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Article

The Fabric Narrative of "Home": The Local Expression of Women's Red Art in Community Public Buildings

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Abstract: As an important form of traditional Chinese women's handicraft art, women's red carries rich cultural significance. In modern context, its regeneration and expression in public space, especially through the fabric narrative into the community architectural environment, has become an important medium connecting historical memory and contemporary expression, with the dual value of cultural heritage and spatial identity. This paper explores the path of local expression of women's red art in community public buildings through digital image processing and color analysis. The study firstly collects and pre-processes 152 images of women's red fabrics in different periods, extracts representative colors through K-means clustering algorithm combined with PCCS color system, and further analyzes the distribution of hue, brightness and saturation. The results show that the colors of women's red fabrics are dominated by red and blue, accounting for 50.16% and 30.82%, respectively; the brightness is concentrated in the middle and high range, accounting for 93.42%; and the strong hue is dominated, accounting for 27.41%. On this basis, the evaluation system of community public buildings' locality composed of 24 indicators was constructed, and the AHP method was used to complete the indicator assignment and validity test. 268 valid questionnaires were recovered from the empirical research of Y community, and the scoring results showed that the total evaluation score was 4.275, which verified the applicability of the system and the effectiveness of the art of women's red art to create the atmosphere of "home" in the space. The validity of the system and the effectiveness of female red art in creating the atmosphere of "home" in the space is verified.

Keywords: female red art; K-means clustering; PCCS color system; fabric narrative; locality; community public buildings

1. Introduction

In ancient times, weaving was mainly one of women's domestic activities, known as "women's hong", which covered a variety of skills such as weaving, embroidery, crocheting, knitting and so on, and it was an important way for women to show their talent and hard work [1]. For a long time, weaving was also regarded as a kind of "feminized" behavior, and it was the manual work that women should be responsible for [2]. In the family unit of ancient and feudal societies, weaving and related weaving activities were important economic means for women to survive [3-4]. Whether it is weaving, embroidery or knitting, women generate economic income for their families and maintain their livelihood through these skills [5].

At the same time, weaving is also an important way for women to pass on the family culture and skills, and many families pass on their weaving skills from generation to generation, which is not only an inheritance of skills, but also an inheritance of culture and values [6-8]. In such a traditional

perception, knitting, weaving, and women's honor are naturally endowed with femininity [9]. However, in modern society, with the emphasis on traditional culture and the love of handicrafts, weaving has gradually stood out from women's red skills and become a unique artistic creation carrier for female artists [10-11]. The role of weaving in women's life has gradually changed, witnessing women's growth, passing on culture and skills, and showing women's creativity and charm [12-13]. The community public buildings linked to the art of women's red are also endowed with a new meaning of expression, which has an important research value.

The revival of traditional handicrafts in contemporary society is not only about the continuation of skills, but also about the reconstruction of cultural identity and the regeneration of public space. As a unique medium of female expression in Chinese culture, women's hong, including weaving, embroidery, knitting and other forms of practice, is culturally coded in its patterns, colors and materials, and contains a deep understanding of nature, ethics and aesthetics. However, in the context of modern urbanization and the industrialization of architecture, the local expression of women's red art has often been marginalized, and its value and expression in community public architecture need to be systematically explored. As the basic unit of modern urban life, community is no longer just a carrier of functional space, but a field of emotional resonance and cultural reproduction. In this context, the use of women's red fabric as a visual and symbolic language to intervene in architectural space design is expected to evoke a sense of cultural belonging and spatial intimacy among residents, thus realizing the cultural construction of “home”. Therefore, how to effectively implant this traditional element into community architecture has become an important issue in cultural space design.

In this study, image color data mining is used as a technical path, combining the PCCS color system and the K-means clustering algorithm to extract the representative color values of historical women's red fabrics; then, we constructed a hierarchical analysis method for the evaluation of the locality system, and carried out a field survey to verify the adaptability and effect of this method in Community Y, with the aim of providing a feasible path for the re-creation of traditional culture in the modern space.

2. Color extraction algorithm for women's red fabric based on K-means clustering

In order to explore the practical effects of women's red art in fabric narratives, this chapter proposes a color analysis method based on the K-means clustering algorithm and the PCCS color system, and makes practical use of the proposed method.

2.1. Sample collection and image pre-processing

2.1.1. Women's Red Sample Collection

In order to further improve the scientific validity and credibility of the color data analysis, this study collects samples of women's red-related textile garments from several different dynasties or periods, most of which belong to the historical fabrics that are on display or have been displayed in the China Silk Museum, the Palace Museum, and the Hunan Provincial Museum, etc., and a few of which originate from folk collections or modern design works. The original images were obtained from the official websites of all registered museums in China. Since the art collections of women's red are relatively rare, the analyzed samples of the clustering algorithm include all the collections that can be searched for at present to meet the research theme. In this study, after the preliminary investigation, we collected and integrated a number of collection images in museums, and screened a total of 152 valid sample images of women's red textiles, which were classified into 6 pieces in the Shang and Zhou Dynasties, 20 pieces in the Qin and Han Dynasties, 3 pieces in the Wei, Jin, and North and South Dynasties, 13 pieces in the Sui, Tang, and Five Dynasties Dynasties, 42 pieces in the Song Dynasty, 12 pieces in the Liao, Jin, and Yuan Dynasties, 24 pieces in the Ming Dynasty, 19 pieces in the Qing Dynasty, 5 pieces in the Republican Period, and 8 pieces in the Modern Period. The modern period has 8 pieces.

2.1.2. Image preprocessing of women's red samples

Due to the uneven illumination or background inconsistency in some of the female red sample images, all sample images were pre-processed before color extraction and analysis, including two basic steps of subject keying and image noise reduction, to prevent the sample image quality from causing errors in the color extraction and data analysis of this study. The pre-processing link uses Adobe Photoshop CS6 “Selection Tools” in the “Quick Selection Tool” and “Magic Wand Tool” to key out the effective content of each sample image. Effective content, and all the effective content in the image of

the background of the temporary unified replacement of pure white to meet the $R = 255$, $G = 255$, $B = 255$, and in the subsequent K-means clustering algorithm analysis of all the pixels of the pure white background from the collection of samples points to be eliminated.

