Research on the Application of Architectural Pattern Elements in Southern Fujian in the Age of Artificial Intelligence

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Abstract. The decoration of ancient buildings comes from the artistic treatment and artistic expression of architectural components, which is attached to architectural entities and reflects national aesthetic concepts and national cultural traditions. The diversified and integrated culture in southern Fujian also makes the architecture in this area have its own expression. The traditional architecture here is exaggerated, colorful and decorated with many patterns. Therefore, such a beautiful traditional building should be passed down by design techniques. Visual elements, such as patterns, bricks, doors and windows, ornaments and carvings, all constitute the classic symbol styles of characteristic cultural buildings in southern Fujian. This paper tries to analyze the application of architectural pattern elements in southern Fujian from the perspective of artificial intelligence era, aiming at providing reference for further improving artistic creation and aesthetic consciousness.

1. Introduction
Architecture is the material carrier of people's reasonable existence and life, and it is the technological product created by people following the changes of productivity and production relations of the times, which powerfully confirms the development stages and characteristics of the times. Fujian is a treasure-house of geomantic omen along the coast of East and South Fujian of China. Because of its special boundary, mountainous, hilly, rivers, offshore and humid climate, it has established its ancient architectural forms of different types, styles and cultural types very early. The wall body of southern Fujian architecture is the most distinctive. The gables are made of clay sculpture and are symmetrical in bas-relief. The waistline has red bricks, white stones and blue stone shadow sculptures. Pattern, that is, ornamentation, refers to a pattern that is regularized and stereotyped by abstracting and changing according to a certain pattern structure law. With the development and progress of human civilization, it has been enriched continuously, and has been widely used in people's interior space design until now, interpreting and exerting its great aesthetic value of decorative arts.

With the rapid development of the times, people's spiritual level has been greatly improved, and most modern architectural designs are nothing new and cannot satisfy people's pursuit of beauty [2]. At present, artificial intelligence has made initial progress in China's architectural design industry. The image symbols formed by architectural patterns in a certain era have certain symbolic significance, that
is, they represent beautiful visions such as happiness, peace, longevity and nobility. If it can be applied to architectural design, environmental design, visual art and industrial design by means of modern design, it will not only benefit the inheritance and development of national culture, but also benefit the diversity of modern design.

2. The Uniqueness of Southern Fujian Traditional Culture
The architectural decoration of the traditional ancient buildings in southern Fujian is a variety of decorations attached to the building itself, which includes many comprehensive artistic forms, such as functional connection with the building itself, production techniques, dynamic decoration culture, national aesthetic orientation, folk customs and religions, etc. The symbolic pattern features and symbolic language give great cultural vitality to the ancient buildings in southern Fujian. From an aesthetic point of view, the red brick wall in southern Fujian reflects its regional style characteristics, forming the so-called southern Fujian style, which is formed by many factors [3]. The red brick house culture also integrates Chinese and Western cultures well. The Merlion in the stone carving can be seen to be influenced by the southern Fujian culture, and the mountain flower art reveals the breath of Islamic art. Early humans also applied it directly to pottery pots for decoration. The decorative combination of this pattern is changeable and has a strong sense of form. We can find a wide range of applications on the doors and windows of Guandi Temple in Quanzhou, and even find rectangular geometric patterns on the wall.

The roof structure of traditional dwellings in southern Fujian is mainly bucket-through type, and a special structural system developed from bucket-through type is "inserted beam type". Usually, there are several to dozens of households that form a cluster of villages. The size of the cluster varies, and the villages have no complete streets. The rural streets are winding and winding with the changes of slopes. The roads are mostly built with soil or paved with pebbles, while the scattered dwellings are built on the roadside. The architectural patterns in southern Fujian are the perfect combination of meaning and form, and the artistic ideas contained in them are consistent with the basic functions of modern logo design. The hanging flower decoration of Fujian architecture often takes religious patterns as its theme. The shape of the bracket set of the Caishi ancient residence in Southern Fujian is a lion playing with a pearl. The sparrows on both sides are wood carving techniques made of logs. The traditional patterns of flowers and plants and the details of the hollows are excellent. The hanging flower is a ball shape, which mainly uses repeated geometric patterns and flower patterns.

