

# Color Analysis and Application in Art Design of Exterior Environment of Buildings

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## ABSTRACT

**Color is a very appealing visual language that plays a vital role in the display of ancient and modern architectural images. Taking Tibetan dwellings and temples as examples, the article combines folklore and color theory to analyse the color design of the Jokhang Temple, the Potala Palace and the dwellings in Tibet, and then explore the architectural color creativity and characteristics that combine folk customs and local characteristics. It is expected to be able to analyse in depth the color aesthetics of Tibetans in China's ethnic minorities and the roots of Tibetan architectural influence under the influence of Tibetan Buddhist culture.**

**Keywords:** *architectural exterior art design, color use, Tibetan architecture, Potala Palace, Jokhang Temple*

## I. INTRODUCTION

The shelter of the earliest use of rain in ancient times was the bud of today's buildings. Through the work, people create architectural forms with diverse functions and forms. The new buildings are decorated with colors and forms by shaping the three-dimensional space, so that a more perfect form is displayed in front of people. The color form attached to the building can feedback the cultural characteristics and heritage of a region and a nation. Among the various visual elements, color has the most visual impact and the elements that best reflect the emotional changes. The famous "seven-second color" theory is clear, human understanding of people or things will remain in the form of color in seven seconds. For this reason, in the field of modern art design, color design has become an important element reflecting the art form and characteristics. Color has become an important visual vocabulary, which is especially important in architectural expression.

In the long-term development and evolution process of Tibetan architecture, due to the unique geographical location, natural environment, climatic conditions, religious beliefs and national customs, it gradually formed a national architectural image with strong national color. The color of Tibetan architecture is one of the most visual elements that can reflect the shape and characteristics of architecture. Its colorful and simple colors have become one of the most obvious features of Tibetan architecture, expressing a strong and strong plateau atmosphere and ethnicity. heterogeneous.

## II. THE ROLE AND APPLICATION OF COLOR DESIGN IN ARCHITECTURAL SPACE

### A. Color effect

Color is interpreted as "color" in the "New Modern Chinese Dictionary", and the color itself means "the impression produced by the object's emission, reflection, and light wave vision." The richness of color can be explained as the "color" that is common in life, and it can also be regarded as the visual impression left by us in the world. The colors mentioned in this article are all on the two levels. Color can be both the color application of the building space and the illusion and emotional sustenance left to humans through color vision. The real and the virtual, both physical and spiritual, can only reflect the core and value system of building color design. To this end, from the two perspectives of the virtual and real role in the role of color in the architectural space, it also contains two aspects: First, the color is plastic and decorative. Second, color can convey the beauty and emotional sustenance to the audience and can be extended to specific cultural connotations [1].

### B. Convolutional neural network method for color design

The convolutional neural network method is a new type of artificial neural network that combines traditional neural network and deep learning. It optimizes the traditional neural network structure by introducing weight sharing and local sensing to greatly reduce Learning parameters make neural network training more efficient. Through the convolution

method, the color learning of the image from the local to the global learning process is realized, which makes the color design more reasonable and can be fully applied to architectural color design and selection. The operation of the convolutional layer can be expressed as follows.

$$X^{(l,k)} = f \left( \sum_{p=1}^{n_i-1} (W^{(l,k,p)} \otimes X^{(l-1,p)}) + b^{(l,k)} \right) \quad (1)$$

Where:  $X^{(l,k)}$  represents the k group feature map of the  $l$  layer output,  $n_i$  represents the number of layers of the  $l$  layer feature map, and  $W^{(l,k,p)}$  represents the feature of the p group feature map in the  $l-1$  layer to the k group in the  $l$  layer. The filter used [2] when mapping maps. The generation of each set of feature maps of the  $l$  layer requires  $n_i-1$  filters and an offset. Assuming that the filter size is  $h \times w$ , the number of parameters of the  $l$  layer convolutional layer is  $n_{l-1} \times n_l \times h \times w + n_l$ .

Convolutional neural networks are often able to reduce errors by propagation and update the weight of connections between neurons. Taking into account the precise tasks in color design, a loss function of the sum of squares can be taken, as indicated below.

$$E^N = \frac{1}{2N} \sum_{i=1}^N \|y_i - d_i\|_2^2 \quad (2)$$

In the above formula, N is the number of nodes of the output layer of the neural network, and y is the predicted value of the neural network, and d is the artificially labeled value. In the paper, a random gradient descent algorithm is adopted to realize the weight and offset update between neurons, and the final color loss function expression can be obtained as follows:

$$E = \frac{1}{m} \sum_{j=1}^m \left( \frac{1}{2N} \sum_{i=1}^N \|y_i^j - d_i^j\|_2^2 \right) + \frac{1}{2} \eta \|W\|_2^2 \quad (3)$$

In the above formula, m represents the number of color training samples in backpropagation, and W is the weight matrix of the network. The weight of the convolutional neural network is updated in the backpropagation. After the training starts, the random network matrix performs color network initialization, and the color weight  $W_{t+1}$  obtained after multiple iterations of updating can be expressed by the following equation.

$$W_{t+1} = W_t - \lambda g \frac{\partial E}{\partial W_t} \quad (4)$$

By using the convolutional neural network to determine the external color of the building, it can fully absorb the subjective opinions and objective choices, so that the architectural color design is more in line with the regional environment and regional cultural heritage, making the color selection factors more metaphorical, iconic and emotional.