At the same time, for some underexposed images, Adobe Photoshop CS6 was used to remove the noise of the image subject. In Adobe Photoshop CS6, open the sample image, select "Filters" and "Camera Raw Filters" in the menu bar, open the Adobe CameraRaw filter window, select the "Detail" icon on the right side of the window, click to open the details interface, adjust the slider of "Reduce Noise" to reduce the amount of noise in the image, and adjust the noise reduction amplitude by adjusting the "Contrast" and "Brightness" sliders, or use "Sharpen" to retain as much detail as possible. Adjust to the desired effect to complete the image noise reduction.

2.2. Female red fabric color extraction method

2.2.1. K-means clustering algorithm principle and basic process

K-means clustering algorithm [14] is an algorithm that uses distance as a criterion and iteration and relocation as the basic steps. The purpose of this clustering algorithm is to divide a set into disjoint clusters according to a particular criterion and to realize that the data objects in different multiple clusters are as dissimilar as possible.The basic step-by-step flow of the K-means clustering algorithm is shown in Fig. 1.

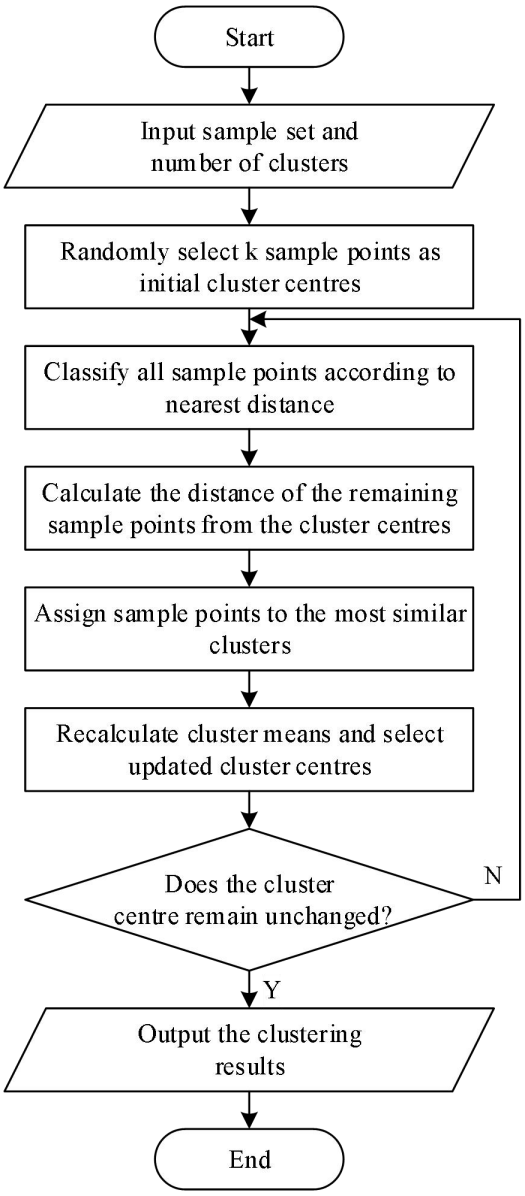

Figure 1. Flowchart of the K-means clustering algorithm

Among many clustering algorithms, K-means clustering algorithm has been widely used in the color extraction and data analysis of digital images, the algorithm has been more mature, more operable, with the function of intuitively displaying the color percentage of the situation, and there is a large space for improvement and innovation, therefore, this study selected K-means clustering algorithm to digitally analyze the color of women's red fabric.

2.2.2. Color extraction based on K-means clustering algorithm

In this study, the RGB mode is selected for image extraction of color values, and the sample set selected is the R, G, B values of each point set in the image. Python code was used to implement the K-means clustering algorithm for the images and parameters in the additive color method mode of RGB, 152 samples of women's red textiles from different periods were collected for color clustering and extraction analysis algorithmic steps are as follows:

(1) After importing the libraries required for the execution of the algorithm, input the sample set and set the desired initial number of clustering centroids k. The core metric for the sample clustering error sum of squares is SSE (sum of squares of errors), as shown in equation (1):

$$SSE = \sum_{k=1}^{K} \sum_{p \in C_k} \left| p - m_k \right|^2 \tag{1}$$

Where: K is the number of clusters. p is the sample, which is the center point of the k th cluster. The larger the K , the smaller the SSE , the higher the degree of sample aggregation. When k is smaller than the true number of clusters, the decrease in SSE will be large because an increase in k will dramatically increase the degree of aggregation of each cluster, while when k reaches the true number of clusters, then increasing k , the degree of aggregation payoff will rapidly become smaller, and the decrease in SSE will decrease abruptly, and then plateau as the value of k continues to increase. This first point of leveling off corresponds to the most appropriate k value.

(2) Read the sample image, modify the dimension and shape of the image according to the set parameters, define the name of the modified image and save it. Here the program carries out pre-analysis preprocessing, modifies the dimensions of the picture uniformly, makes the area of the cluster analysis the same size, and improves the efficiency of the program.

