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Article

# Innovative design research of Huangmei pick pattern based on structural equation model and shape grammar with a focus on biomechanical aspects

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**Abstract:** In order to protect the inheritance and development of Huangmei picking flower, promote the pattern of Huangmei picking flower more in line with the aesthetics and taste of modern people, and enhance the cultural value of Chinese intangible cultural heritage, a pattern innovation scheme based on structural equation model with transcription and shape grammar to establish a clearer connection between design elements and their biological aesthetics and physiological preferences. The design elements of the pattern design that are popular among young consumers are extracted to provide effective guidance for pattern design. Methods: Firstly, the design elements were divided into dimensions, and further analyzed the four dimensions of the action mechanism affecting the popularity of modern young people with the help of structural equation modeling, and prioritized each dimension to guide the designers in the design of pattern elements. Secondly, we employ factor translation and shape grammar to create innovative designs based on these identified dimensions, ensuring that the designs resonate with biological and physiological preferences, such as symmetry and natural forms, which are often appealing to young consumers. Conclusion: Based on the organic combination of structural equation modeling, transliteration and shape grammar, we found that both of them have a positive influence on young people's liking of the pattern, and further determine the priority of each design element and propose corresponding design strategies to redesign the pattern based on the factor transliteration and shape grammar, which assist designers to improve the satisfaction of modern young people from modern aesthetic needs, and provide new ideas for the innovation of modern pattern design. Ultimately, this research contributes to the protection and inheritance of Chinese intangible cultural heritage through innovative design approaches that consider biological and physiological factors.

**Keywords:** intangible cultural heritage; structural equation model; shape grammar; pattern design; biological aesthetics; physiological preferences

## 1. Background of the study

### 1.1. Purpose of research

After thousands of years of cultural changes, patterns exist in intangible cultural heritage in the form of graphics, Chinese characters, decorations, etc. In April 2022, the State Council's Central Office issued the Opinions on Promoting Cultural Industries Empowering Rural Revitalization, proposing that social revitalization be empowered mainly by cultural industries such as creative design, art industry, and handicrafts, and encouraging designers of intangible cultural heritage to combine practical, and encouraging intangible cultural heritage designers to combine the practical with the creation and production of handicrafts. Huangmei cross-stitch, also known as Huangmei pick pattern, originated in the late Song and early Yuan dynasties,

and reached a boom in the Ming and Qing dynasties. It is a kind of embroidery craft that uses colorful threads to pick and embroider all kinds of exquisite patterns on fabrics, with cross-cross stitch as the main method, i.e., using special embroidery threads and cross-grid fabrics, using the method of hitching crosses interwoven with warp and weft to embroider against the special coordinate patterns, using pure cotton fabrics as the raw materials, while colorful threads are used to pick and embroider all kinds of patterns. These threads are usually colorful and rhythmic. Huangmei cross stitch patterns are exquisite and profound, including flowers, animals, people, religion and other subjects. These patterns often have a strong local style and national characteristics, and they hold people's aspirations for a better life and the pursuit of it. As a unique form of Hubei Huangmei traditional handicrafts, which was included in the first batch of national intangible cultural heritage list in 2006, the cultural connotation and cultural attributes of the national intangible cultural heritage are explored, and the products are developed in a more in-depth manner. Combined with modern technology, the products are innovatively empowered to evoke national cultural confidence and conform to the inheritance and development of the times.

## 1.2. Research status of Huangmei picked flowers

As one of the important carriers of China's intangible culture, Huangmei pick flowers have high collection and research value. Among them, Lian et al. [1] have studied the classification of the pattern subject matter of Huangmei picking flower in wedding culture, the structural characteristics and its expression, Li Xin Yang [2] has carried out the extraction of the pattern of Huangmei picking flower, so as to innovate the design of the pattern by modelling; in the research of inheritance protection and development, Yang et al. [3] have systematically analyzed the current situation of Huangmei picking flower protection and the current dilemma faced. Nowadays, the current academic research on Huangmei picking flower mainly focuses on the handicraft skills, pattern appreciation and artistic value of Huangmei picking flower, inheritance protection and development, and scholars who study the pattern appreciation and artistic value of Huangmei picking flower have compiled detailed information on the pattern theme, pattern style, color matching and artistic value [4]. Shan Jixiang, former president of the National Palace Museum, once said, "The inheritance of traditional culture depends on the aesthetics of modern people and is based on archaeological research" [5].

Most of the scholars' studies are limited to the archaeological aspects of Huangmei picking, and these studies often stop at the analysis of the material level, but there are few in-depth discussions on the intrinsic connection between the traditional patterns in Huangmei culture and the modern people's aesthetic concepts and spiritual pursuits. As an important part of Huangmei culture, traditional patterns are not only the embodiment of skills and aesthetics, but also the crystallization of history, culture, folklore, beliefs and other factors. They contain profound cultural significance, reflecting the wisdom of ancient people's life, aesthetic interest and spiritual support. However, with the change of the times, modern people's aesthetic concepts, lifestyles and spiritual needs have changed dramatically, how traditional patterns resonate with modern people in the context of the new era has become an

urgent problem. The lack of exploration of the direction of modern people's thinking means that we fail to fully understand the needs and changes of modern people in the aesthetic and spiritual level, and thus it is difficult to find a point of convergence between traditional patterns and modern people. This leads to the fact that traditional patterns often fall into difficulties in the process of inheritance and regeneration, and it is difficult to revitalize them in the modern society. Therefore, how to inherit, revitalize and regenerate traditional patterns loved by modern people is an urgent problem to be solved.