3. Colorful Red Brick Ancient House Decoration
Wall figure decoration. During the firing process, two or three black textures are regularly burned on the side surface of red brick, which is called "smoke moxibustion brick". This is a representative symbol of architectural design, which makes people know at first sight that it is the unique visual image of the ancient red brick house in southern Fujian. The irregular bricks of "Red Brick and White Stone" and the stone of any shape naturally form a unique wall of red and white, which has the contrast of red and white colors, the texture of stone surface and brick surface, and the shape contrast of stone surface as point and brick seam as line [4]; Abstract patterns are generally very casual, reflecting the author's smartness and freedom, not bound by any idea or culture, so that people can imagine and sketch at will, and the artistic sense is very good. The octagonal symbol represents "all directions are satisfactory" (Figure 1a); Coin symbols represent wealth and wealth; Gourd sounds like "Fulu", and the figure of Gourd is blessed and so on.
As far as decoration is concerned, lotus flowers, melons and fruits, grass leaves, figures and animals can be carved on the pillars, and the carving techniques are also very diverse, including relief, line carving and intaglio carving. The written figures are "Fu", "Xi" and "Shou" (Figure 1b), which represent a beautiful vision. In these traditional patterns, we can learn about history, such as ideological trends, customs and morals, living habits, etc. More importantly, we can extract the essence from these traditional patterns and apply it to the design of modern patterns.

**Swallowtail figure decoration.** The color of the interior design of Guandi Temple in Quanzhou is very clear. Large-scale application of vermilion, with strong contrast to the hue green. Abstract reproduction is to extract and abstract and evolve the features of original fragments [5]. In order to retain the traditional meaning, while using modern material means to design and express. The roof of southern Fujian architecture has beautiful changes and light posture. The roof is hyperboloid, with steep slope at the ridge and gentle slope at the eaves, and the upturned "dovetail ridge" is towering and soaring. The design of Xiamen Haicang Cultural Center draws on the axial symmetry of southern Fujian ancient houses and the upturned dovetail shape of the roof. Traditional decorative patterns not only depict a characteristic, but also convey people's yearning and feeling for a better life. In southern Fujian residential buildings, most of them are door leaves which open to patio. The cage fan is light in structure and thin in door plate, which is convenient for opening and closing. The door pillow stone squats under the frames on both sides of the gate in the shape of a whole low stone, and is connected with the ground. Its main function is to undertake the opening and closing of the facade. Under the roof, the mountain tip above the bird tread line is called "gauge tail", and the decoration of gauge tail is mostly relief made of gray plastic, which is called gray batch in ancient times. The raw material is mainly lime, which is a traditional decoration process of Han nationality with rich colors and a wide range of decorative themes [6].

**Beam frame decoration.** The traditional elements of southern Fujian are bound by all aspects in modern design. When designing, we have to consider the user's expectation, demand and motivation, whether the client and the user accept the modern design of southern Fujian traditional elements, how to accept the form and degree, and whether it is difficult to realize the technology when the design finally falls into the real thing. Of course, the number of carved beams is related to the economic status and status of residents [7]. The main contents of carving on the bucket arch, stigma, beam frame and lintel are flowers, birds, dragons, phoenixes, etc. Since ancient times, China has expressed its yearning for a happy life with the symbolic meaning of various auspicious symbols, and integrated it into its own culture. Fish has the meaning of being rich. Exquisitely carved stone fish can often be seen on the eaves, with their mouths open, fierce expressions and carved decorations on their bodies. They also have the meaning of relieving disasters and ward off evil spirits (Figure 2).
Outline the shape of dovetail ridge with solid or line, and express the shape of dovetail ridge with the light and shadow relation of building components. For example, the steel frame is hollowed out to outline the dovetail ridge; The wooden frames are arranged and combined to form the shape of dovetail ridge; Sculpture used in modern architectural design is not used as decoration, but as an important part of architecture, which can enhance the sense of history, make people have a feeling of reverence and increase the cultural connotation.

Door and window decoration. People pay attention to color first, then shape, and then texture and detail of objects. Therefore, color, as a pre-eminent communication element, plays an important role in design. For example, stone carving, jade carving and wood carving are very common forms of sculpture. The main raw material of wood carving is the base metal, which generally constitutes the basic structural part of the building, while the stone carving is basically used in the decorative position and can be used as a step. The windows facing the courtyard in the house are generally stone windows in the form of round carvings, also known as assorted windows, which have various forms such as fan-shaped, hexagonal, octagonal, round, etc. These stone windows can enrich the space in the house, and the decorative patterns are mostly flower symbols, and the flowers and vines are wrapped around the pillars of the stone windows, symbolizing that the garden is as spring and full of vitality. Therefore, most of the hanging fish in ancient buildings in Fujian are not in their original shapes. Hanging fish is an ancient architectural decoration element made of colored clay sculpture, shearing and sticking, cross toe pottery, etc. under the eaves of two gables. Its shapes are changeable, and common ones are banana leaves, moire, lion dragons, scroll, flower basket, bat and so on. Fujian's residential buildings are the most common ones, with colorful colors, which are in sharp contrast with red brick gables and highlight local characteristics.

