A Study on the Discovery of the Perceptual Value of Yimeng Coloured Printed Fabric Patterns

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Abstract: As one of the first folk printing and dyeing techniques to be included in the Intangible Cultural Heritage List of Shandong Province, Yimeng Colour Printed Fabric is widely loved by the people of northern China for its rich and varied motifs, exaggerated bold colours and strong decorative qualities. Today, however, the Yimeng colour print is constrained by technology and form, and the patterns and colours are too traditional. It has become difficult to meet people's living and aesthetic needs, and there is a serious heritage crisis, and even some patterns and designs have begun to be gradually lost with the departure of the older generation of craftsmen. Therefore, we need to conduct an in-depth study of it from the perspective of inheritance and innovation. By systematically sorting out and analysing the compositional features of traditional colour prints, the Fuzzy analytic hierarchy process is used to summarise people's perceptual value expectations of their constituent elements. In this way, the basic principles and methods of introducing new designs into the composition elements of the colourful prints are identified, and the traditional elements are naturally integrated into modern products. This will gradually promote the integration of Yimeng colour prints with modern products and lifestyles, and give Yimeng colour prints more impetus for development.

Keywords: Artistic features, Yimeng coloured printed fabric, Fuzzy analytic hierarchy process

1. Analysis of the artistic characteristics of the Yimeng colour print pattern

The main components of the Yimou colour print are the composition of the pattern, the motif, the colour features, the symbolism, the subject matter and the use. The patterns are usually in the form of two types of flowers, namely the folding scattered flower and the group flower, and are organized in the form of freestanding, two-sided continuous and four-sided continuous patterns [1]. The composition is mainly composed of the main pattern plus the border and corner patterns, with the main objects generally having a high degree of fullness [2] and a central position in the whole picture. The Yimeng colour print has a wide variety of patterns, including botanical patterns, animal patterns, people patterns, objects, geometric patterns and text patterns [3] [4]. The content of the patterns contains beautiful symbolic meanings, which are extracted from ordinary life and are of great cultural value. The strong layering of colours is based on a strict "seven reds, eight greens and twelve blues" approach, with a large number of pure colours used in the main colours, and a high demand for colour tones, not just gradations of the same shade, but also a balance of contrasting colours and a fusion of multiple shades. The composition is also carefully structured around the position and area of the colours, with a large amount of white space used to make subtle transitions to ensure a warm and harmonious palette [5]. The most important factor in the formation of this colour palette is the warm, simple character and aesthetic of the Qilu people [6] [7] who often connoted hidden meanings in their texts or motifs. There is a wide variety of subjects [8], but most of them are derived from popular everyday life and folk myths and legends, and can be divided into three main categories: birds, animals, fish and insects, flowers, fruits and vegetables, and dramatic characters [9]. These images have been used in many similar ways, such as pictographs, to impart beautiful symbolic meanings to the images, and to illustrate the strong desire of the working public for civilisation and a happy life. The symbolic meaning of the Yimeng colourful prints can be broadly divided into four categories: praying for good fortune, marrying, inviting wealth and warding off evil spirits, depending on the content of the interpretation. The widespread popular use of Yimeng is due to the region's excellent production resources and strong cultural background. Many of the folkloric activities associated with auspicious celebrations, such as weddings and birthday celebrations, also drove the colourful prints into the daily lives of the public [10], making them an efficient vehicle for

communicating many of the associated folkloric meanings, such as praying for good fortune and avoiding misfortune. This makes them particularly distinctive for their time and geography.

2. Study on users' perceptual preference for Yimeng colour print patterns

2.1. Process for evaluating perceptual preferences of Yimeng colour print patterns based on FAHP method

(1) To collect the samples, the 186 samples collected were firstly screened by focus groups to eliminate similar samples, after which the design elements contained in the remaining 157 Yimeng colour print samples were classified into 78 different categories, including 21 animal elements, 25 plant elements, 11 nature and artefact elements, 12 character elements and 9 character A representative sample of each group was selected through focus groups and the questionnaire was then designed according to the classification of the design elements.

(2) Establishing a hierarchy of indicators, the target layer was a perceptual preference study of Yimou colour print patterns. Through the focus group method, the guideline layer was eventually divided into seven design elements, namely pattern composition, pattern, colour, symbolism, subject matter, unit pattern and usage. Sub-criteria layers were further divided into sub-criteria layers for the motifs and unit motifs, with the motifs further divided into plants, animals, people, objects, words, geometry and scenery; and the unit motifs further divided into size and sparseness.