(3) Obtain the changed picture parameters, convert the dimensions of the picture array to a two-dimensional array, and obtain the dimensions of the converted two-dimensional array. The algorithm constructs a clusterer, performs clustering, and obtains the clustering centroids and labels. Among other things, the step of clustering requires dividing the corresponding sample points into clusters that are most similar to them according to the calculated Euclidean distance from each sample point to the center point to complete this clustering. When calculating the Euclidean distance between the color RGB values of the remaining sample points and the color RGB values of the center of each cluster, the Euclidean distance between the color RGB values of the remaining sample points and the color RGB values of the center of each cluster can be derived according to the formula of the Euclidean distance between the sample points as shown in Equation (2):

$$D = \sqrt{(R_0 - R_1)^2 + (G_0 - G_1)^2 + (B_0 - B_1)^2} \tag{2}$$

Where: D denotes the Euclidean distance between the color RGB value of the remaining sample points in this image and the color RGB value of the center of each cluster; R_0 , G_0 , B_0 denote the pixel color R , G , B values of the pixel color of the center of the current cluster, respectively, and R_1 , G_1 , B_1 denote the remaining pixel color R , G , B values of the sample points, respectively.

(4) Create a dictionary with the ratio value as the key of the dictionary and the RGB value corresponding to the center point as the value of the dictionary.

(5) Obtain the ratio value of the number of color points corresponding to each center point to the total number of points in the point set of that image, as shown in equation (3), respectively, and save each clustered center point with the corresponding $ratio$:

$$ratio = \frac{n_1}{n_2} \times 100\% \tag{3}$$

Where: $ratio$ denotes the value of the ratio, n_1 denotes the number of sample points with the same color as each center point, and n_2 denotes the total number of sample points in this image.

(6) Sort the dictionary according to the size of the corresponding $ratio$ values, and convert the sorted dictionary into a list and print the $ratio$ values and the corresponding RGB values of each clustered centerpoint .

(7) Visualize the centroid matrix generated by the algorithm. Using the clustering centroids generated by the algorithm, generate the corresponding matrix according to the set matrix width and height parameters to prepare for further data visualization.

(8) Obtain the actual height of the adjusted image, and for each clustering center of this sample image, generate a matrix A with the specification of height×width×ratio of that color×3.

(9) Fill the elements of the matrix A with the RGB values of each color, convert the visualization results to images and save them.

2.3. Empirical analysis of women's red fabric color digitization

In this section, the collected image samples of women's red fabrics are used for empirical analysis to verify the effectiveness of the proposed color extraction method based on K-means clustering algorithm.

2.3.1. Overall representative color extraction

The representative color of women's red fabric refers to the overall representative color extracted by

using the main color of a single image as a sample. For the extraction of the main color of a single image, the first step is the determination of the optimal number of clusters. Take a female red fabric image as an example, after the super-pixel segmentation processing to a certain extent reduces the number of colors in the picture, through the scatter plot represents the color distribution after segmentation as shown in Figure 2, according to the color type and color scatter plot can be initially estimated that the number of main color distribution is 7~9 kinds.

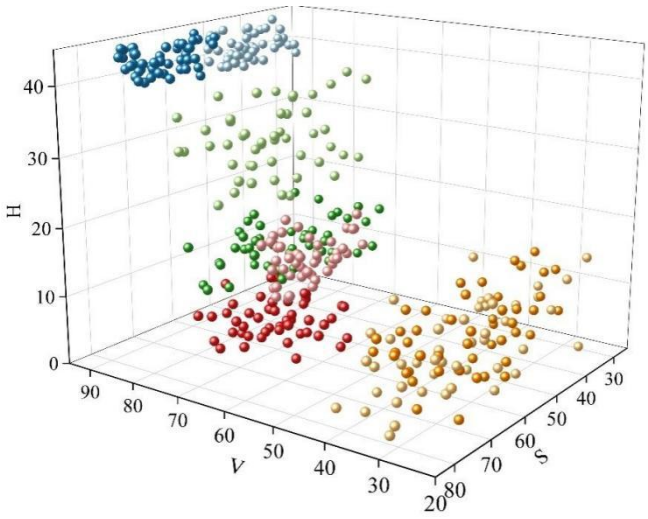

Figure 2. HSV color distribution scatter plot

In order to avoid the errors that exist in subjectively determining the optimal number of clusters, this paper also combines the contour coefficient method for objective analysis. The contour coefficient is a classical method for determining the optimal number of clusters, which evaluates the advantages and disadvantages of the clustering effect through the two factors of intra-family compactness and inter-family dispersion of the samples, and the closer the value is to 1 indicates that the clustering effect is better. The clustered mean contour coefficient values are shown in Figure 3. It can be found that the highest value is obtained when the clustering is 8, which is able to achieve better classification results compared to other numbers of clusters.

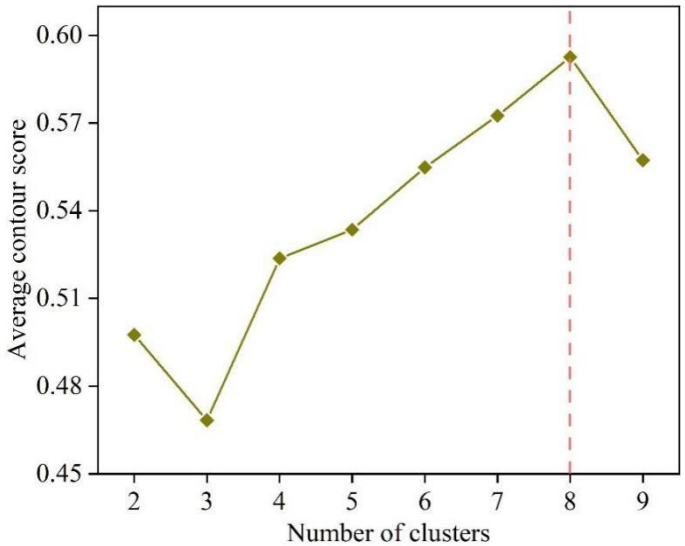

Figure 3. Clustering contour coefficient value

In order to further compare the clustering effect under different numbers, the sample distribution of each cluster was obtained after setting the number of clusters to 7, 8 and 9 respectively. It can be found that when the number of clusters is 9, there are clusters with scores lower than the average contour coefficient, and it can also be seen from the color card distribution that when the number of clusters is 9, it is basically splitting the 12.0% of the colors into two extremely similar colors. And although the

scores of each cluster are higher than the average contour coefficient score at category 7, there exists a cluster with significantly more samples than the other clusters, which does not separate the colors better. Combining the contour coefficient values and the clustered cluster contour map analysis can determine that the optimal number of primary colors for this tattoo image is 8 classes.