### III. THE FACTORS OF COLOR DESIGN AND COLOR SELECTION IN ENVIRONMENTAL ART

#### A. Color metaphor

The metaphor of color is based on the environment and can fully express the higher level of aesthetic information such as the inherent intention of the building and the value orientation. For example, in the Tibetan representative building, it is a golden metaphor that shows the noble colors that most people can't easily get, so it has a high spirit.

#### B. Color symbolism

Color planning covers a rich form of beauty in urban architectural planning. For example, the milky white façade of the Potala Palace and the exquisite inner wall carvings give it a unique form of beauty and mood. The color has the symbolism of the clan, symbolizing the thinking structure and religious belief formed by a famous family in the long history of civilization [3]. The Chinese nation is a positive and civilized country. It is good at using pure red, yellow, green and gold to express the symbol of perfection, satisfaction, celebration and honor. It highlights the bright and bright, warm and relaxed visual feast.

#### C. Color emotion

When human beings are watching colors, they can appreciate the visual impact brought by color, on the other hand, they can stimulate people's association with life and environment, and then the viewer's thoughts and moods are affected by color.

#### D. An overview of the color characteristics of Tibetan architecture

Tibetan architecture likes to use simple but strong colors to express the unique ethnic and religious personality of the building, combining architectural style and material selection to highlight its distinctive features. Tibetan architecture has regular rules for color applications, but color applications vary in different types of buildings. For example, on the exterior walls of buildings symbolizing religious beliefs, the colors are very clear and the colors are pure. Common colors are

milky white, red, gold, and a little blue. The general residence is the original color of the civil or stone, or white. The color of each part of the building is not the same. For example, the color selection of the wall needs to show different color characteristics according to the type and level of the building. The general building doors and windows are often decorated with black trapezoidal windows, while the advanced the building's daughter wall is often decorated with red agate colors. Through the examination of the color of Tibetan architecture, it is found that white, red, yellow, blue, green and black are often the common types of colors, and they prefer a large area of primary color in the use of color, the building color is pure and simple, simple [4]. And magnificent. The color choice of Tibetan architecture shows obvious nationality and religion. The choice and development of color is influenced by the plateau environment and historical culture. Each color has a strong religious meaning and cultural significance. As shown in the "Fig. 1" below, the brightly colored Potala Palace Golden Summit reflects the unique architectural style of the nation.



Fig. 1. Potala Palace Golden Summit.

#### IV. THE RELATIONSHIP BETWEEN TIBETAN ARCHITECTURAL COLOR AND REGIONAL ENVIRONMENTAL CONDITIONS

Tibet belongs to the snowy plateau. The environment is sinister, the climate is dry and cold, the area is vast, and the oxygen is thin. In the long history and social changes, in view of the regional environmental conditions, the color of nature is pure in this sacred land. And the white, simple and warm form is expressed. The holy snowy plateau, white clouds, blue skies, pure lakes and rivers, and green grasslands have given Tibetan ancestors the most direct color enlightenment. In addition, the vast plateau living conditions are extremely difficult, and the monotonous desert lacks a changing landscape. The Tibetan people reproduce the colors that the intuitive world can experience by reshaping life. The simple and cheerful color is the most intuitive response in the hearts of the Tibetan people. It also expresses the romantic

atmosphere in which they create a difficult environment. It also represents the Tibetan people's feelings about the land under their feet. "Fig. 2" shows the overall architectural structure and color matching of the ethnic customs street in Lhasa, Tibet.



Fig. 2. Tibet Lhasa National Customs Street.

Under the circumstance of the changes of the times and the improvement of the living environment, the Tibetan people who walked from the grassland grazing to the building of the house have raised their awareness of color to a certain height. In the later use of architectural colors, they fully tapped the color to the environment. Improvement effect. The color of Tibetan architecture tends to adopt a warm color, and the material is biased towards wood and stone. Temperature-bearing materials such as bricks and tiles, on the one hand, express a strong living atmosphere, and can also help Tibetans to find a warm sense of physical satisfaction in the cold environment. In the plateau, the climate is dry and cold, and the buildings are generally piled up with unpolished stones and masonry [5]. The wall windows are often decorated with dark red decorative strips. The windows of the house are small and small in number, often decorated in dark red, and the entrance is often darkly colored, so that the part of the building and the environment fits warmly. The Qinghai-Tibet Plateau is the place with the longest solar radiation. The choice of building materials and the application of warm colors can accelerate the absorption of solar radiation and help Tibetans to warm. However, ultraviolet rays with excessive solar radiation may also pose a threat to health. Tibetans often wear hats and face masks to prevent exposure to solar radiation, and they are not exposed to the skin all year round. In addition, the building is characterized by a small wall and a small window. The use of white as a decoration on the wall can prevent the sun from radiating, but the heavier colors such as black, red and gold can help Tibetans absorb the heat of the sun to survive the cold. Winter. As shown in "Fig. 3", the overall housing structure and color matching of Tibetan urban residents.