(3) A representative sample was selected based on the classification of design elements, and a questionnaire on users' perceptual preferences for Yimeng colour print patterns was created based on the representative categories.

(4) Establishing a fuzzy judgement model for perceptual preference research on Yimeng colour print patterns based on the questionnaire results, and testing and analysing the results.

(5) Calculate the relative weights and draw conclusions to obtain users' perceptual preferences for Yimeng colour prints, and to find priorities for designers in product design.

The FAHP evaluation process for the perceptual preference of Yimeng colour print patterns is shown in Figure 1.
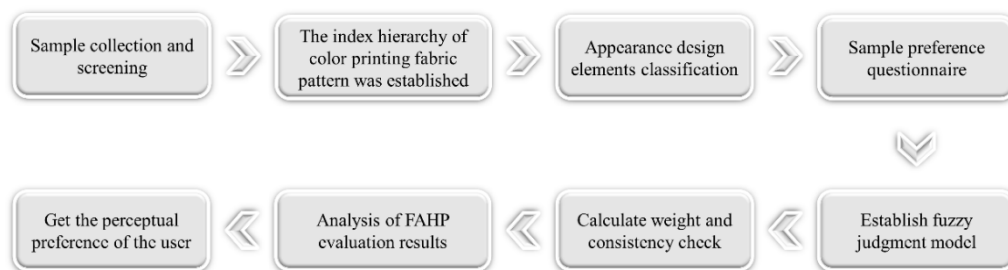

Figure 1: FAHP evaluation process for perceptual preference of Yimeng colour print patterns.

2.2. Model construction and establishment of weight values

2.2.1. Establishing a hierarchy of indicators

The hierarchical model of perceptual preference for Yimeng colourful printed fabric patterns is shown in Figure 2. The first layer is the target layer, i.e. the perceptual preference research of Yimeng coloured printed fabric patterns. The second level is the criterion level, i.e. the seven elements that influence the perceptual preference judgement of Yimeng coloured prints, which correspond to pattern composition, pattern, colour, meaning, theme, unit pattern and usage. The third layer is the sub-criteria layer, which further divides the motifs into plants, animals, people, objects, words, geometry and scenery; and the unit motifs into size and sparseness. The sub-criteria layer refines each of the design elements based on the samples collected. The sub-criterion layer has a strong or weak influence on the criterion layer, which is reflected in the results of the questionnaire.
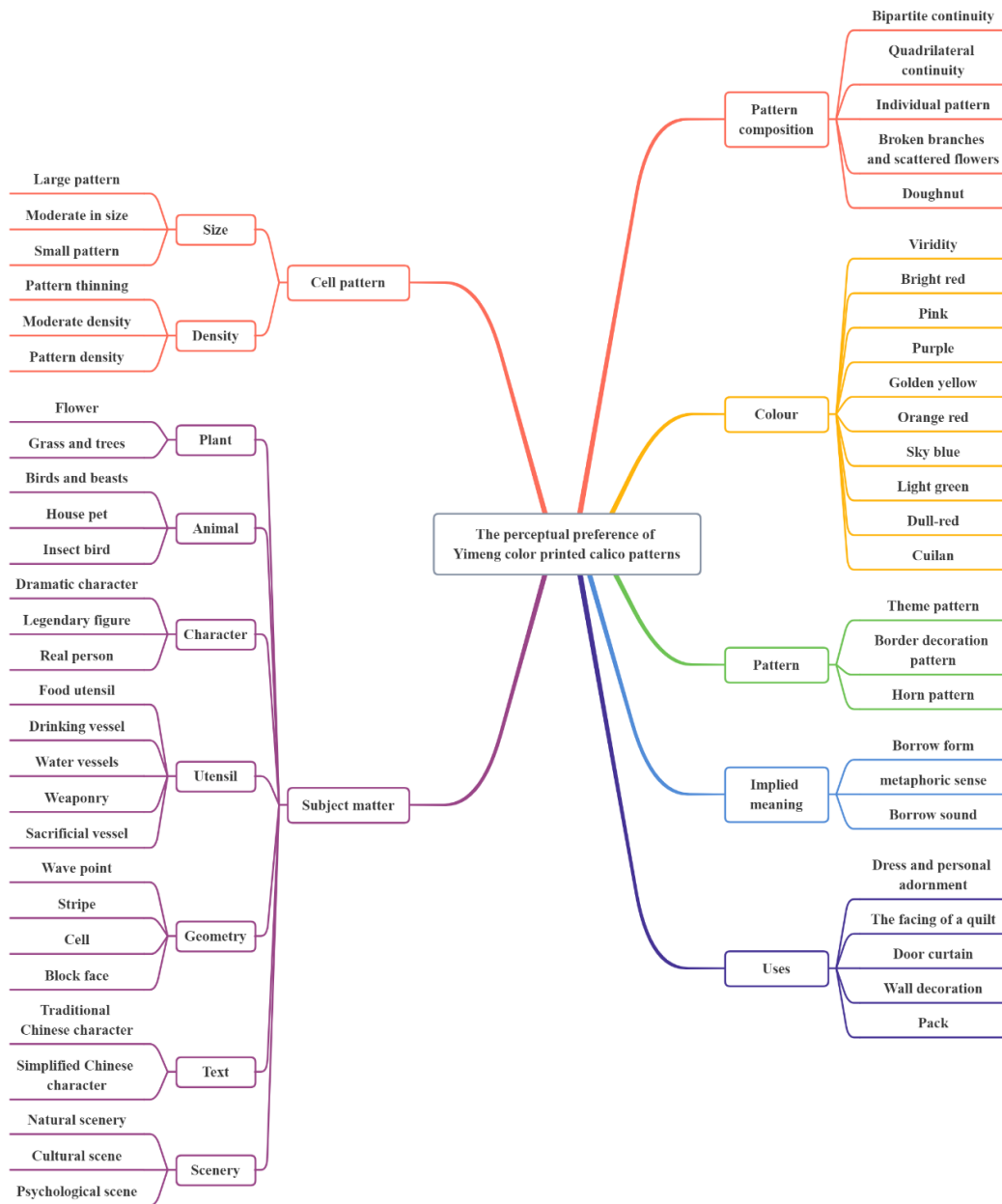
Figure 2: Hierarchical model of perceptual preference for Yimeng colour print patterns.