Accordingly, this method was applied to each of the tattoo pictures in the sample set, i.e., the respective optimal number of clusters was determined based on a comprehensive comparative analysis of their color types, color value distributions and clustered profile coefficients. The clustering extraction of 152 pictures was carried out separately, and a total of 633 color values and the color card and percentage of each color were obtained, which were used to analyze the composition and characteristics of the main color of each image, and to visually reflect the overall color of the screen and the proportionality between different colors.

In this paper, the number of secondary clusters of color data is determined according to the HSV color non-uniform quantization model to determine the number of clusters of hue (H) to 8 classes, saturation (S) and brightness (V) is set as 3 classes. The representative color extraction values and color cards are shown in Table 1, firstly, the hue values of 633 colors are divided into 8 categories by K-means clustering, and the final clustering centers in the color ring position are 15°, 40°, 88°, 145°, 212°, 260°, 320°, and 351°, respectively. Secondly, the brightness and saturation values in each class of colors are clustered separately to obtain the brightness and saturation represented by each color phase. Finally, the clustering results of each channel are integrated to obtain 24 representative colors and the corresponding color cards, which are sorted and numbered according to the size of the color values.

Table 1. Representative color extraction values and color cards

Number	Color value			Color card
	H/°	S/%	V/%	
C01		21	85	
C02	15	29	42	
C03		55	74	
C04		24	83	
C05	40	30	49	
C06		64	83	
C07		18	72	
C08	88	22	49	
C09		48	68	
C10		14	71	
C11	145	12	48	
C12		36	62	
C13		14	78	
C14	212	21	54	
C15		42	65	
C16		12	74	
C17	260	25	48	
C18		39	60	
C19		9	72	
C20	320	15	40	
C21		32	56	
C22		14	66	
C23	351	21	42	
C24		48	75	

2.3.2. Overall representative color analysis

(1) Distribution of three attributes of color

The overall color of the female red fabric image can first be analyzed in terms of the distribution of the three attributes of hue, brightness and saturation color. In order to facilitate the description, the HSV hue ring 0 ° as a starting point, the interval of 60 ° uniformly divided into red (R), blue (B), green (C), green (G), yellow (Y), purple (P), a total of six basic color system. Hue distribution as shown in Figure 4, in the hue cluster class column-dot line diagram can be analyzed that the color distribution of women's red fabric has a more obvious regularity, the color is mainly concentrated in the blue and red systems, accounting for 30.82% and 50.16% of the total number of colors. Green, cyan and other cold colors are used relatively less, the distribution is less than 4%.

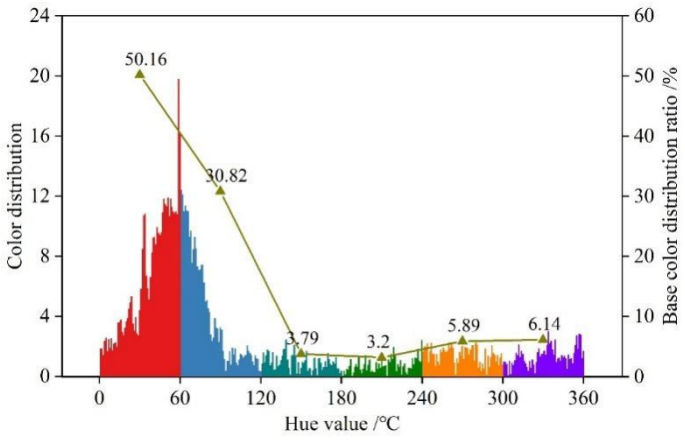

Figure 4. Hue distribution

For the analysis of color saturation and brightness, the scale was divided into three equal distances respectively, and divided into three levels of low [0%,33%], medium [34%,66%], and high [67%,100%], and the distribution of brightness and saturation is shown in Figure 5. The color brightness of women's red fabric patterns is concentrated in the medium-high brightness color range, accounting for 93.42% of the total data. Saturation overall high, concentrated in the distribution of medium saturation and high saturation between the low saturation colors accounted for only 3.72% of the overall data. It shows that the overall color of women's red fabric patterns using bright, contrasting colors to express the national rich, passionate emotions, brightness and saturation of the distribution of the law so that the women's red fabrics as a whole tends to be more colorful, high-profile style.

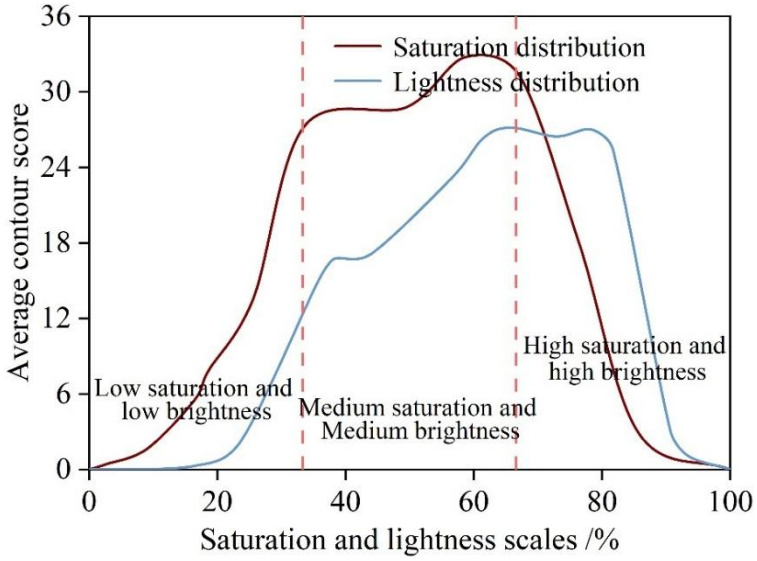

Figure 5. Saturation and lightness distribution

(2) PCCS Hue Analysis

The difference between color brightness and saturation in the intuitive visual perception is the difference in hue, which will also have an impact on color matching. In order to facilitate the realization of a variety of matching between colors, this paper uses the PCCS color system.