4. Selection of Creative Entry Point of Architectural Pattern Elements in Southern Fujian in the Era of Artificial Intelligence

Take the form element as the creative breakthrough point. Form refers to the shape and expression of an object, which is the manifestation of things under certain conditions. Early southern Fujian flower brick was influenced by southern Fujian foreign flower brick, and its form was mainly flower pattern, which was basically refined from common flower patterns. Abstract and varied flower patterns are matched with grass, which greatly increases its decoration. Architectural decoration design itself is exploitable, which is the key to realize the combination of traditional elements and modern architectural decoration [8]. In conscious or unconscious deduction, various techniques are used to treat and beautify, resulting in many decorative patterns which are full of interest, profound meaning and concise. In southern Fujian, it is also called "cutting flowers", "sticking porcelain", "piling and cutting" and so on. It requires a gardener to break the porcelain bowl, then carefully cut off the edges and corners of the fragments, trim them into the shapes of patches, generally triangular or Long Lin-shaped, and then stick these colorful patches on the clay sculpture shapes made in advance. It enriches the cultural heritage of architecture and integrates traditional elements with modern architectural decoration.

It is the most basic way to use the traditional flower brick pattern in southern Fujian by printing it directly on shoes. It can be tiled and printed with a wide range of tile patterns, or it can be decorated locally in a small range, or it can be used in combination with other processes. In addition to these sculpture techniques, a layer of color flat coating will be added to the outside of these sculptures. Since
these sculptures are wood carvings, ink will be added to the flat coating in order to protect the surface of its wood. It can be used as the main load-bearing structure, giving play to certain shockproof performance, and at the same time, it has certain aesthetics. Architects should make good use of this when designing modern architecture. The traditional roof tiles are translated into modern steel forms, and the roof of the roof expresses the traditional complex curved surface form through linear steel, and conveys the cultural spirit of the new southern Fujian regional architecture through the expression of light and shadow.

**Taking color elements as creative breakthrough point.** Quanzhou is the most concentrated area of southern Fujian culture. Although there is no clear information showing that Quanzhou is the birthplace of southern Fujian culture, it can be seen from various works that scholars support this view. Case-based reasoning, once considered as a promising artificial intelligence method, is now melting into the mainstream. For example, artificial intelligence computer technology is used to simulate people's processing of architectural picture data, refine some new architectural textures, and form clusters to generate new architectural images. The typical color matching of ancient houses in southern Fujian is red brick and white stone, which uses the contrast between red brick and white blue stone; The five colors on the roof of the temple building in southern Fujian are dazzling. Using the traditional cutting and sticking process, the burnt and brightly colored glazed ceramic bowls and plates and other fragments are molded into dragons and phoenixes, figures, flowers and birds; In the design, we can design the polished tiles and non-polished tiles more deeply and vividly by choosing different films. Modern sticking film technology and traditional tile elements collide with each other and can be perfectly combined.

The introduction of generalized matrix is based on the following considerations: because the basic matrix $B_{n\times m}$ of different masonry wallboard has different dimensions, it is inconvenient to calculate and analyze it. The concepts and methods put forward below are to make the digital matrix describing the failure mode of masonry wallboard have the same dimension, so as to prepare for further study.

The proposed function is shown in formula (1). When this function is applied to all sub-matrices, it can be transformed into the corresponding generalized wallboard matrix $T$, and the generalized wallboard matrix of all masonry wallboard has the same dimension.

$$T = \xi(\{S_i\})$$  \hspace{1cm} (1)

Where

- $T$ — Generalized wallboard;
- $\xi$ — Transformation rules.

Thus, the concept of generalized wallboard is put forward to represent the failure modes of masonry wallboard with different sizes. $T$ with fixed dimension matrix is the generalized wallboard corresponding to masonry wallboard, which is also called generalized wallboard matrix. Equation (2) gives the position of each $S_i$ in $T$, which is expressed by transformation rule $\xi$.

$$T = \xi([S_i]) = \begin{pmatrix} S_1 & S_2 \\ S_3 & S_4 \\ S_5 & S_6 \\ S_7 & S_8 \end{pmatrix}$$  \hspace{1cm} (2)

According to rule $\xi$, the set of submatrixes $S_i$ constitutes the generalized wallboard matrix $T$. For example, the generalized wallboard matrix $S_i$ of masonry wallboard Test12 is:
It can be seen from fig. 3 that the value interval of state value based on FEA dimensionless method is \([0, 1]\), which is much larger than the value interval of cellular automata model \([0.5, 1]\). This makes the state distinction of different regions more obvious, which leads to better prediction results to some extent.

