteristics of Mawangdui silk paintings, used the K-means clustering algorithm to identify dominant hues and suggested the potential for quantifying the relationship between color preferences and regional culture. Inspired by this approach, this study uses the representative work The Sixty Jiazi Gods as its case, applying color sampling, RGB encoding, and clustering analysis to restore typical color usage patterns, and integrating traditional experiential rules with data logic to provide a digital pathway for intangible heritage color research.

In summary, existing studies offer foundational insights into the historical background, color preferences, and preliminary methodologies relevant to this topic. However, deeper analysis of color structure and integration of traditional knowledge with scientific methods remains limited. This research combines color perception theory and color symbolism theory, employing digital tools such as the K-means algorithm to extract the dominant color system of Yang's clay sculpture and explore its underlying cultural logic and transmission mechanism, aiming to establish an effective bridge between tradition and contemporary expression.

Research Methodology

To explore the color characteristics of Yang's clay sculpture in a systematic and reliable way, this study adopts a mixed-methods approach combining qualitative and quantitative research. Specifically, it integrates data analysis based on digital color extraction and clustering, field observations, expert interviews, and literature review. These methods complement each other and provide a comprehensive understanding of how color is applied and inherited in this intangible cultural heritage tradition.

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Data Analysis Method

This study takes The Sixty Jiazi Gods, a well-known piece from Yang's clay sculpture tradition, as the main subject of observation. With the help of a handheld color sensor, the researcher gathered color information directly from the artworks and supporting images. Each color was recorded carefully, noting both its RGB values and approximate visual reference codes to maintain consistency. After the colors were collected, they were grouped and compared using a basic clustering method to find patterns in how color appears across the piece (Kan & Nenghui, 2023). As a result, the commonly used colors were sorted into eight main groups, which included a total of 29 different shades.

Field Investigation Method

As part of this study, the researcher visited places where Yang's clay sculptures are displayed. By spending time with the works directly, the researcher observed how colors were used, how surfaces were treated, and how each piece was made. Notes were taken throughout, especially on what kinds of pigments and materials were used, and on the features that made the work stand out (YanPing, 2013). These visits offered a hands-on look at the craft and became an important part of the later analysis. Beyond just watching, the researcher also had the chance to see how the sculptures are made in real time—and even take part in some of the process. This hands-on experience helped build a clearer, more personal understanding of how the skills behind the sculptures are kept alive and passed on.

Expert Interview Method

In this study, the researcher spoke with artists who continue the clay sculpture tradition, including both local makers and those with wider recognition (Yang J. , 2024). These conversations helped explain how color choices are made during the process and how certain practices have been passed down over time.

The artists also talked about how they prepare their colors and work with different materials when creating the figures. Beyond the techniques themselves, the discussions touched on how daily life and community traditions influence their sense of color. Their stories showed that the visual style of the work is closely shaped by the place it comes from, making it both personal and deeply connected to local culture.

Literature Review Method

The researcher wanted to understand where Yang's clay sculpture came from. To do this, they read a few local records. These included documents from Longde County and Guyuan City (Introduction to Longde, 2024) (Introduction to Guyuan, 2023).Both places are closely tied to the tradition.One book, written by Yang Xianlong, stood out. He is part of the family that kept this craft going (Yang, 2018), That book gave a lot of background. Other readings helped too. What the researcher read was then compared with what they saw on site. This step helped confirm certain things. For example, how colors are picked, or how tools and materials are used. Seeing and reading together made the picture clearer. It also helped bring ideas together across the study.

Research Process

To provide a structured understanding of Yang's clay sculpture color system, this research follows a sequential process consisting of sample selection, data collection, and color classification. The focus is on a representative work—The Sixty Jiazi Gods—which offers

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comprehensive visual data due to its scale, craftsmanship, and recognized artistic value. The process integrates on-site investigations, expert consultation, and digital techniques including RGB extraction and clustering analysis. By combining traditional knowledge with modern tools, this section outlines how the research establishes a scientific basis for analyzing the visual and symbolic features of color in Yang's clay sculpture.

Selection of Yang's Clay Sculpture Samples

The researcher looked at several important pieces of Yang's clay sculpture to study how color is used. To record the colors, a handheld device was used to read their RGB values. After collecting the numbers, the data was sorted and reviewed. This helped show how colors are chosen and combined in the sculptures.