Fig. 3. Overall housing structure and color matching of Tibetan urban residents.

All in all, it is precisely because of the natural geographical environment and the technological environment of the Qinghai-Tibet Plateau that Tibetans can make a comfortable and suitable living environment in the plateau environment through unremitting efforts to transform the environment and create a comfortable and suitable living environment. The building forms a unique color style.

## V. ANALYSIS OF THE ARCHITECTURAL COLOR BASED ON THE PERSPECTIVE OF FOLK CULTURE AND RELIGIOUS CULTURE

### A. Analysis of folk culture

The colors of Tibetans can be seen everywhere, and most of them contain religious colors. White, red, yellow, green, blue, and black are the common colors used by Tibetans in daily life. White, red and yellow are common colors in residential houses, and the importance and symbolism of things are usually measured by the size of the proportion [6]. White stones, hatha, wool, and clouds are the most sacred things that Tibetans see in a day. When Tibetans worship the gods, white wool is often placed on the arrow to show respect for the gods. On the route to the meridian, be sure to place the arrow on the stone pile, which is the most common etiquette in Tibetan culture. Whether it is a wedding or a funeral, or a festival or a sacrificial event, Hada as a blessed silk fabric usually appears in etiquette. Hada is pure and auspicious to the Tibetans. Similarly, the color of Hada is different. The five-color Hatha is the costume of the Buddha and will only be used on certain festivals. The white Hada represents the white clouds, the yellow Hada represents the earth, the red Hada represents the god of the universe, the green Hada represents the rivers and lakes, and the blue Hada represents the blue sky. The five-color Hada can also be used in the wedding, wrapping the five-color Hada around the back of the bride with the arrow, representing the bride's family. In the early morning in Tibet, Tibetans in pastoral areas will wash with milk mixed with water. This form of water is

called white water. Because there are legends, people can get good luck for one year after washing their faces with white water. The horse that the Tibetan girl rides when she gets married must also be a white horse. At the same time, Tibetans always sprinkle white stones around their houses. They think that white stones represent the symbol of auspiciousness and can ward off evil. "Fig. 4" shows the overall architectural structure of the Potala Palace and the white wall decoration of the building.



Fig. 4. Potala Palace.

Whether it is a residential or religious temple, the colors of Tibetan architecture are often decorated with gold and gold on the surface of the building, such as doors and windows, columns, and walls to enhance the architectural features. Tibetan architectural colors are often used in architectural systems and can generally be grouped into the following categories. First, the color decoration of Tibetan architecture often shows the characteristics of large area, high purity and strong contrast. Common colors are white, blue, black, red, yellow and green. Simple, pure and gorgeous colors create a warm and quiet scene for Tibetan architecture. Second, influenced by culture, the main colors of Tibetan architectural colors are often similar in color and clear in color. Third, the use of color in different Tibetan buildings has different meanings. For example, the white in the temple often represents the gods, the yellow represents the dragon king and the leader, the red and the black represent the monster.

### B. Tibetan architectural color religious meaning

In order to respect the Dalai Lama and the gods, the color application of the temple is generally mainly selected with high recognition and bright colors, which are reflected in the exterior walls, doors and windows, and the top of the building. For example, the white facade of the Potala Palace, decorated with red windows and golden tops. Although the exterior walls of buildings will vary in color depending on the type of building, the windows of Tibetan buildings generally use black window coverings, because Tibetans firmly believe that black window coverings can help to ward off evil spirits. The doors of Tibetan architecture are

generally graceful and colorful [7]. Coloring is generally dominated by maroon red, and some people will draw totems such as clouds on the door. The wall of the temple building is often dressed in black or maroon to form a wide color. There are also golden religious decorations on the white walls, reflecting a strong religious color. A characteristic and important building with a Chinese-style sloped roof covered with sheet metal tiles, glass tiles or blue tiles. The use of Tibetan architectural color reflects the dignified atmosphere of traditional architecture and has a high artistic value [8].

## VI. CONCLUSION

The use of external color of the building reflects the unique cultural heritage and local characteristics, combined with the characteristics of the color can reflect the artistic effect of the building. Tibetan architectural color is one of the visual elements of architectural form and is a typical feature on the snowy plateau. The color of Tibetan architecture originated from the geographical environment and climatic conditions, and was influenced by Tibetan religious beliefs and color aesthetics to form a unique architectural color style and form. It developed into a representative of ethnic architecture and is a Tibetan architectural art. Significant features on the top. Color gives life to Tibetan architecture, and it can make viewers associate, bring psychological freshness and pleasure. Even from a deeper perspective, architectural color is an integral part of urban color and urban culture and spirit.

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