The brightness and saturation in the color system have a high degree of consistency with the S and V channel scales in the HSV space, which can realize the migration application of the color system to determine different hues through specific values. In this paper, the extracted color S and V channel values of the female red fabric pattern are divided equally and correspond to the hue system, so as to determine the different hues of the color and then calculate its percentage.

Through the overall hue analysis, it can be seen that the color hue of the female red fabric pattern is relatively concentrated in five hues. Among them, the strong tone color distribution is the most, accounting for 27.41% of the overall number of colors. Followed by bright tones and soft tones, accounting for 18.54% and 12.47% of the overall color, light tones and light tones and other tones with weak color tendency only account for about 6% of the overall hue. The 24 representative colors are categorized according to their color values, and the average values of saturation and lightness of each color in each hue are concentrated in strong tones, bright tones and soft tones in descending order. Combined with the previous research on Chinese social history and cultural information, the colors in ancient China were limited to traditional dyes, and the colors were mainly monochromatic, advocating bright colors with distinctive characteristics of the times.

3. Evaluation of locality in public buildings in communities oriented to women's art

This chapter explores the effect of the local expression of women's red art in community public buildings by constructing a system for evaluating the locality of community public buildings, i.e., evaluating whether women's red art is able to create the atmosphere of “home” in the fabric narratives.

3.1. Determination of the index system for evaluating the locality of community public buildings

3.1.1. Interpretation and typology of indicators

In this paper, two research questionnaires were created to evaluate the selection of indicators based on the set of in situ design indicators under each of the two dimensions. Questionnaire 1 was designed for graduate students in architecture and practitioners with architectural education background to score the indicators under the ontology construction dimension in terms of their relevance to the evaluation of in situ design. The second questionnaire was directed to residents with rich community life experience to score the importance of the indicators under the built-use dimension.

According to the scoring results of the above questionnaire, this paper finally determines a total of 24 evaluation indicators, including community public buildings in the evaluation index system shown in Table 2. The indicator system consists of guideline layer, factor layer, indicator layer, classification of evaluation object and explanation of indicator evaluation content. From the perspective of scientificity and accuracy of indicator evaluation, the indicators in the system are divided into two categories again. One is the professional evaluation indicators used for analyzing and evaluating by architectural professionals, and the other is the usage evaluation indicators used by community residents to understand the evaluation from the usage perspective. According to the different categories of indicators, in the specific operation of the final evaluation system, the evaluation and scoring will also be carried out by both groups of architectural professionals and users.

Table 2. Evaluation index system of local characteristics of community public buildings

Criterion layer	Factor layer	General indicator layer	Indicator classification	
			Professional evaluation indicators (P)	Usage evaluation index (U)
Ontology construction (A1)	Pre-planning (B1)	Collection of residents' wishes (C1)		U
		Functional requirements are met (C2)		U
		Site selection (C3)	P	
	Overall planning (B2)	External space environment design (C4)	P	
		Architectural layout form (C5)	P	
		Roof shape design (C6)	P	
	External form design of the building (B3)	Facade modeling and exterior decoration design (C7)	P	
		Architectural color (C8)	P	
	Internal space design of buildings (B4)	Scale ratio (C9)	P	
		Functional division in use (C10)	P	
		Creation of spatial characteristics (C11)	P	
		Structural system and performance (C12)	P	
		Interior decoration and renovation (C13)	P	
	Construction technology and construction (B5)	Traditional construction techniques are used (C14)		U
		The application of ecological innovation technologies (C15)	P	
		Material selection and texture (C16)		U
Completed and put into use (A2)	Building material benefit (B6)	Harmonious architectural style (C17)		U
		Construction operation effect (C18)		U
		Enhancement of public vitality (C19)		U
	Usage effect (B7)	Indoor sensory experience (C20)		U
		Usage frequency (C21)		U
		Space application (C22)		U
	Psychological identification (B8)	Sense of belonging (C23)		U
		Sense of pleasure (C24)		U

3.1.2. Standardization of evaluation indicators

The indicators presented in Table 2 are qualitatively descriptive and need to be standardized in order to be included in a unified evaluation system. The standardization of indicators in this section is based on the Likert scale. The scale consists of a set of simple descriptions, and each statement has five answers: "strongly agree", "agree", "not necessarily", "disagree" and "strongly disagree", and each

answer has a cumulative score of 5, 4, 3, 2, and 1, respectively, indicating that in a public building, the evaluator's approval of the content of each indicator decreases from high to low. The sum of the scores received by each respondent for each question indicates the strength or weakness of their attitude towards the subject of the description or their different status. Therefore, each individual index of the evaluation system is divided into 5 scoring levels, and the standardization process of the indicators is completed. In the end, the architectural professionals and users who participated in the evaluation scored each indicator according to their personal choice.

3.2. Hierarchical analysis-based indicator assignment process

In this chapter, the hierarchical analysis method [15] was used to calculate the weights of the indicators for in situ evaluation. Firstly, by consulting experts in the field of community architecture and architecture teachers in colleges and universities, and comparing each indicator one by one, so as to derive the relationship of its importance. The steps for calculating the weights of specific indicators are as follows:

(1) Define the goal and establish the hierarchical structure. First of all, it is necessary to clarify the goal of the construction of the evaluation system of community public buildings in place, and secondly, to determine the representativeness of the selected indicators, followed by sorting out the hierarchical structure of the system.

(2) Construct judgment matrix. Through expert scoring, each level of indicators in the criterion level, factor level and indicator level is compared two by two to make a judgment on the relationship of importance, so as to get the judgment matrix of the importance of the indicators.