As an important part of Chinese traditional patterns, it is necessary to take the right way of communication between traditional patterns and modern life to revitalize the visual aesthetic elements of modern people, not simply copy and paste them, but only to understand today's fashion trends, establish a link with modern life, so that modern people can feel the cultural connotation behind the patterns, in order to be widely accepted by young people. In turn, traditional Chinese culture can be carried forward [6] Therefore, in order to better carry out the inheritance and development of Huangmei picking flower, it is necessary to use modern technology to more accurately and deeply study people's favorite categories of Huangmei pick pattern, explore the preference of modern young people for patterns, so as to carry out targeted pattern innovation, in order to better revitalize, regenerate and inherit Huangmei pick pattern.

## 2. Research framework and methodology

### 2.1. Research framework

The content displayed in the Huangmei picket pattern has contemporary significance and reflects the many excellent qualities of the Chinese nation. The contemporary design concept is an innovation, and its topicality is the mainstream of today's society and the public's awareness of what is popular [6]. The innovative design of the pattern combined with modern aesthetics directly affects the development and inheritance of the pattern, so it is very important to understand people's favorite degree combined with modern design.

Firstly, we studied Huangmei picking pattern and its content background, extracted different dimensions and design elements that influence the design pattern; secondly, we analyzed the young people's favorite degree of pattern elements in different dimensions, the emotional output of cultural perception, and cultural transmission through structural equation model, and accurately understood the real preference of modern people after using shape grammar to reorganize and transform the basic units of traditional patterns, through Finally, the new patterns are applied to traditional costumes and creative products to improve the cultural connotation and artistic value of Huangmei flower patterns.

### 2.2. Research methodology

#### Overview of structural equation modeling

Structural equation modeling (SEM) was introduced in 1973 by the Swedish statistician Joreskog.K.G. It refers to the use of equations of parameters in the analysis of observable or latent variables.8 SEM integrates path analysis and confirmatory

factor analysis (CFA), and it can not only test traditional models but also perform tests of complex relationships and models, applied in different contexts. Structural equation modeling is used to provide a framework for analyzing potential variables affecting each other in path studies.

### 2.3. Overview of shape grammar

Shape Grammar (SG) is an algorithm based on the theory of "symbolic language" proposed by George Stiny and James Gips, and other American design and computation theorists. 102.2 Research Methodology

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$$X = \Lambda x\xi + \delta \tag{1}$$

$$y = \Lambda y\eta + \varepsilon \tag{2}$$

where $x$ and $y$ refer to the exogenous observed variable and the endogenous where $x$ and $y$ refer to the exogenous observed variable and the endogenous observed variable, $\xi$ and $\eta$ refer to the exogenous latent variable and the endogenous latent variable, and $\delta$ and $\varepsilon$ are the measurement errors of $x$ and $y$. Λx is the relationship between the exogenous observed variable $x$ and the exogenous latent variable $\xi$, and $\Lambda y$ is the relationship between the endogenous observed variable y and the endogenous latent variable $\eta$. At this point $\eta$ is as follows:

$$H = \beta + \Gamma\xi + \xi \tag{3}$$

where $\beta$ is the relationship between the endogenous latent variables, $\Gamma$ is the effect of the exogenous latent variables on the endogenous latent variables, and $\zeta$ is the part of the model that is not explained.

### 2.4. Overview of shape grammar

Shape Grammar (SG) is an algorithm based on the theory of "symbolic language" proposed by George Stiny and James Gips, and other American design and computation theorists. Shape Grammar (SG) is an approach to design and analysis based on the theory of "formal language" [9].

## 3. Research process

### 3.1. Design element extraction based on structural equation model

Firstly, the interviewees were selected according to the content of this study. In order to improve the reliability of the extraction results of the design elements of the pattern, the local craftsmen who had experience in making Huangmei pick flowers were selected as the interviewees, and after informing the interviewees of the content and topic, a formal in-depth interview was conducted according to the interview outline prepared in advance to explore the elements affecting the design of the Huangmei pick flower pattern as comprehensively and deeply as possible, and After obtaining the consent of the interviewees, the whole interview process was stenographically recorded and audio-taped to facilitate timely checking and verification of the data. A total of 52 craftspeople were interviewed, including 18 males and 34 females. After completing the interviews, the data from the cell phones were organized and summarized, and finally 15 design elements were extracted, and the pattern design elements are shown in **Figure 1**. Through literature review and survey research, it was found that visual aspects such as color composition can have an impact on young people's enjoyment of pattern aspects, thus affecting the spread of culture and the inheritance and development of non-heritage handicraft culture. In addition, the stitching skills of craftsmen are one of the factors that influence the spread of patterns, and the difference between silk thread material and cloth surface also affects people's choice. The difference in the material of silk thread and cloth surface also affects people's choice. The difference in people's perception of motifs and symbolic understanding of motifs will make people feel happy, thus affecting the degree of people's love for motifs. To sum up, according to the design elements of the motifs, visual attributes, behavioral attributes, emotional attributes, value attributes, and liking degree are selected as the five main factors that influence young people's liking of the motifs, and the model is used to verify whether the five design attributes have a significant impact on the liking of modern young people in literary design. The dimensions of the pattern design are divided in **Table 1** [10].