2.2.2. Pattern design element extraction and questionnaire preparation

Through morphological analysis of representative sample images, the design elements of the Yimeng colour print patterns and their characteristic categories were summarised. This is followed by the creation of a user perception preference questionnaire. The validity of this questionnaire is determined by the consistency of the test results. The questionnaire was tested on 20 industrial design students in this study, who were given a lecture training prior to the test. A total of 20 questionnaires were collected, 1 invalid questionnaire was excluded and 19 valid questionnaires were retained for the follow-up study.

2.2.3. Construction of fuzzy judgment matrix

Respondents only need to compare two elements of the same level with those of the previous level as a criterion, judge the importance relationship between them, and score the importance according to the scale, after which we recover the questionnaire and bring it into a triangular fuzzy matrix to derive the weight of respondents' preferences for each factor and indicator. In order to quantify the relative importance of any two options with respect to a criterion, a scale of 1-9 is used to express the magnitude of importance between indicators. The quantification and meaning of the defined terms of the 1-9 scale are shown in Table 1.

Table 1: Quantification and meaning of scale definition terms.

Scale grade	Semantic evaluation	Fuzzy value
1	Equally important	$1/m_{ij} = (1, 1, 2)$
3	Slightly important	$\tilde{3} = (2, 3, 4)$
5	important	$\tilde{5} = (4, 5, 6)$
7	Very important	$\tilde{7} = (6, 7, 8)$
9	Extremely important	$\tilde{9} = (8, 9, 9)$
2, 4, 6, 8	An intermediate value is inserted into two consecutive scales	$\tilde{2} = (1, 2, 3),$ $\tilde{4} = (3, 4, 5),$ $\tilde{6} = (5, 6, 7),$ $\tilde{8} = (7, 8, 9)$
1/3, 1/5, 1/7, 1/9	The ratio of the importance of elements i to j	$\widetilde{1/3} = (1/4, 1/3, 1/2)$ $\widetilde{1/5} = (1/6, 1/5, 1/4)$ $\widetilde{1/7} = (1/8, 1/7, 1/6)$ $\widetilde{1/9} = (1/9, 1/9, 1/8)$

2.2.4. Group decision data

Table 2: Group decision bottom weighting table.