In order to quantitatively determine the importance of each factor, this paper uses a scale of 1 to 9 based on psychological descriptions. When comparing the indicators one by one, the four values of 1, 3, 5 and 9 indicate "equally important", "slightly important", "obviously important", "strongly important" and "extremely important". At the same time, 2, 4, 6, and 8 are added to the importance judgment between the above two adjacent measures, and the reciprocal of all measures from 1 to 9 indicates their opposite importance.

(3) Hierarchical ordering. The purpose of hierarchical ordering is to determine the order of importance of all the indicator elements at this level in relation to an indicator element at the previous level. According to this step, the maximum eigenvector of the judgment matrix can be calculated, which represents the degree of influence of the indicator elements in this level relative to the indicators in the previous level, that is, the weight value of each indicator in the hierarchical single sort.

(4) Hierarchical total sorting and consistency test. According to the results of the middle level single sorting of the indicator elements of the previous level, it is possible to calculate, based on the previous level, the importance of all the indicators of this level, that is, the total hierarchical sorting. In the calculation of weights, the judgment matrices entered need to pass the consistency test.

The consistency test is calculated based on the matrix theory, and the main steps are as follows:

$$C.I. = \frac{\lambda_{\max} - n}{n-1} \tag{4}$$

$$R.I. = \frac{\lambda'_{\max} - n}{n-1} \tag{5}$$

Where $\lambda_{\max}$ is the largest characteristic root. When the value of CR is less than 0.1, then the hierarchical total ranking passes the consistency test, otherwise the judgment matrix needs to be readjusted, and ultimately, the value of CR should be less than 0.1. where CR refers to the ratio of consistency metrics $C.I.$ to the average stochastic consistency metrics RI, that is:

$$CR = \frac{CI}{RI} \tag{6}$$

where CR is the stochastic consistency ratio of the judgment matrix and CI is the consistency index of the judgment matrix. It is given by the following equation:

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{7}$$

RI is the average stochastic consistency index of the judgment matrix, and the values of RI for judgment matrices of order 1 to 9 are shown in Table 3. When a judgment matrix's $CR < 0.1$ is $CI = 0$, it is considered to have satisfactory consistency, otherwise it is necessary to adjust the

indicator importance information in the matrix to make it consistent.

Table 3. *RI* values of the judgment matrices of order 1 to 9

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

3.3. Determination and Classification of Evaluation Levels

In this paper, the final scores based on the evaluation of the effectiveness of community public buildings in locality practice are divided into four grades of I, II, III and IV according to the numerical size, and their corresponding scoring intervals are [4,5], [3,4), [2,3), and [1,2), respectively. Grade I indicates that the community public buildings are well constructed in situ, and the users are highly satisfied with them as a whole. Grade II indicates that community public buildings are well constructed on the ground and basically satisfy the users' needs, but the use of local spatial environment needs to be optimized. Grade III indicates that the construction effect of the community public building on the site is average, and some of the construction and use effects meet the needs of the users and need to be further optimized. Grade IV indicates that community public buildings are poorly constructed on the ground, and cannot meet the daily needs of rural users.

3.4. Selection and weighting of indicators for the locality assessment dimension

This section selects and calculates the weights of the indicators in the constructed evaluation system for the locality of community public buildings based on the fabric narratives of women's red art, with a view to using them in the actual evaluation.

3.4.1. Indicator screening

Combining the original set of evaluation indicators in the dimensions of “ontology construction” and “completed use”, we use the expert scoring method and hierarchical analysis method to construct the indicator importance judgment matrix, and use SPSSAU to model and calculate the weight coefficients of the 24 indicators to improve the indicator framework of the evaluation system.

The statistical results of the correlation of the indicators for the evaluation of the locality of community public buildings are shown in Figure 6. The calculation results show that the correlation of all the elements is higher than 70%, which indicates that the selection of indicators of the proposed locality evaluation system is effective.

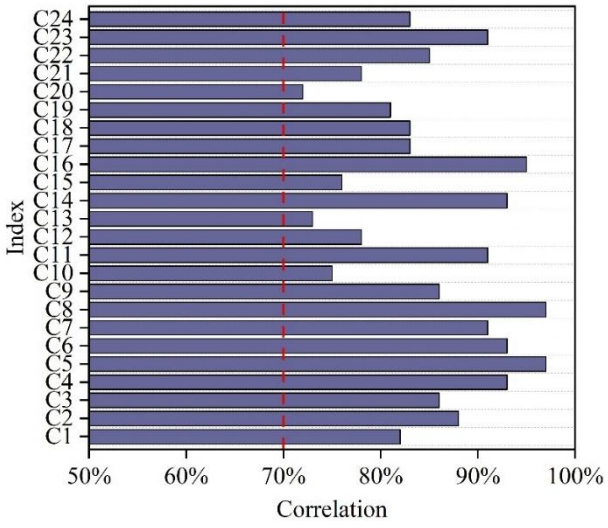

Figure 6. Correlation statistics of local evaluation indicators for community public buildings

3.4.2. Weighting analysis

Matching each evaluation index with the corresponding type of on-site elements of community public buildings helps to correspond the abstract indexes to the concrete references of community public buildings, and clarifies the specific content and evaluation object of each evaluation index from a professional point of view. As the weight calculation process of the evaluation indicators is

complicated, in order to ensure the scientificity and accuracy of the results, the overall model of the evaluation indicator system is constructed through SPSSAU hierarchical analysis software, and the judgment matrix of the questionnaire results is inputted into the software for the calculation of weight values and consistency test. Finally, the results were obtained through the arithmetic mean method. The evaluation indexes and weights of community public buildings' locality are shown in Table 4.