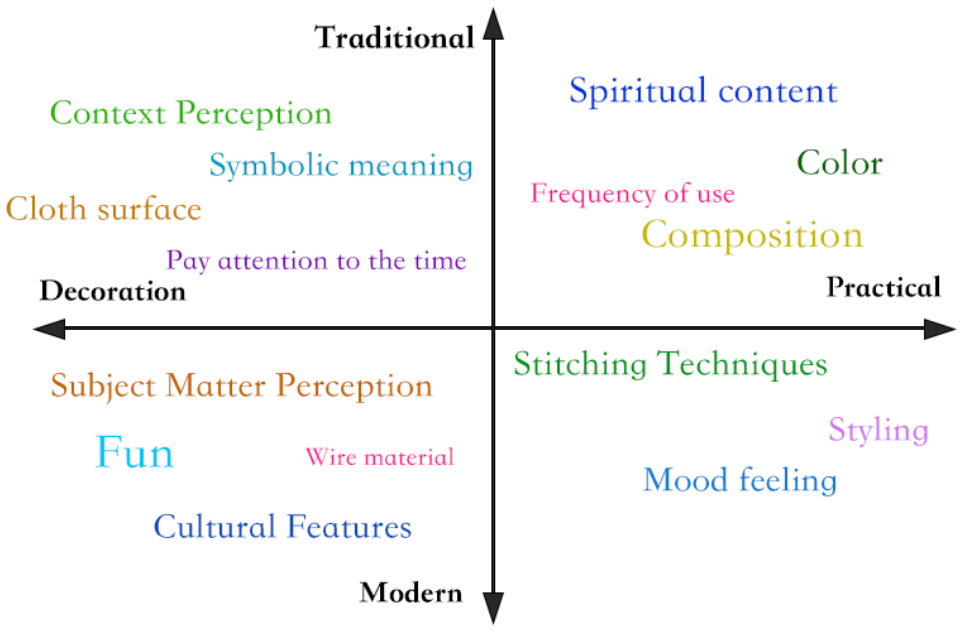



**Figure 1.** Pattern design element.

**Table 1.** Pattern design elements dimensional division.

| Design Dimensions | Design Elements | | |
|---|---|---|---|
| Visual Attributes (VI) | Composition (VI1) | Color (VI2) | Styling (VI3) |
| Behavioral Properties (FU) | Stitching Techniques (FU1) | Cloth surface (FU2) | Wire material (FU3) |
| Emotional Properties (VA) | Subject Matter Perception (VA1) | Context Perception (VA2) | Funkiness (VA3) |
| Value Attributes (EM) | Symbolic meaning (EM1) | Cultural Features (EM2) | Spiritual content (EM3) |
| Likeness (GS) | Pay attention to the time (GS1) | Mood feeling (GS2) | Frequency of use (GS3) |

### 3.2. Questionnaire distribution and scale description statistics

After the design elements were divided, the data were collected by distributing questionnaires, so as to accurately analyze the specific action mechanism of Huangmei picking pattern design dimensions on users' favorite, and determine the priority of pattern design according to the analysis results. A total of 207 questionnaires were distributed in this study, and after excluding incomplete and obviously unqualified questionnaires, the total number of valid samples was 188. In the questionnaire, the proportion of male participants was 47.9% and female 52.1%; the largest proportion was between 20 and 23 years old, 37.2%; students were the main participants of this questionnaire, accounting for about 47.3%; in terms of education, the largest base of users received undergraduate education, accounting for 44.7%, followed by graduate students, accounting for 30.9%; in terms of monthly income level, 47.3% of participants belonged to 1000 yuan or less. The data show that: the group participating in the research is mainly in the age of 20 to 23, and the vast majority of students with undergraduate and graduate students as the main group, this group of consumers are more curious about new things, have a certain aesthetic and ideas for modern design, will become one of the main groups using Huangmei pick pattern design.

### 3.3. Reliability analysis

In order to ensure the internal consistency of the scale, before conducting exploratory factor analysis, the internal consistency reliability Cronbach' s Alpha value of each variable was calculated using SPSS 27. 0 software for internal consistency test, Cronbach' s Alpha if greater than 0.7, the result is considered to be in the ideal range, the results of the reliability analysis of the variables are shown in **Table 2** The Cronbach's Alpha ranged from 0.801 to 0.874, all of which were greater than 0.7, which indicated that the collected data had good internal consistency and reliability, and met the requirements of the reliability test.

**Table 2.** Reliability analysis.

| **Design Dimension** | **Clone Baha coefficient** | **Number of items** | **Overall cloned Baha coefficient** |
|---|---|---|---|
| VI | 0.850 | 4 | |
| FU | 0.874 | 5 | |
| VA | 0.846 | 4 | 0.893 |
| EM | 0.801 | 4 | |
| GS | 0.840 | 4 | |

An exploratory factorial validity analysis test was conducted to test the KMO and Barlett's spherical test for the total table, and the validation results are shown in **Table 3**, with a KMO value of 0.883 and a Barlett's spherical test chi-square value of 1815.124. The significance level was 0.000 < 0.001, indicating that the statistical test for the total table was significant and had good structural validity.