One of the main examples in this study is The Sixty Jiazi Gods. It was made by Yang Qihe, who represents the fourth generation in the family line. The work is based on the idea of the sixty Jiazi cycle, which is a traditional cultural system used to mark time.It draws inspiration from the traditionally inherited roles and images of the sixty Jiazi gods (Chen, 2014).Sixty uniquely postured and distinct Jiazi God statues were designed, which are now preserved in the Hunyuan Pavilion on Kongtong Mountain. Recognized as a masterpiece of Yang's clay sculpture, it is considered one of the classic representative works of this art form (Yang J. , 2024).This work holds significant artistic and cultural value, particularly in its representative use of color. Given its large scale and the considerable number of statues, it provides a sufficient quantity of high-quality samples for the study (Yang X. , 2018),Therefore, it is highly suitable to serve as the sample for this study.

During the sample selection process, the researcher consulted Yang Jianian, the fifth-generation inheritor of Yang's clay sculpture, to present the intention and plan of selecting The Sixty Jiazi Gods as a representative work for sample collection and study. Yang Jianian fully endorsed the idea and highly praised The Sixty Jiazi Gods, considering it a masterpiece among the representative works of Yang's clay sculpture over the years. He emphasized that the color usage in this series not only reflects the typical color characteristics and preferences of Yang's clay sculpture but also holds significant research value in terms of color matching and coloring techniques (Yang J. , 2024).

Color Data Collection Method for Yang's Clay Sculpture

While collecting information, the researcher used a small color scanning device to record colors from different sculpture pieces. The tool reads colors from the surface and sends the data to a phone. It's simple to use, easy to carry, and gives steady results. This made it helpful for checking color accuracy and avoiding mistakes during collection (Wanyu & Guoqing, 2024). Once the scan is complete, the device shows a digital color code that matches common systems like NCS. The same color can also be viewed in other formats, such as RGB or CMYK. This helped the researcher keep track of the colors and understand how they were used in the works (Wanyu & Guoqing, 2024).

In this project, the study used both NCS and RGB to look at how colors were applied. NCS is based on how people naturally see colors, like how light or strong a shade looks. It's often used in everyday design work. But when working with numbers and data, it may not always be accurate enough.

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Because of this, the collected color data was converted into a format that could be more easily used for grouping. This allowed the researcher to organize the colors based on how close they looked to one another, using a basic sorting method. (Wanyu & Guoqing, 2024).This helped show which colors showed up most often in the artworks.

After that, the main RGB values were used to build a color chart. This chart shows the most common colors in the sculpture and helps explain the way color is used in the work. The full process followed several steps, as outlined below.

Table 1: Workflow and Methodological Steps for Color Data Collection, Processing, and Analysis in Yang's Clay Sculpture

Phase	Initial State	Processing Steps	Resulting State
Data Collection	Clay sculptures, high-resolution photos	Use COLORPIN SE to collect color data from the artworks and convert it to NCS and RGB data	NCS and RGB data obtained
Data Preprocessing	Raw color data	Preprocess the data for each color group and remove outliers	Reliable data
Clustering Parameter Determination	Reliable data	Use the elbow method to determine the optimal number of clusters and convert the data into RGB format	RGB data and the optimal number of clusters obtained
Color Clustering	RGB data and the optimal number of clusters	Apply the K-means clustering algorithm to classify the RGB data	Representative RGB values for each color
Standard Color Palette Construction	Representative RGB values	Construct a standard color palette to visually present the color characteristics of Yang's clay sculpture	A standard color palette visually displaying the color features

This study applies the K-means clustering algorithm to classify the RGB color data extracted from The Sixty Jiazi Gods to summarize the commonly used colors in Yang's clay sculpture. To figure out how many color groups to use, the researcher applied what's known as the elbow method. This involved testing different group counts and checking how the results changed each time. For each test, the differences between the color points and their group centers were added up. These results were then shown on a chart to see how the error dropped as more groups were added.

At first, the error went down quickly. But after a point, the drop became smaller. That turning point—where the curve bends—helps show the best number of groups to use (Dong & Gao, 2023). In this study, when testing the red color group, the bend appeared when the group count reached four. So, four groups were used in that part of the analysis. The idea behind this method is shown in the formula below.

$$SSE = \sum_{k=1}^{K} \sum_{i \in C_k} \| x_i - \mu_k \|^2$$

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The K-means method works by checking how close each point is to a group center. To do this, it uses a type of distance formula. This formula is called Euclidean distance and is shown below.

$$d(x_i, \mu_k) = \sqrt{\{(R_i - R_k)^2 + (G_i - G_k)^2 + (B_i - B_k)^2\}}$$

Within the clustering framework, the term $d(xi, \mu k)$ refers to the distance between an individual data point xi and the centroid of its assigned cluster μk. Here, (Ri, Gi, Bi) denotes the RGB values of the data point, while (Rk, Gk, Bk) represents the corresponding RGB coordinates of the cluster center.