Table 4. Local evaluation indicators and weights of community public buildings

Criterion layer	Weight	Factor layer	Weight	General indicator layer	Weight
A1	0.491	B1	0.108	C1	0.024
				C2	0.056
				C3	0.028
		B2	0.142	C4	0.071
				C5	0.071
		B3	0.127	C6	0.029
				C7	0.035
				C8	0.019
				C9	0.044
		B4	0.086	C10	0.028
				C11	0.031
				C12	0.018
		B5	0.028	C13	0.009
				C14	0.013
				C15	0.003
				C16	0.012
A2	0.509	B6	0.149	C17	0.084
				C18	0.020
				C19	0.045
		B7	0.238	C20	0.081
				C21	0.041
				C22	0.116
		B8	0.122	C23	0.071
				C24	0.051

3.5. Validation of the dimension of in situ evaluation of public buildings in Y neighborhoods

In this section, public buildings in Community Y were selected for the validation of in situ evaluative dimensions. The study was conducted in May 2024 with permanent residents of the community as the research object, 280 evaluation questionnaires were distributed, and 268 valid questionnaires were recovered. The SPSS28.0 software was used to test the reliability and validity of the questionnaire, and the consistency coefficient obtained was 0.895, and the KMO test coefficient was 0.853, which indicated that the questionnaire had good reliability and validity, and the valid questionnaires were analyzed for the frequency of demographic variables by the SPSS28.0 software.

The analysis results show that the total evaluation score of the locality of public buildings in Community Y is 4.275, which indicates that the effectiveness of the locality creation of public buildings in Community Y is good, and the respondents' satisfaction with the current situation is high. Applying the four-quadrant principle, the average value of the weights of the indicators in the indicator layer, 0.0417, and the average value of the ratings, 4.2537, were used as the origin of the horizontal and vertical coordinates, thus dividing into four important quadrants. Specifically, the quadrant with high ratings and high weights is defined as the dominance zone, the quadrant with low ratings but high weights is defined as the repair zone, the quadrant with high ratings but low weights is defined as the maintenance zone, and the quadrant with low ratings and low weights is defined as the opportunity zone, and in this way, we constructed the quadrangle diagram model of the importance of each factor and the evaluation of the in-situ nature as shown in Figure 7. Comparing the quadrangle diagram of the index level, it is found that the public buildings in community Y show high locality in seven evaluation indexes such as residents' will solicitation C1, site selection C3, building layout form C5, roof modeling design C6, façade modeling and external decorative design C7, material selection and texture C16, and frequency of use C21, which are located in the dominance zone. The locality in the design of external space environment C4, scale proportion C9, meeting functional needs C2 and the use of traditional construction techniques C14 needs to be optimized, and these indicators are in the repair

zone.

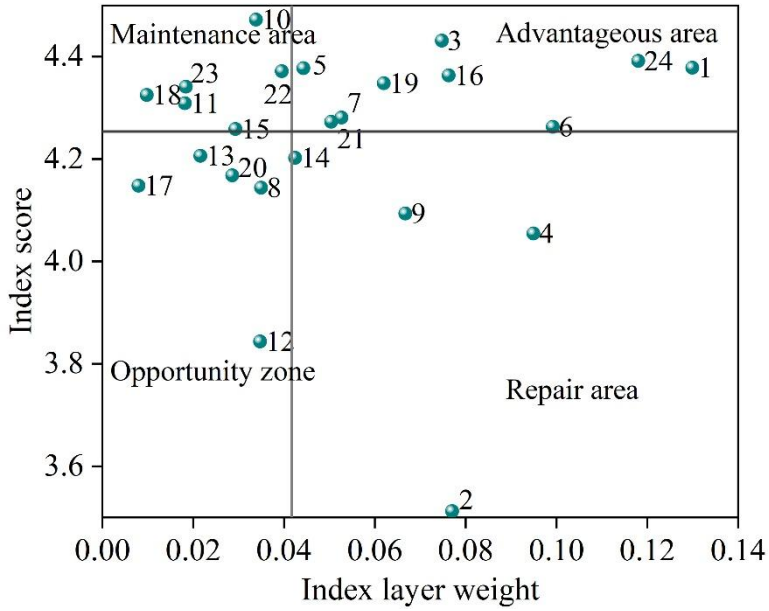

Figure 7. Scatter plot of the four-part model of the indicator layer

4. Connotation and value of the artistic characteristics of the local expression of women's redness

In order to better realize the local expression of women's red art in community public buildings, this chapter explores the connotation and value of the artistic characteristics of women's red tools.

4.1. Harmony and harmony, the beauty of self-compatibility

The sense of self-compatibility in design is reflected in the artistic characteristics of the women's red tools. In China, self-compatibility has three meanings: nourishment of the soul, harmony, and universality.

In terms of “large scale”, the creation of women's red tools originated from the human need for “clothing to cover the body”, and with the advancement of human technology, the types of women's red tools and their artistic characteristics are also changing. Especially in the Ming and Qing Dynasties, people's aesthetic sense of enhancement, women's red tools of artistic characteristics. Therefore, it is self-consistent in the unique context of each era, which reflects the broad universality of self-consistency.

From the “small scale”, the artistic characteristics of the women's red tools, its connotation of auspicious symbolism and its own shape, pattern, color and material of the artistic language, which reflects the meaning of harmony in the self-togetherness. Secondly, the concepts of harmony between heaven and earth and people, beauty and commonality contained in ancient wisdom carry a rich ecological philosophy, which provides important guidance for the internal consistency of the design of women's red tools. Therefore, the design of women's red tools not only needs to consider the external knowledge to meet the material needs of the modern people, but also needs to be aware of the inner, to obtain the correct metaphysical beliefs in order to satisfy the needs of the soul, which embodies the meaning of self-togetherness and nourishment of the soul. In short, no matter which way one looks at the tools, they are able to demonstrate an inner harmony and unity.

4.2. Taking from nature and going to nature

"Taking nature" is the process of human beings from being afraid of nature to adapting to nature, which is manifested in taking natural things and transforming them, and "going to nature" is the inevitable result of human beings adapting to nature, which is manifested in tending to nature the transformed things.