**Table 3.** Structural validity analysis.

| | | |
|---|---|---|
| Kaiser-Meyer-OlkinMetrics | | 0.883 |
| | Cardinality | 1815.124 |
| Barlett sphericity test | Df | 210 |
| | Sig. | 0 |

**Table 4.** Convergent validity analysis of each dimension.

| | **Path Relationships** | | **Estimate** | **CR** | **AVE** |
|---|---|---|---|---|---|
| VI01 | <--- | VI | 0.720 | 0.850 | 0.587 |
| VI02 | <--- | VI | 0.750 | | |
| VI03 | <--- | VI | 0.817 | | |
| VI04 | <--- | VI | 0.775 | | |
| FU01 | <--- | FU | 0.797 | 0.875 | 0.584 |
| FU02 | <--- | FU | 0.808 | | |
| FU03 | <--- | FU | 0.678 | | |
| FU04 | <--- | FU | 0.757 | | |
| FU05 | <--- | FU | 0.773 | | |
| VA01 | <--- | VA | 0.786 | 0.847 | 0.58 |
| VA02 | <--- | VA | 0.777 | | |
| VA03 | <--- | VA | 0.745 | | |
| VA04 | <--- | VA | 0.738 | | |
| EM01 | <--- | EM | 0.759 | 0.826 | 0.544 |
| EM02 | <--- | EM | 0.700 | | |
| EM03 | <--- | EM | 0.767 | | |
| EM04 | <--- | EM | 0.721 | | |
| GS01 | <--- | GS | 0.742 | 0.84 | 0.568 |
| GS02 | <--- | GS | 0.746 | | |
| GS03 | <--- | GS | 0.764 | | |
| GS04 | <--- | GS | 0.763 | | |

Validity tests for each dimensional distinction

| | VI | FU | VA | EM |
|---|---|---|---|---|
| VI | 0.587 | | | |
| FU | 0.329 | 0.584 | | |
| VA | 0.34 | 0.293 | 0.58 | |
| EM | 0.35 | 0.416 | 0.384 | 0.544 |
| AVE value square root | 0.766 | 0.764 | 0.762 | 0.738 |

Further analysis of the convergent validity analysis is shown in **Table 4**. It can be seen that the factor loading coefficients are greater than 0.7, which is within the ideal range. In addition, the AVE values are also greater than 0.5, which indicates that the data have good convergent validity. The AVE of each factor is greater than its correlation coefficient with other factors, and the former is greater than the latter. In conclusion, these data indicate that there are differences among the potential variables, which further indicates that the questions designed in this questionnaire have good variability and the data are reliable for further analysis.

If the measurement model is poorly fitted, it can lead to inaccurate results. Therefore, it is necessary to analyze and verify the fit of the model before building the structural model. By importing the data into AMOS27.0 for analysis, the model fit test is shown in **Table 5**. from the results in **Table 5**, it can be seen that each fit index IFI, TLI, CFI, and GFI of the model is greater than 0.9, the root means square error of approximation RMSEA = 0.058, which is less than the critical value of 0.08, and the ratio of cardinality degrees of freedom X2/DF = 1.639, which is less than the critical value of 5. The fitted parameters all meet the socio-statistical measurement criteria. Therefore, the structural equation model constructed in this paper has a good overall fit and a high degree of confidence. Further, AMOS 22.0 was applied to analyze the mechanism of action among potential variables and the corresponding standardized coefficients were obtained, as shown in **Table 6**.

**Table 5.** Model suitability.

| Indicators | Reference Standards | Actual measurement results |
|---|---|---|
| CMIN/DF | <3 is sufficient | 1.121 |
| RMSEA | <0.08 is good | 0.058 |
| IFL | >0.9 is excellent | 0.988 |
| TLI | >0.9 is excellent | 0.986 |
| CFI | >0.9 is excellent | 0.988 |
| GFI | >0.9 is excellent | 0.912 |
| RFI | >0.9 is excellent | 0.900 |

## 3.4. Hypothesis testing and analysis

The results of the structural equation model are shown in **Figure 2**, the path coefficients, and the significance test are shown in **Table 6**. The results of the study show that each path coefficient is greater than 0, and the *p*-value is less than 0.05, which indicates that the visual, behavioral, emotional, and value attributes of the design of the yellow plum blossom pattern will affect the young people's love for the pattern design, and all have a significant positive impact.

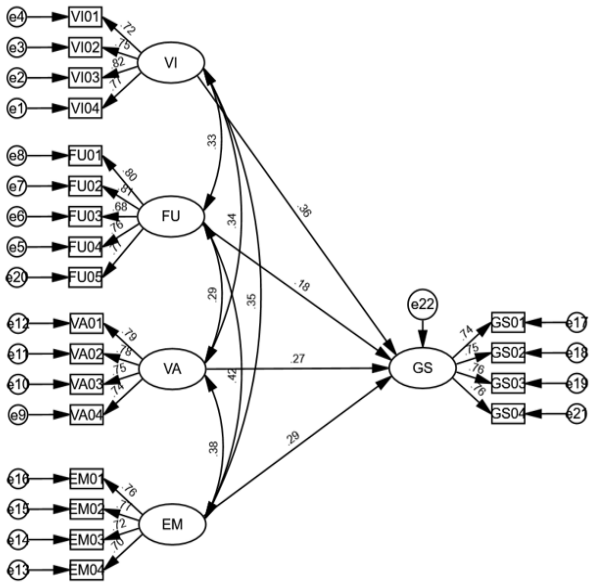



**Figure 2.** Structural equation model results.

**Table 6.** SEM path relationship test.

| **Path Relationships** | | | **Estimate** | **S.E.** | **C.R.** | ***P*** |
|---|---|---|---|---|---|---|
| GS | ← | VI | 0.364 | 0.075 | 4.666 | *** |
| GS | ← | FU | 0.183 | 0.065 | 2.502 | 0.012 |
| GS | ← | VA | 0.267 | 0.073 | 3.536 | *** |
| GS | ← | EM | 0.292 | 0.085 | 3.582 | *** |

The study shows that visual attributes play the most important role, with a coefficient of 0.364, followed by value attributes, with a coefficient of 0.292, indicating that the cultural or practical values embedded in pattern designs also attract adolescents to a large extent. The coefficients for emotional and behavioral attributes are 0.267 and 0.183, respectively, which are slightly less influential than the previous two, but still indicate that they play an important role in shaping adolescents' preferences. The study further refined the maximum contribution of certain specific factors within the respective attribute dimensions. Specifically, among the factors related to visual attributes, a particular factor (e.g., color scheme or compositional design) had the most significant impact on the enhancement of human splicing skills with a high coefficient of 0.808, which implies that good visual design can effectively promote adolescents' visual recognition and creation skills. At the level of emotional attributes, theme perception serves as a key factor with a coefficient of 0.786, revealing the importance of correctly selecting and designing pattern themes to stimulate the emotional resonance of adolescents. As for value attributes, symbolism became the most influential factor within this dimension with a coefficient of 0.759, indicating that the cultural symbols and deeper meanings carried by patterns play a key role in enhancing adolescents' value identity.