In each round of the process, the color points are grouped again based on how close they are to the current centers. After that, the center of each group is updated by taking the average of the colors in that group. This cycle repeats until the group centers stop changing. At that point, the groups are stable and reflect the way the colors are naturally organized in the data (Dong & Gao, 2023). The way to calculate the center color of each group is shown in the formula below:

$$R_k = \frac{1}{n_k} \sum_{i \in C_k} R_i \quad G_k = \frac{1}{n_k} \sum_{i \in C_k} G_i \quad B_k = \frac{1}{n_k} \sum_{i \in C_k} B_i$$

Here, Ck stands for the group of color points in the k-th cluster. The number nk shows how many points are in that group. The values (Rk, Gk, Bk) represent the average red, green, and blue levels for that group's center.

This process keeps repeating until the group centers stop changing, which means the sorting is finished. (Dong & Gao, 2023).

After grouping the color data, the study identified 29 main colors. Each one represents a shade that often appears in The Sixty Jiazi Gods. Together, these colors show the common color choices used in the artworks. They also offer a helpful reference for building a consistent color set for future design or restoration work.Furthermore, this outcome forms the visual and analytical foundation for summarizing the distinct chromatic features of Yang's clay sculpture.

The following is a schematic diagram of the research process:

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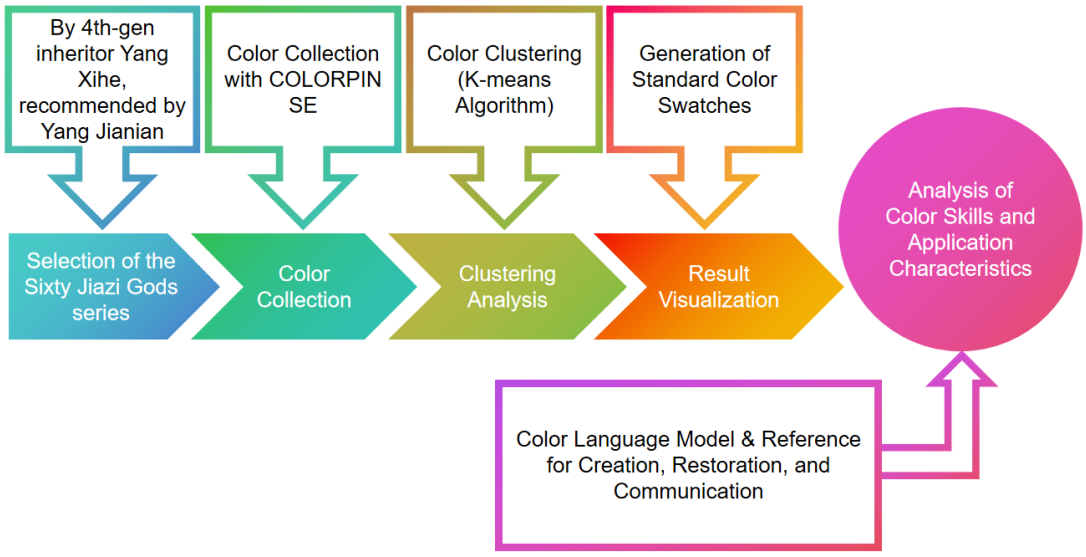

Figure 1: Workflow of Color Data Collection, Analysis, and Standard Color Palette Construction for The Sixty Jiazi Gods

Color Statistics and Classification Process of Yang's Clay Sculpture

This study conducted a quantitative analysis of the color data from The Sixty Jiazi Gods, covering eight main color groups: red, blue, green, yellow, brown, purple, white, and black. Color data were collected from key parts of the work using the COLORPIN SE color reader and then converted into standardized RGB format.

For example, in the red color group, 26 sets of RGB data were collected. The elbow method was applied to analyze the clustering trend of the red data. The results showed inflection points when the K value was 3 or 4. After considering the actual color representation, the optimal number of clusters for the red group was determined to be K = 4. Subsequently, the K-means clustering algorithm was used to classify the red data, resulting in four representative cluster centroids:

Red (228, 128, 127)
Dark Red (175, 29, 34)
Orange-Red (241, 85, 47)
Light Red (254, 210, 199)

The number of colors in each group was counted, with results of 2, 9, 10, and 5 for the four categories. The same steps were used for the rest of the color sets. First, the elbow method helped decide how many groups to use. Then, the K-means method was used to find the key colors in each group, along with how often they appeared.