Underlying elements	Conclusion values (global weights)	Peer weights	Higher
Two-party continuum	0.0250	0.1824	
Quadratic continuum	0.0278	0.2021	
Individual motifs	0.0281	0.2047	Pattern composition
lit. fold a branch and scatter flowers	0.0288	0.2100	
Regalia	0.0276	0.2008	
Thematic motifs	0.0513	0.3509	
Border motifs	0.0490	0.3351	Pattern
Angular motifs	0.0459	0.3140	
Emerald green	0.0141	0.0919	
Big Red	0.0151	0.0983	
Roses	0.0137	0.0889	
Purple	0.0164	0.1065	
Golden yellow	0.0150	0.0977	Colour
Orange-red	0.0160	0.1042	
Sky Blue	0.0168	0.1088	
Water Green	0.0160	0.1036	
Dark red	0.0150	0.0971	
Cuilan	0.0159	0.1030	
Borrow a form	0.0480	0.3368	
Borrowing	0.0492	0.3447	Implication
Borrowed sounds	0.0454	0.3184	
Flowers	0.0105	0.4842	Plants
Grass	0.0112	0.5158	
Birds and animals	0.0075	0.3465	
Domestic pets	0.0066	0.3070	Animals
Bird of prey	0.0075	0.3465	
Theatre Characters	0.0070	0.3439	
Legendary figures	0.0068	0.3333	People
Real people	0.0066	0.3228	
Tableware	0.0039	0.1921	
Drinking vessels	0.0040	0.2013	
Watercraft	0.0040	0.1987	Artifacts
Arms	0.0041	0.2039	
Rituals	0.0041	0.2039	
Polka Dots	0.0057	0.2636	
Stripes	0.0052	0.2408	Geometry
Plaid	0.0055	0.2531	
Block surface	0.0052	0.2425	
Traditional Chinese	0.0105	0.5342	Text
Simplified Chinese	0.0092	0.4658	
Nature	0.0078	0.3561	
Humanscape	0.0077	0.3482	Scenery
Mental Scene	0.0065	0.2956	
Pattern large	0.0206	0.3246	
Medium size	0.0217	0.3430	Size
Pattern small	0.0211	0.3325	
Pattern sparse	0.0216	0.3061	
Medium density	0.0266	0.3772	Sparse and dense
The pattern is dense	0.0223	0.3167	
Costumes	0.0286	0.2058	
Quilt top	0.0279	0.2005	
Door curtains	0.0270	0.1939	Uses
Wall decorations	0.0273	0.1966	
Packaging	0.0283	0.2032	

Table 3: Weighting table for intermediate levels of group decision making.

Nodes	Global weights	Peer weights	Higher
Pattern composition	0.1373	0.1373	Research on the perceptual preference of Yimou colour print patterns
Pattern	0.1461	0.1461	
Colour	0.1540	0.1540	
Implication	0.1426	0.1426	
Subject matter	0.1470	0.1470	
Unit patterns	0.1338	0.1338	
Uses	0.1391	0.1391	

The data from the 19 valid questionnaires above were counted and collated, and then brought into a triangular fuzzy matrix to derive the weights of respondents' overall preferences for each factor and indicator. The findings of the group decision bottom weights are summarised in Table 2 and the findings of the group decision middle weights are summarised in Table 3 respectively.

3. Results of FAHP evaluation of perceptual preference of Yimeng color print patterns

From the analysis of the FAHP test data above, the weight coefficients of each Yimou colour print fabric element category can be obtained and the following results can be drawn from the experimental data: colour (0.154) is the most important Yimou colour print fabric design element to users, followed by subject matter (0.147), pattern (0.1461), symbolism (0.1426), use (0.1391), pattern composition (0.1373), and the design factor with the least weight is the unit pattern (0.1338). This means that of the seven design factors influencing the Yimou colour print, colour (0.154) has the highest weight. The priority is: colour > subject matter > pattern > symbolism > use > pattern composition > unit pattern, which shows that users are most concerned about the perceptual imagery brought by the colour of the Yimeng colour print design.

From the analysis of the data, it can be seen that among the pattern composition factors, the relative weight of folding scattered flowers (0.21) is the highest in the same category, so users tend to choose Yimeng colour print fabric with folding scattered flowers pattern style. This is followed by individual patterns (0.2047), four-sided continuous (0.2021), and group flowers (0.2008), with the least weighted design factor being two-sided continuous (0.1824). Therefore, among the design factors that influence the composition of the Yimeng colour print, the priority that designers should consider is: folding and scattering of flowers > individual pattern > four-sided continuous > group of flowers > two-sided continuous.