Further by SPSS descriptive analysis, as shown in **Table 7**. Among the color elements that play the largest role in visual attributes, modern young people prefer warm colors, accounting for 29%; among the stitching techniques that play the largest role in behavioral attributes, people prefer draft stitches, accounting for 39%; among

the subject matter perceptions that play the largest role in emotional attributes, people prefer plants, accounting for 30%; among the symbolic symbols that play the largest role in value attributes, people prefer the style of the times, accounting for 40%.

**Table 7.** SPSS descriptive analysis results.

| Variables | Options | Frequency | Percentage |
|---|---|---|---|
| VI001 | Common color (navy) | 47 | 25% |
| | Very used colors (onion green, earthy red, deep black) | 47 | 25% |
| | Cool tones (green, blue) | 39 | 21% |
| | Warm tones (red, yellow, etc.) | 55 | 29% |
| FU001 | Needle pulling stitch | 74 | 39% |
| | Cross Stitch | 64 | 34% |
| | Straight stitch | 50 | 27% |
| VA001 | Animal | 26 | 14% |
| | Words and poems | 54 | 29% |
| | Opera Class | 51 | 27% |
| | Plant category | 57 | 30% |
| EM001 | Love and Marriage | 65 | 35% |
| | Fortune and Good Luck | 47 | 25% |
| | Timescape | 76 | 40% |

## 3.5. Design insights

### 3.5.1. Visual attributes

Based on the results of this paper, designers should focus on the color matching and composition of the pattern design in terms of visual attributes. In the design of yellow plum blossom pattern, the main guide should be the difference of color, and pursue the color combination that can make consumers focus at a glance, so as to highlight the essential attributes of pattern design.

### 3.5.2. Behavioral attributes

In terms of behavioral attributes, more attention should be paid to the craftsman's stitching skills. From the point of view of the production process, unlike other embroidery techniques, Huangmei picking is mainly based on the picking technique, through the form of repeatedly picking while threading, highlighting the characteristics of traditional handicrafts, in order to present a new visual appearance of Huangmei picking and Chinese traditional handicrafts to everyone, and continue to preserve and carry forward.

### 3.5.3. Emotional attributes

In terms of emotional attributes, the theme perception can obviously improve the modern young people's love of pattern design, different themes can also make modern people have a deeper understanding of the pattern with the yellow plum picking, so as

to stimulate people's deeper psychological activities and emotional resonance, for the emotional value of the yellow plum picking pattern "value-added".

#### 3.5.4. Value attributes

Pattern design is no longer limited to the pure aesthetics, but has gradually become a bridge between designers and the spirit of the times, carrying the image of the nation while also reflecting the strong cultural connotation and social value. Based on the results of this paper, in terms of value attributes, designers should pay more attention to the symbolic meaning of Huangmei pick flower pattern, most of the young people are more concerned about the spiritual resonance, and apply the symbolic meaning to the pattern design, which is undoubtedly a good carrier to express the heritage and innovation of the pattern.

## 4. Pattern innovation process based on shape grammar

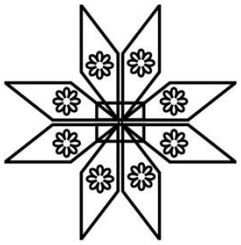
### 4.1. Extraction of core texture and innovation scheme of pattern

#### Core texture extraction and basic element formation

According to the above research results, different elements are analyzed and extracted from four dimensions to help designers clarify the importance of each attribute when designing yellow plum blossom patterns and identify the core design elements more accurately, so as to better use shape grammar to extract and translate the image elements of yellow plum blossom.

Biologically speaking, translation refers to the process of synthesizing proteins with a certain amino acid sequence by using the messenger RNA (mRNA) obtained from DNA transcription as a template [11]. From the perspective of art and design, translation can be understood as the process of transforming the original pattern into a new pattern by taking the traditional pattern as the initial template and combining it with a certain regular design [11]. Through the preliminary research based on structural equation modeling, we learned that people prefer botanical motifs, so we designed them in a more targeted way. The three representative patterns of plants, lotus, peony and plum blossom, were selected and redesigned with modern patterns, exaggerating and abstracting on the basis of retaining the original characteristics, and extracting and translating the elements to create a new pattern, which is more in line with modern aesthetics and the trend of this era, in order to spread it better. After the abstraction of the basic patterns, the corresponding design factor library is established, see **Table 8**.