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A full summary of the results is shown in the table below.

Table 2: Color Group Classification, Representative RGB Values, and Usage Frequency for The Sixty Jiazi Gods

Color Group	Cluster Category	Cluster Count (K)	Representative RGB	Usage Frequency
Red	Red	4	(228,128,127)	2
	Dark Red		(175,29,34)	9
	Orange-Red		(241,85,47)	10
	Light Red		(254,210,199)	5
Blue	Sky Blue	4	(5,118,180)	10
	Dark Blue		(11,51,110)	7
	Lake Blue		(62,89,155)	23
	Light Blue		(143,179,215)	22
Green	Mint Green	4	(183,218,179)	22
	Apple Green		(126,174,116)	15
	Medium Green		(72,140,69)	32
	Dark Green		(10,108,76)	39
Yellow	Bright Yellow	4	(250,217,114)	16
	Gray Yellow		(210,158,74)	20
	Orange Yellow		(229,165,10)	7
	Light Yellow		(250,230,192)	10
Brown	Light Ochre	4	(218,186,174)	24
	Brown		(119,67,46)	19
	Medium Ochre		(181,147,101)	11
	Ochre		(164,114,77)	9
Purple	Light Purple	3	(205,186,231)	8
	Dark Purple		(93,60,133)	5
	Medium Purple		(140,135,195)	3
White	Cool White	3	(242,244,248)	2
	Warm White		(250,249,236)	14
	Beige		(247,244,231)	6
Black	Black	3	(39,39,42)	27
	Medium Black		(111,110,119)	4
	Light Ink		(174,183,195)	5

For each color group, the best number of clusters was chosen using the elbow method. After that, the K-means method was used to sort the colors into smaller sets, with each group showing a different type of color within the larger set.

This process was done for all eight color groups. In the end, 29 main RGB colors were identified. These represent the most common and important shades found in the data. The figure below shows how these colors are grouped, along with the related color codes, to give a clear view of the results.

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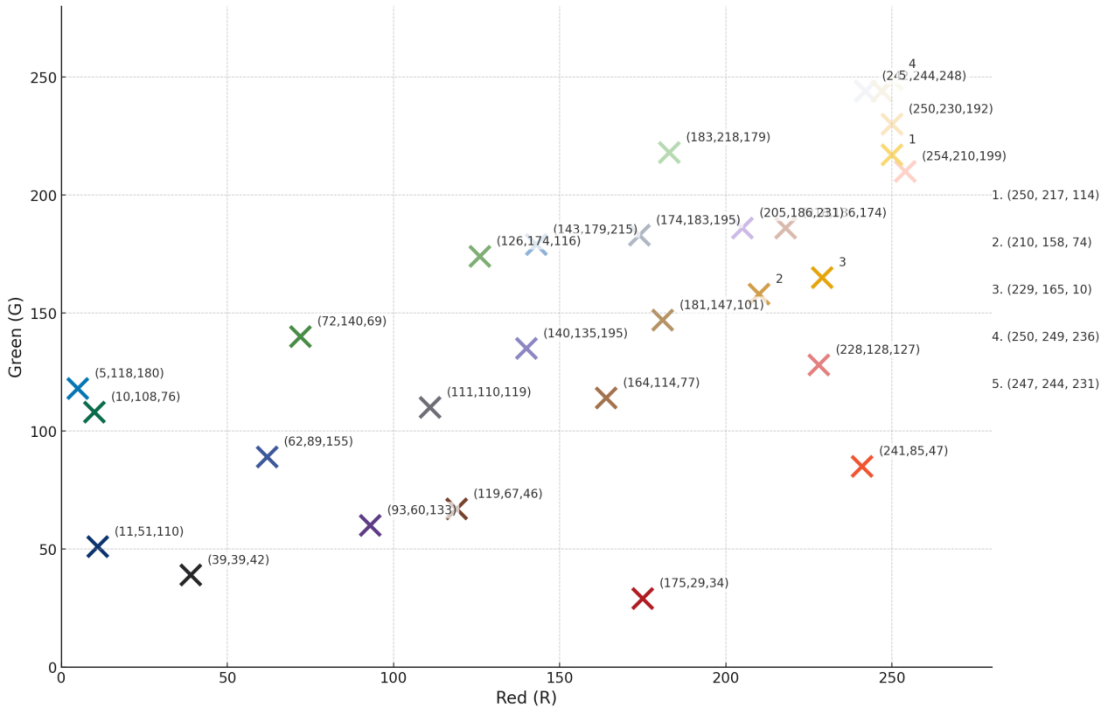
Figure 2: Representative RGB Color Positions for Yang's Clay Sculpture