The second pattern factor, with the highest relative weight value, is the main pattern (0.3509), followed by the edge pattern (0.3351) and finally the corner pattern (0.314). Therefore, among the design factors influencing the design of the Yimou colour print, the priority that designers should consider is: main pattern > edge pattern > corner pattern.

The 3rd colour factor has the highest relative weight value of sky blue (0.1088), followed by purple (0.1065), orange red (0.1042), aqua green (0.1036), emerald green (0.103), big red (0.0983), golden yellow (0.0977), dark red (0.0971), emerald green (0.0919), and finally the least weighted design factor is peach red (0.0889). Therefore, among the design factors affecting the colour of Yimeng colour print, the priority to be considered by the designer is: sky blue > purple > orange red > aqua green > emerald green > big red > golden yellow > dark red > emerald green > peach red.

The 4th allegorical factor has the highest relative weight value of borrowing meaning (0.3447), followed by borrowing form (0.3368), and finally the least weighted design factor is borrowing sound (0.3184). Therefore, among the design factors that influence the meaning of Yimeng colour print, the priority that designers should consider is: borrowing meaning > borrowing form > borrowing sound.

The 5th inscription factor has the highest relative weight value of scenery (0.1496), followed by plants (0.1479), animals (0.147), geometry (0.147), people (0.1382), artefacts (0.1365) and finally the least weighted design factor is text (0.1338). Therefore, among the design factors affecting the Yimeng colour print theme, the priority to be considered by the designer is: scenery > plants > animals = geometry > people > artefacts > text.

The 6th unit pattern factor has the highest relative weight value of sparseness (0.5263) and the less weighted design factor is size (0.4737). Therefore, among the design factors affecting the unit pattern of the Yimou colour print, the priority to be considered by the designer is: sparsity > size.

Finally, among the use factors, apparel (0.2058) has the highest relative weight value, followed by packaging (0.2032), quilting (0.2005), wall decoration (0.1966), and the lowest relative weight value is for door curtains (0.1939). Therefore, among the design factors that influence the use of Yimou colour print fabric, the priority to be considered by designers is: clothing > packaging > quilting > wall decoration > door curtain.

4. Conclusions

The main objective of this study is to understand modern consumers' perceptions and aesthetic preferences of Yimeng colour print fabric patterns, to obtain feedback on users' intuitive perceptions of colour print fabric through perceptual evaluation and analysis of Yimeng colour print fabric patterns and their colour schemes, to convert the subjects' perceptual elements of colour print fabric products into quantitative values for design reference, and to further verify the feasibility and It is hoped that this can be applied to the present day. It is hoped that the characteristics of Yimeng colour print can be applied to modern products, and that the impact of different patterns on consumer psychology can be understood, so that the relationship between the colour scheme of Yimeng colour print and consumer psychology can be established and designers can be motivated to make products that match consumer perception.

References

[1] Gai Guanghui. Exploring the art of Yimeng color printing fabric. 2012. Soochow University, MA thesis.

[2] Wang Jia. A comparison of the artistic characteristics and application study of Taiwan flower cloth and Shandong folk color printing cloth. 2016. Southwest University, MA thesis.

[3] Zhang Mingyue. A study on the art of Shandong color printing fabric. 2016. Donghua University, MA thesis.

[4] Zhao Wei. An investigation into the path of living heritage of Shandong colored printed cloth. 2022. Shandong Arts Institute, MA thesis.

[5] Cui Shuang." The application of Linyi's colorful printed fabric elements in brand image design - taking the brand image design of "Daoxi" gift as an example." Shandong Trade Union Forum 22.05 (2016): 112-115.

[6] Lv Yuji, Wang Hongfu." Analysis and design application of Shandong color printing fabric patterns." Silk 54.03 (2017): 51-58.

[7] Dong Miao. Research on the inheritance and development of traditional colorful printed cloth patterns based on. 2021. Tianjin University of Technology, MA thesis.

[8] Wang Yu. Linyi Color Printed Fabric Information Communication Redesign. 2022. Shandong Institute of Arts and Crafts, MA thesis.

[9] Sui Wenwen. Exploration of Shandong traditional color printing fabric and innovative application of clothing. 2017. Beijing Institute of Fashion, MA thesis.

[10] Liang Bing." Research on the characteristics of Yimeng color printing cloth craft and inheritance development." Cultural Heritage. 05(2019): 151-158.