**Table 8.** Pattern design factor library.

| Timescape | Types of Patterns | Design factor extraction | Design factor translations |
|---|---|---|---|
|  | Lotus pattern |  |  |
|  | Peony pattern |  |  |
|  | Plum Blossom Pattern |  |  |

Through the extraction and translation of the pattern, designers can also more conveniently complement the pattern for transformation and design, and realize the automatic generation of new patterns [12]. The shape grammar changes the morphological characteristics of the pattern according to the specific evolution of translation, rotation, mirroring, etc., and constantly enriches and innovates new patterns to evoke the identity of modern youth. Taking the letter "P" as an example, the graphic extension is obtained according to the rules of shape grammar evolution. Rule 1 is translation, rule 2 is horizontal mirroring, rule 3 is vertical mirroring, and rule 4 is 45° rotation with itself as the center. The above rules are called generation rules, and after forming the basic unit based on the generation rules, we continue to follow the derivative rules to obtain innovative patterns. The derivative derivation is as follows: rule 5 is tilted mirror 45°, rule 6 is rotated 15° by itself, rule 7 is rotated 90° by the edge and corner, rule 8 is rotated 30° by itself. The pattern evolution rules are shown in **Figure 3**.

After extracting the pattern from the above design factor library, the basic unit is obtained by one or more evolutions according to the design rules, as shown in **Table 9**.

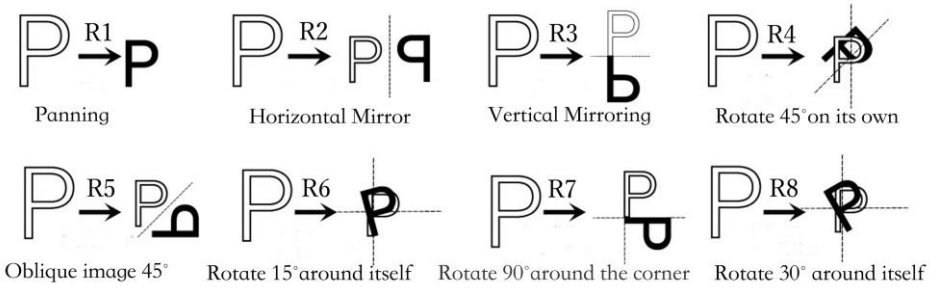
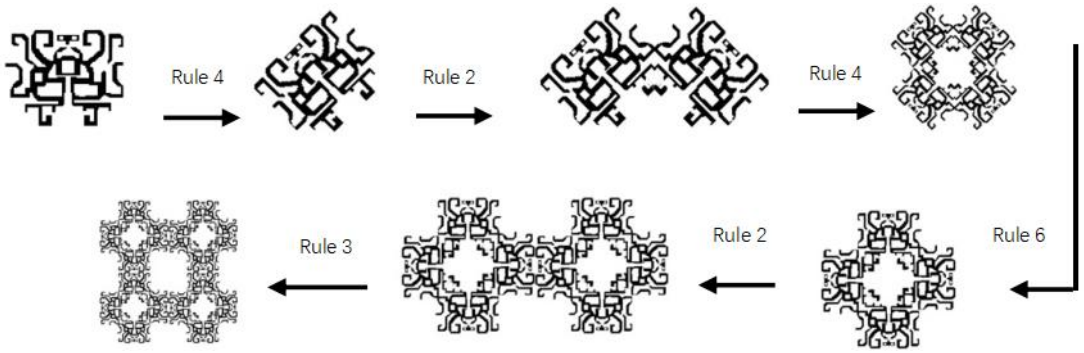
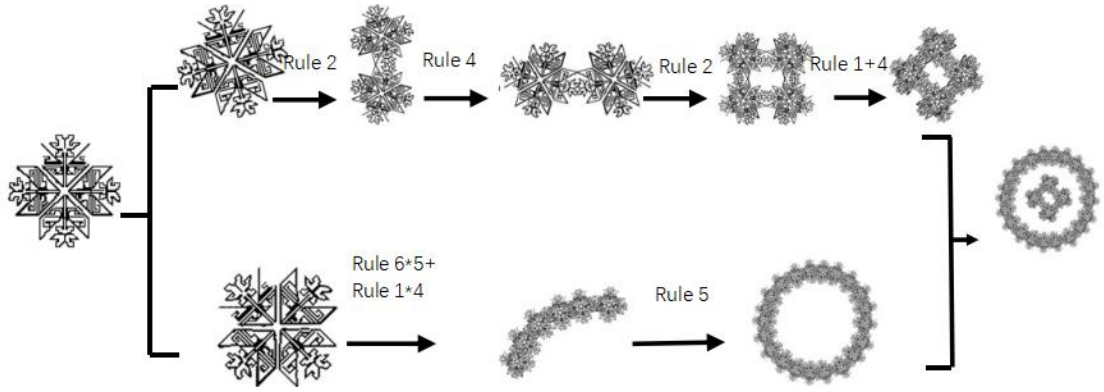
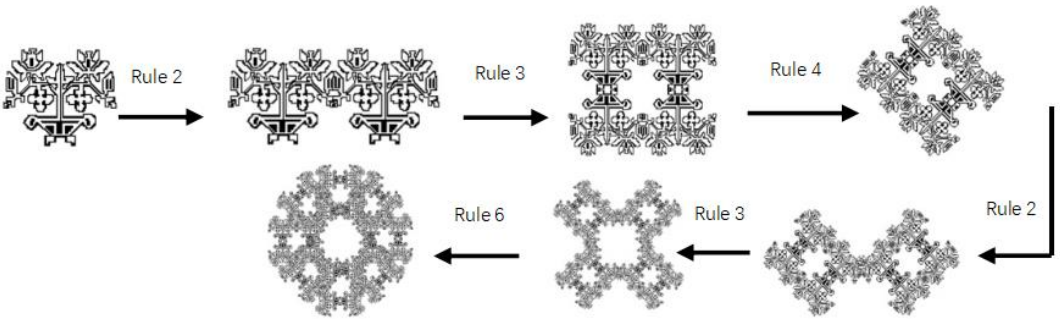