Comprehensive Comparison of Interviews and Literature

As part of this study, the researcher held several interviews with Yang Jianian, a fifth-generation inheritor of Yang's clay sculpture tradition (Yang J. , 2024). Notes from these conversations were written down in detail and later organized using Taguette, a tool used to sort and mark text.

This helped identify repeated ideas about how colors are chosen, which materials are used, and how different skills have been passed down over time. To make sure the results were solid, the interview notes were compared with what was found in books and digital data. Looking at these sources side by side gave the researcher a fuller picture, showing where old practices match—or differ from—what modern tools can find. (Yang J. , Yang's Clay Sculpture "Color Matching Song" Inheritance, 2024).

Cross-validation of Interviews and Literature

Some points raised in the interviews—especially about how colors are used and how pigments are chosen—matched what has been written in earlier studies on Yang's clay sculpture. For example, Yang Jianian often talked about the importance of keeping color rules strict. This idea also appears in written sources, which describe these rules as a key part of how the sculpture keeps its look and style over time. (Yang J. , Yang's Clay Sculpture "Color Matching Song" Inheritance, 2024). These standards are mainly reflected in the principles of color matching and coloring methods, ensuring color harmony and visual impact. Additionally, the techniques frequently mentioned by the inheritor—such as single-color flat painting, multi-color layering, and gradient blending (La Yunzi)—are consistent with traditional clay sculpture coloring practices. With the development of these techniques, they have been both preserved and innovated in Yang's clay sculpture, fully demonstrating its balance between tradition and

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innovation in color application (Yang J. , How Yang's clay modeling skills are taught by word and example, 2024).

Data Validation

Combining the interview and literature content, the researcher compared the 29 commonly used colors in The Sixty Jiazi Gods with the color application patterns described by the inheritor. The comparison revealed that the green and blue color groups had higher usage frequencies in the data. This finding aligns with the literature's description of Yang's clay sculpture, which often features a "balance of warm and cool tones with a calm and dignified color palette." (Yang X. , Artistic Characteristics and Cultural Inheritance of Yang's Clay Sculptures, 2014). This further validates the accuracy of the data analysis results. Notably, the frequent use of high-brightness yellow and low-brightness brown in the works aims to enhance the visual hierarchy and cultural symbolism in traditional themes (Yang J. , Yang's Clay Sculpture "Color Matching Song" Inheritance, 2024).

Integration of Traditional Color Theory and Modern Data Methods

The K-means clustering method used in this study provides a quantitative basis for traditional color theory (Kan & Nenghui, 2023). allowing the color distribution and usage patterns to be presented more intuitively (Dong & Gao, 2023). Yang's clay sculpture's traditional color theory focuses on sensory perception and experiential knowledge, emphasizing the visual and cultural effects of color combinations (Yang J. , The Art of Yang's Clay Sculpture, 2024). Modern data methods, through statistical analysis and clustering, provide an objective foundation for understanding color patterns. By comparing interview findings with literature, this study not only validates the scientific basis of traditional clay sculpture color theory but also reveals the strong compatibility between traditional experience and modern technology. The development of Yang's clay sculpture color techniques exemplifies how traditional culture can adapt to a modern context. Through precise color data and diverse visual expressions, it opens new pathways for the preservation and innovation of intangible cultural heritage (Dong & Gao, 2023).

Research Results

To reveal the visual characteristics and cultural logic of color use in Yang's clay sculpture, this section presents the key results derived from clustering analysis, field observations, expert interviews, and literature synthesis. The findings are grouped into four subsections: the construction of a color palette and classification, identification of main chromatic features, analysis of color origins, and digital validation of analytical methods.

Construction of Yang's Clay Sculpture Color Palette and Color Classification

Through clustering analysis of the representative work The Sixty Jiazi Gods and a systematic compilation of the content from inheritor interviews, (Yang J. , The Art of Yang's Clay Sculpture, 2024), This study constructed a standard color palette consisting of 29 commonly used colors. The palette covers multiple color groups, including red, blue, green, yellow, brown, purple, white, and black. It provides a visual representation of the color application in both the overall composition and detailed parts of Yang's clay sculpture.