\[
T_{\text{Test12}} = \xi([S]) = \begin{pmatrix} S_1 & S_2 \\ S_3 & S_4 \\ S_5 & S_6 \\ S_7 & S_8 \end{pmatrix}
\]  

(3)

The buildings in each region have their own different characteristics, among which there are unique building elements that people think can represent the region. Among traditional architectural elements in China, traditional color matching is the key. Yellow, white, red, blue and black are common traditional colors, such as the pink walls and tiles in Suzhou gardens, the vermilion walls in the Forbidden City, and the combination of white and gray in Huizhou architecture. In southern Fujian culture, religious culture and architectural culture are the most shining points. Taking the ridge decoration of Guanyue Temple in Huaitong, Quanzhou as an example, the ridge decoration of many ancient buildings in southern Fujian is colorful, and its two ends are towering and tilted. The tilted parts are made by sticking colored porcelain pieces with ceramic dragon heads. These furnishings can create a strong cultural atmosphere and cultivate sentiment. Decorative pendants are widely used indoors, including fabric sofas and wall ornaments.

**Taking decorative pattern elements as creative breakthrough point.** The symbolic expression is intended to convey the dovetail ridge as a major element in southern Fujian. The dovetail ridge can be constructed by different materials, or its shape can be printed on the street and billboards. The patterns of south Fujian tiles expressed by high-frequency technology can be either positive or negative. In the architectural decoration, the combination with traditional elements in the true sense is no longer the pursuit of similarity with southern Fujian architecture, nor the accumulation of Chinese elements, but a similar artistic conception. There are many kinds of decorative patterns in southern Fujian culture, and the performance of decorative patterns in southern Fujian dwellings is richer from techniques to themes than other design categories. Contemporary materials and technologies provide a good foundation for the expression of regional architecture in southern Fujian. Roof shape is an important expression, which can be expressed abstractly or fully. If there is a large area of decoration with a single traditional pattern.

![Figure 3 Comparison of the state values of the basic model obtained by CA and FEA-based dimensionless model](image-url)
on the ceiling, it will be tedious and depressing, but a wide variety of traditional patterns can solve this problem. For example, decorating smallpox with palindromes will present simple lines, which also achieves modern people's pursuit of simplicity.

The wall space with red brick as the main material and red as the main material is a remarkable feature in southern Fujian. Love for red bricks in the wall; Conception of tile collage pattern; Explore the skills of building walls; Most of the red brick buildings in southern Fujian are based on three large houses with double floors, and there are rare large houses with five bays. Large courtyards are also equipped with protective houses around. Red bricks and tiles are widely used in this kind of buildings, and white granite is widely used as terrace stone. The roofs are mostly dovetail ridges with slightly tilted ends. The walls, corridors and ridges are exquisitely decorated, which are not only unique in appearance, but also quite different from other buildings in decoration and color patterns. Such as brick carving, stone carving, wood carving and porcelain carving, all have unique decoration indoors and outdoors, which makes the art of the whole large house appear more exquisite and wonderful. Such as brick, stone, wood, porcelain carving, mainly used for exterior decoration, door lintel, main entrance eaves, walls, external wall foundation, column foundation, etc.; Wood carving is mainly used for beams, pendants, window sash, door leaf and wooden grille. Carving techniques include wired carving, relief carving, semi-transparent carving, hollow carving, etc.

In the inheritance of southern Fujian architecture, "red brick culture" plays a vital role. The biggest decorative feature of Quanzhou traditional dwellings is that a large number of red bricks are used for decoration, which has formed a unique charming red brick culture through historical precipitation. The red brick wall decoration art is exquisite in craftsmanship, rich in meaning and rich in decorative techniques, and has great artistic value.

5. Summary
The multi-dimensional living environment created by the combination of extensive themes and contents, colorful architectural color patterns, wonderful decorative patterns and traditional Chinese cultural characteristics and living concepts of ancient buildings in southern Fujian has greatly beautified people's vision and psychology, and profoundly demonstrated the unique regional culture of southern Fujian. Compared with ancient buildings in other provinces and cities in China, it is quite different and has rich research value. The decorative pattern of red brick house is a treasure of architectural art and folk culture in southern Fujian. The image of the decorative pattern embodies and inherits the traditional context and wisdom. The red brick decorative culture also comes from the inheritance of architectural culture in southern Fujian. Through the understanding and re-creation of the traditional decorative beauty, the unique decorative pattern in southern Fujian has been created. In addition, when the traditional elements of southern Fujian are applied to modern design, the complex figurative patterns may need to be simplified and abstracted, the multi-level colors may need to be condensed, and the relationship between shapes and bottom of drawings may need to be refined and deepened, which will affect the expression of traditional elements and the re-understanding of traditional elements today.

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