**Figure 3.** Pattern evolution rule.

**Table 9.** Basic pattern derivation.

| | |
|---|---|
| Evolution 1 |   |
| Evolution 2 |   |
| Evolution 3 |   |

## 4.2. Innovative design practice

### 4.2.1. Basic pattern innovation practice

After the research results show that visual [12] attributes and emotional attributes are the key factors for modern young people to choose patterns. In terms of visual attributes, based on the previous analysis of people's favorite pattern preference, it is proposed to refine the characteristics of people's favorite color of the pattern and the shape of the basic unit combination, forming a rich national visual effect; color

matching is divided into two categories: color and plain, based on the above analysis, it can be seen that in terms of color modern young people prefer warm tones and the combination of common and unusual colors, reflecting the yellow plum The characteristics of the color of the picket pattern. In terms of emotional attributes, we dig deep into the essence and value of Huangmei culture and explore the inheritance of Huangmei pick pattern, so as to fully absorb the spirit and connotation of Huangmei pick pattern. Make its pattern collection with strong recognizability and cohesion.

#### 4.2.2. Innovative pattern practice

From the perspective of innovation, Huangmei pick pattern should rely on the style of the times to enhance its cultural value, and Chinese spaceflight as the new engine of the times, as one of the new era of heavy scientific and technological innovation, we need to integrate the ancient and modern, traditional and modern culture collision, highlighting the charm of Chinese culture. The new era of spaceflight and the ancient era of flying mythology fusion, looking back at the Chinese people's flying road, is the vast number of people's dreams of the stars, the most vivid and romantic interpretation and interpretation of heaven and earth complex. Huangmei pick pattern and space integration innovation, is a modern technology space and non-heritage culture between a space-time dialogue. After the integration of space elements, Huangmei pick pattern also has the imprint of the current era of space fever, these inheritance, expressing the myth and legend of flying, ascending, space imagery, expressing the long-lasting longing for the sun, moon and stars, the deep interest in exploring the sky, the deep concern for the relationship between heaven and man. The fusion of Huangmei pick pattern is not only to inherit the non-heritage culture, but also to enhance the national pride and reflect the strong confidence of China's own creative ability, showing the creative transformation and innovative development of Chinese traditional culture in the process of keeping the righteousness and innovation, highlighting the interplay of scientific spirit and humanistic sentiment. Thirty years of wind and rain, generations of aerospace greats, just as generations of non-hereditary inheritance of Huangmei pick flowers, Huangmei pick flowers and aerospace fire from generation to generation into a new connotation and new power, so that Huangmei pick flowers become a source of strength to strengthen the construction of a strong country in China's non-heritage culture. Chinese culture, the spirit of China is in need of a new era of young successors rooted in residence to continue to innovate a new height of China, to promote the spirit of China, the spirit of craftsmanship, national spirit, the spirit of China's new era of cultural core value system continues to accumulate into the Chinese wisdom, stationed to amaze the world, a long history. So this paper extracts the astronaut element in space and the visual language of space rocket, artistic symbols, colors and other elements, updates the expression of the pattern, extracts the design factor in Huangmei picking flower and the new era astronaut to combine the translation, as shown in **Table 10**, so that it obtains the artistic innovation degree [13]. After extracting the pattern to carry out an overview, extracts the innovative pattern derivation of Huangmei picking flower combined with the elements of Huangmei opera,as shown in **Table 11**. to carry out secondary creation, as shown in **Figure 4**, to enhance the cultural science and innovation of the pattern, and the pattern design is shown in **Figure 5**.

**Table 10.** Combination of elements of contemporary style.

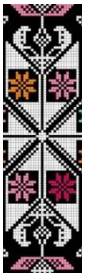
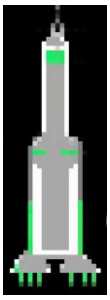
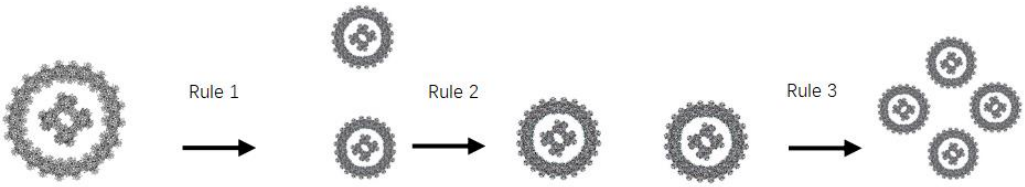
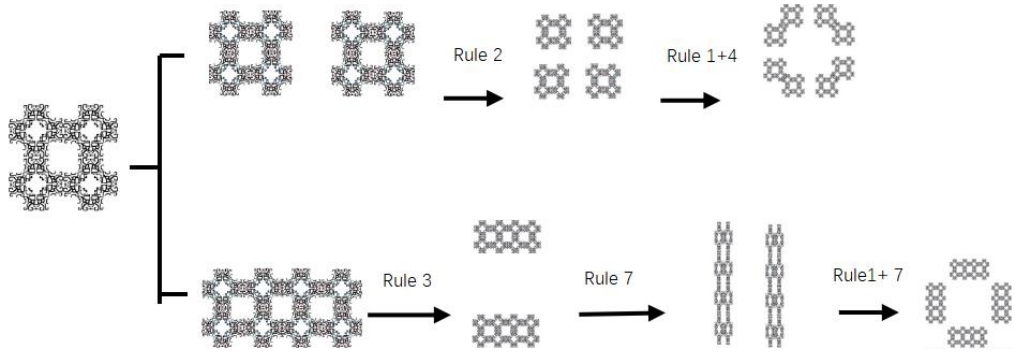
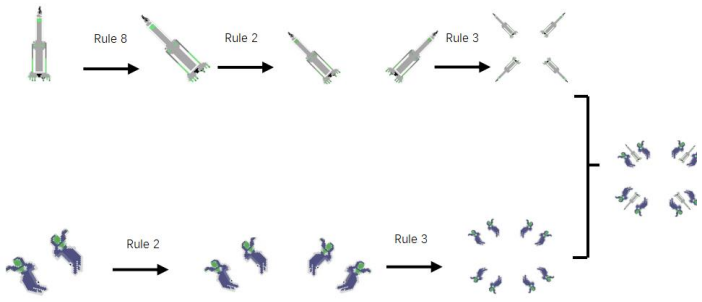
| Original pattern drawing | Pattern type | Design factor extraction | Translation of Design Factor and Modern Style |
|---|---|---|---|
|  | Character |  |  |
|  | Bouquet of flowers |  |  |