The color palette for Yang's clay sculpture is shown in the figure below:

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red colour scheme	RGB(228, 128, 127)	RGB(175, 29, 34)	RGB(241, 85, 47)	RGB(254, 210, 199)
blue colour scheme	RGB(5, 118, 180)	RGB(11, 51, 110)	RGB(62, 89, 155)	RGB(143, 179, 215)
green colour scheme	RGB(183, 218, 179)	RGB(126, 174, 116)	RGB(72, 140, 69)	RGB(10, 108, 76)
yellow colour scheme	RGB(250, 217, 114)	RGB(210, 158, 74)	RGB(250, 230, 192)	RGB(229, 165, 10)
brownish colour scheme	RGB(218, 186, 174)	RGB(181, 147, 101)	RGB(164, 114, 77)	RGB(119, 67, 46)
Purple colour scheme	RGB(205, 186, 231)	RGB(93, 60, 133)	RGB(140, 135, 195)	
white colour scheme	RGB(242, 244, 248)	RGB(247, 244, 231)	RGB(250, 249, 236)	
black colour scheme	RGB(122, 118, 128)	RGB(174, 183, 195)	RGB(38, 38, 43)	

Figure 3: Standard Color Palette for Yang's Clay Sculpture

Yang's clay sculpture employs a diverse range of colors to create a strong visual impact and profound cultural symbolism. The layered and segmented use of different colors highlights the exceptional color application techniques in the sculptures (Yang X. , Artistic Characteristics and Cultural Inheritance of Yang's Clay Sculptures, 2014). Based on data statistics, literature records, and the inheritor's descriptions of color perception from the interviews, the usage frequency and visual effects of each color are summarized as follows:

Table 3: Color Usage, Frequency, and Visual Effects in The Sixty Jiazi Gods

Color Group	Color	Usage Frequency	Visual Effect
Red	Red	2	Strong visual impact, used for decoration in key areas.
	Dark Red	9	Majestic and solemn, suitable for large areas without causing visual fatigue, often used for clothing.
	Orange-Red	10	Highly saturated, adds vitality to highlight key areas, commonly used for props and accents.
	Pink	5	Soft emotional expression, used for clothing and skin tone to create a gentle effect.
Blue	Sky Blue	10	Strong visual impact, conveys a refreshing and stable feel.
	Dark Blue	7	Full effect, reflects calm characteristics, often used as support or contrast.
	Lake Blue	23	Highly adaptable, pairs well with various colors to enrich layers.
	Light Blue	22	Creates a fresh and peaceful atmosphere, key color for the main deity image.
Green	Light Green	22	Soft visual effect, creates a tranquil atmosphere.

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	Apple Green	15	Fresh and natural, adds vitality, harmonizes well with other colors.
	Green	32	Soft green tone, harmonious overall effect.
	Dark Green	39	Stable and deep, commonly used for main character figures.
Yellow	Yellow	16	Strong decorative effect, conveys sacredness and solemnity.
	Gray Yellow	20	Warm and sacred, often appears on deity clothing, creating a strong decorative effect.
	Light Yellow	10	Soft and warm, used for highlights on clothing edges.
	Orange Yellow	7	Enhances warm-cool contrast, adding vibrance.
Brown	Light Brown	24	Used on faces and clothing edges, reflecting detail and dignity.
	Medium Ochre	11	Often a transitional color in blending, improving overall harmony.
	Ochre	9	Used for clothing or important decorations, conveying solemnity.
	Brown	19	Strong sense of stability, often used in clothing and decorations.
Purple	Medium Purple	3	Moderate purple with a cool tone, suitable as an auxiliary color for balance.
	Purple	5	Represents authority and supernatural power, adding mystery.
	Light Purple	8	Blends well with other colors, ensuring visual harmony.
White	Cool White	2	Used for beards and hair, emphasizing shadow effects.
	Beige	6	Highlight for skin, creating a soft glow.
	Soft White	14	Commonly used for inner garments, reflecting purity.
Black	Medium Black	4	Neutral grayish black, soft undertone, used for deeper parts of clothing.
	Light Ink	5	High-brightness light gray, soft effect, used for accessories.
	Black	27	Classic deep black, strong visual weight.

Most colors are at medium brightness and medium purity levels, ensuring the overall harmony and stability of the work. For key decorative areas or the deity's face, high or low brightness is intentionally used to create visual focal points (Yang X. , Artistic Characteristics and Cultural Inheritance of Yang's Clay Sculptures, 2014). Moreover, the green and blue color groups are the most frequently used, accounting for approximately 25% and 20% of the total color usage, respectively. This is closely related to the preference for blue-green tones in the attire of various deities to convey a sense of mystery and transcendence.

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Color Main Characteristics

Through an analysis of the color application in Yang's clay sculpture The Sixty Jiazi Gods, the unique features and preferences in color usage can be summarized as follows: Overall, the work adopts medium brightness and medium purity tones to highlight the characteristics and mystique of the deities while maintaining overall harmony (Yang X. , Ningxia Yang's colorful sculptures, 2018). When highlighting key elements, such as major deities or significant decorations, high-brightness and high-purity colors are used to enhance visual impact and attraction. Low-brightness and low-purity colors, on the other hand, are employed to convey deeper emotions and a sense of depth, creating contrast with the brighter tones to introduce rhythm and tension in the color palette. This balance of contrast and harmony not only gives the work strong visual impact but also conveys layers of emotion and cultural meaning. It further showcases the sophisticated artistry of Yang's clay sculpture and offers a unique interpretation of Chinese traditional culture and mythology (Yang X. , Ningxia Yang's colorful sculptures, 2018).

Combining data and references, Yang's clay sculpture demonstrates remarkable expertise in the use of color language in clay sculpture works, with highly distinctive color combinations (Ding N. , 2024). For folk religious statues, it is essential to highlight the majesty of the figures. Yang's clay sculpture often employs a combination of warm and cool colors to maintain vividness while using cool tones to convey a sense of sternness and mystery. Under the premise of overall harmony, strong contrasts enhance the color effect, resulting in a bright and vibrant color style. Yang's clay sculpture skillfully integrates the metaphorical language of color with the deeper meaning of the clay works, expressing symbolic significance while meeting both traditional and contemporary aesthetic demands (Yang X. , Ningxia Yang's colorful sculptures, 2018).

It is evident that Yang's clay sculpture has strict requirements for color application, displaying a unique artistic style and charm. The color techniques of Yang's clay sculpture are diverse and highly regulated, resulting in an overall effect that is splendid and magnificent (Yang J. , Yang's Clay Sculpture "Color Matching Song" Inheritance, 2024). Through the use of strong color contrasts, Yang's clay sculpture conveys vitality and dynamism. By applying strikingly contrasting colors, the clay works become more prominent and captivating, effectively drawing attention and expressing rich and intense emotions (Yang J. , The Art of Yang's Clay Sculpture, 2024). The unique use and combination of colors establish a highly distinctive color style that sets Yang's clay sculpture apart from other types of clay sculptures.

These color design preferences provide valuable guidance and inspiration for the future inheritance and innovative design of Yang's clay sculpture.

Analysis of Color Origins

The color origins of Yang's clay sculpture are deeply rooted in its geographical environment and material tradition, reflecting both natural influences and long-standing craftsmanship. This section explores the two foundational aspects of its color logic: regional style and pigment techniques. On one hand, the distinctive color combinations and contrasts are shaped by the rustic aesthetic of the Liupan Mountain region, where local climate, terrain, and customs give rise to a stable, dignified, yet vibrant palette. On the other hand, the use of mineral-based pigments and traditional layering methods—developed and passed down through generations—ensures chromatic depth, longevity, and cultural consistency. Together, these

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factors form a coherent regional color system that bridges visual expression with cultural identity, making Yang's clay sculpture a vivid reflection of the Northwestern Chinese folk aesthetic.

Regional Style

The color style of Yang's clay sculpture is deeply influenced by the strong and rustic regional characteristics of the Liupan Mountain area. Both traditional literature and the narratives of inheritors indicate that the unique natural landscape, climate conditions, and local customs of the Liupan Mountain region have subtly shaped the aesthetic preferences of local folk art (Yang J. , The Art of Yang's Clay Sculpture, 2024). The overall works predominantly use medium-brightness and medium-purity colors, with high-purity and low-brightness colors added in specific areas to create warm and cool contrasts. This approach not only enriches the visual layers but also vividly reflects the simple yet rich regional culture of Ningxia (Introduction to Guyuan, 2023). Various color application techniques—such as single-color flat painting, multi-color layering, and gradient blending (La Yunzi)—not only inherit traditional statue-making methods but also enhance the clarity and depth of color combinations. This unique color style is strongly influenced by the natural environment of the Liupan Mountain region, characterized by its hilly terrain and diverse vegetation (Introduction to Longde, 2024). It exhibits a strong, rustic, and vibrant regional aesthetic.