**Table 11.** Pattern derivation.

| | |
|---|---|
| Evoluti On 1 |  |
| Evoluti On 2 |  |
| Evoluti on 3 |  |
| Evoluti on 4 |  |

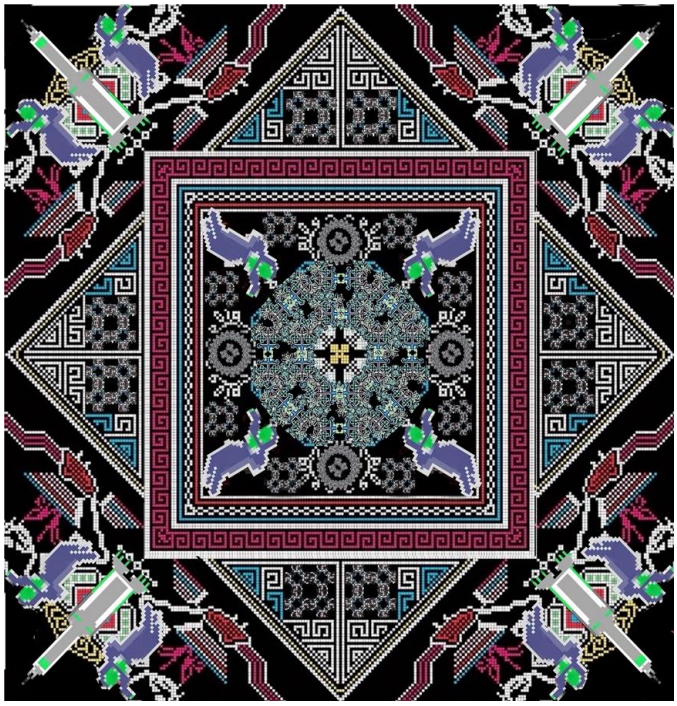


**Figure 4.** Secondary creation pattern.

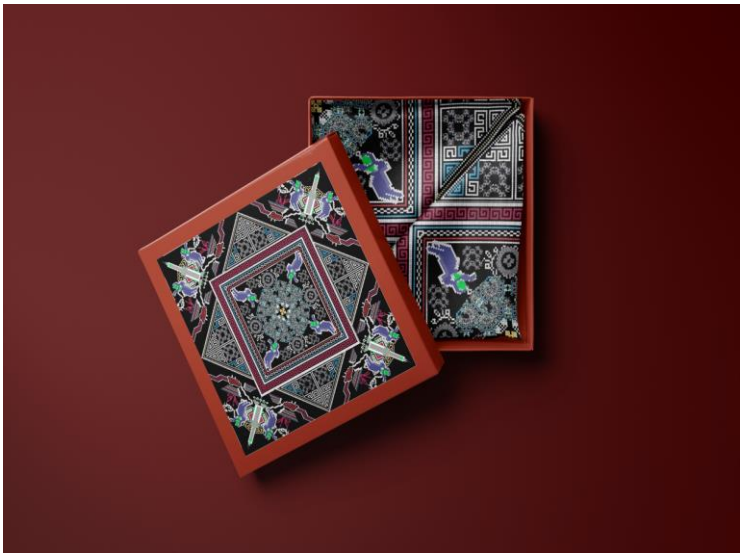


**Figure 5.** Cultural scientific and innovative design drawing.

## 5. Conclusion

In this paper, we quantified the influence and mechanism of the modern young people's liking of Huangmei pick pattern, and converted these factors into 15 design elements, and further classified the 15 design elements into five different dimensions by using factor analysis. This can help designers to clarify the importance of each attribute in pattern design, so that they can make a reasonable configuration of pattern design [13]. Then, based on the findings of the study, we used transliteration and shape grammar to deduce and redesign traditional patterns, which provides new ideas for the extraction and application of traditional design elements in modern pattern design and its innovative development [14]. The design of the design is a new way of thinking,

which spreads the culture of Huangmei County, Hubei Province, and maps out the new trend of preserving and passing on the non-heritage culture [15].

From an overall point of view, this paper achieves the established research objectives and adopts the structural equation modeling model and shape grammar for the innovative design of the Huangmei pick pattern, but from the other side, structural equation modeling is usually used for the statistical analysis of normally distributed data, and if the data do not conform to the normal distribution, it may lead to inaccurate results of the SEM analysis, which may in turn affect the final results of the ensemble. Therefore, in the future research, in order to do a good job of protecting and inheriting the Huangmei pick pattern, we should also continue to explore the possibility of applying different models and algorithms to the innovative design of the Huangmei pick pattern.

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