Pigments and Craftsmanship

In the creation of deity statues, Yang's clay sculpture inheritors have consistently adhered to the use of traditional mineral pigments. These pigments are known for their rich color, strong coverage, and high durability, ensuring long-term color stability in the preservation of the works (Yang X. , Ningxia Yang's colorful sculptures, 2018). It has also greatly contributed to the formation of the unique color style of Yang's clay sculpture through long-term practice. The use of mineral pigments combined with traditional coloring methods adds richness and depth to Yang's clay sculpture. Techniques such as flat coloring, layered tones, and gradient blending (La Yunzi) create smooth transitions and vivid effects (Yang X. , Artistic Characteristics and Cultural Inheritance of Yang's Clay Sculptures, 2014). These color techniques make the sculptures not only more detailed in shape but also richer in visual style. Over time, this layered way of using color has come to reflect local culture closely. It has now become one of the most recognizable parts of the Yang family's artistic approach. (Yang J. , The Art of Yang's Clay Sculpture, 2024).

Digital Analysis Results and Validation

In this part of the study, the researcher used basic digital methods to explore how color appears in traditional clay sculpture. The aim was to learn more about color choices by working with actual samples. To check the reliability of the findings, the digital results were compared with the colors used in real sculptures. Views from skilled artists and long-time practitioners were also considered (Kan & Nenghui, 2023).

The digital results turned out to be very similar to those found in handmade works. This shows that simple grouping techniques, such as K-means, can be useful in studying color patterns in traditional art. It also suggests that digital tools have value when trying to understand and document folk traditions.

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By sorting the color data from The Sixty Jiazi Gods, this study identified 29 colors that appear often in the work. These colors help show which tones are most common and how they are used across different parts of the sculpture. The result is a digital record that can support future efforts in areas like design, exhibition, or restoration of Yang's clay figures (Dong & Gao, 2023).

This approach also provides an easy way to look at color use in traditional art. It may be useful for applying digital tools to study and document other types of cultural heritage. The method has potential for wider use in cultural and creative fields.

Conclusion

This study looked at how color appears in The Sixty Jiazi Gods, an important work in the clay sculpture tradition of the Yang family. The research drew on several methods, including on-site visits, conversations with artists, reading related materials, and using digital tools. Through this process, the researcher identified a group of colors that are often seen in the piece. These colors give a clear picture of how color is used throughout the work.

The study also considered how color choices are influenced by local traditions, natural materials, and long-standing making techniques. The artwork shows a wide range of colors. In some areas, bold contrasts are used, while in others, the color shifts more gently through layering. These choices give the figures depth and help express a calm, solemn feeling.At the same time, they reflect the cultural background of the Liupan Mountain area (Yang X. , Ningxia Yang's colorful sculptures, 2018).

In terms of pigments and craftsmanship, Yang's clay sculpture consistently adheres to the use of traditional mineral pigments, ensuring color stability and expressiveness. Over long-term practice, it has developed strict color-matching standards and painting procedures. This craftsmanship results in vibrant and durable colors, giving the works a distinctive visual appeal (Yang J. , How Yang's clay modeling skills are taught by word and example, 2024). The diverse color application techniques reflect the inheritors' mastery of color details. The craftsmanship's rich meaning and the regional cultural characteristics are fully expressed in the works (Yang J. , How Yang's clay modeling skills are taught by word and example, 2024).

By constructing a standard color palette of 29 commonly used colors and conducting systematic clustering analysis, this study provides a digital reference for the color design of Yang's clay sculpture. It offers data support for cultural relic restoration and the inheritance of intangible cultural heritage while laying the foundation for modern improvement and innovative design in traditional craftsmanship. The consistency between the data results and the physical samples, as well as the oral experiences of inheritors, validates the feasibility of modern digital measurement techniques in traditional art research, expanding new pathways for the preservation of traditional culture.

Future research could build on this foundation by expanding the sample size to include more masterpieces, thereby verifying the universality of color patterns and regional differences. Additionally, comparative studies across various forms of folk art should be explored, such as comparing the color characteristics and application patterns of traditional clay sculptures from other regions. This would promote the diversified development of northern Chinese folk art. (Kan & Nenghui, 2023)。

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This study not only provides a scientific basis for the preservation of Yang's clay sculpture as intangible cultural heritage and for cultural relic restoration but also explores a new digital research pathway for the innovative inheritance of traditional craftsmanship.

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