(1) Taking from nature. In the traditional Chinese idea of creation, the small peasant economy of self-sufficiency is regarded as the basis of all human material activities. This concept has forged an intimate and harmonious relationship between human beings and nature. Guided by this concept,

people live in harmony with nature, respecting it and relying on it. Therefore, in the design of women's red tools, the natural attributes of the tools are particularly emphasized. This is reflected in the common use of wooden materials, such as nanmu, camphor, cypress, elm, etc., which not only stems from the respect for nature, but also highlights the concern for the properties and qualities of the natural world. The production of women's red tools is not only a matter of taking materials from nature, but also a matter of using the tools for human beings, integrating human activities with the natural world, and achieving the realm of harmonious coexistence between human beings and nature. The choice of material is usually unified with its color presentation. This material and color unity not only makes the overall style of the tool more unified and coordinated, but also for the tool gives a unique aesthetic characteristics.

(2) To the nature. Zhuangzi wrote in the “Run of Heaven” that the highest state of man is to follow nature and tend to nature. The specific manifestation of the women's red tools is that their patterns and shapes reflect people's yearning for nature. The shapes and patterns of women's red tools are taken from natural themes, such as plants, figures, animals, and geometric shapes condensed by man through nature, all of which reflect man's yearning for and respect for nature.

4.3. People-centeredness and physical well-being

The most primitive and simple wisdom of anthropomorphic thinking is embedded in ancient artifact design, such as women's red tools. This thought has had a profound impact on the principles of ancient Chinese artifact making, combining human needs with the functions of machines to achieve the best design goals.

The design of women's embroidery tools often takes into account the principles of ergonomics, so that the user can operate more comfortably and efficiently, and achieve a state of physical and mental well-being. For example, the size of the embroidery frame conforms to the range of the human body working in a seated position, and the weight and shape of the thread wrapping board are within the range of the human hand. At the same time, the makers also pay attention to the aesthetic performance of the women's red tools, through the elegant curves, harmonious proportions and fine detailing, making the women's red tools not only functionally perfect, but also have more artistic and aesthetic value. This combination of ergonomics and aesthetics not only enhances the practicality of the tools but also increases the visual aesthetics. This shows that when making the tools, the makers put people at the center of the design, and regard them as the main body of the design and the object of service, rather than just focusing on the artifacts themselves.

4.4. From shape to shape, from form to meaning

“From form to form, from form to meaning” specifically refers to the subject's deep observation of objective natural things and the extraction of spiritual connotations from them. Then, through the refraction of the mind and the imitation of the imagination, a unique image is formed.

Among them, the kernel of “from form to form” is the generalization of form. Through the generalization of form, plants and animals are refined, the core of their forms are condensed and “implanted” into the stylized patterns of the tools. Contemporary designers should also deeply understand this design connotation, condense the shape, pattern and color in nature, extract the key design elements, and apply them in the design to create simple and concise design works.

Secondly, “from form to meaning” is not confined to the figurative form of the object performance, but pay more attention to the spiritual connotation of the design, and strive to go from the appearance to the inner, focusing on the expression of the meaning of things. From the figurative form to the imagery of meaning, this is the artistic characteristics of women's red tools embodied in the “form to meaning”. Today's designers should also focus on the emotional meaning of the design elements, so as to give them the inner spirit, in order to complete the design of the “self-fulfillment”.

“From form to form, from form to meaning” is a profound connotation embodied in the artistic characteristics of women's red tools, and today's designers should understand its deep meaning, and be good at refining the form of nature and condensing its spiritual connotation in the current design activities, so as to design works rich in meaning.

5. Conclusion

The color analysis results of women's red fabrics reveal that they are highly adaptable in expressing spatial atmosphere and emotional memory. The saturation distribution data shows that the proportion of medium and high saturation is 96.28%, which shows the visual impact and cultural tension of the pattern color; in the hue classification, the bright and soft hues together amount to 31.01%, which shows the aesthetic temperature and spiritual intention conveyed by the fabric. Further, in the

construction of the ground evaluation system, the core indicators such as functional demand satisfaction (weight 0.056), architectural layout form (0.071) and frequency of use (0.041) are all located in the dominant zone of the empirical four-quadrant diagram through the assignment of the SPSSAU and the AHP method, showing the multidimensional value of the art of women's red in the process of integration in the public space. Seventy-two percent of the residents resonated with the expression of “fabric narrative” in the architecture, further proving the practical feasibility and aesthetic adaptability of this path in enhancing the emotional dimension and cultural identity of public space.

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References

1. Banner, J. (2021). Two ends of the same thread: Reimagining the boundaries of personal and professional labour in eighteenth-century needlework and twenty-first-century crochet. Clothing Cultures, 8(1), 49-57.
2. Kim, S. (2018). A Study on the Expanded Application Trends of Needlework Techniques and Structures. Journal of Fashion Business, 22(1), 71-81.
3. Kelley, A. C. (2023). Searching for professional women in the mid to late Roman textile industry. Past & Present, 258(1), 3-43.
4. Whittle, J., & Hailwood, M. (2020). The gender division of labour in early modern England. The Economic History Review, 73(1), 3-32.
5. Luo, B., Ahmed, S., & Long, C. (2020). Bamboos for weaving and relevant traditional knowledge in Sansui, Southwest China. Journal of ethnobiology and ethnomedicine, 16, 1-9.
6. Basu, S. (2024). Women as carriers of the ‘weaving legacy’: Shifting labour and changing gender relations in marriage. International Journal of Educational Research Open, 7, 100361.
7. Nugroho, C., Nurhayati, I. K., Nasionalita, K., & Malau, R. M. U. (2021). Weaving and cultural identity of Batak Toba women. Journal of Asian and African Studies, 56(6), 1165-1177.
8. Hwang, S. H., & Huang, H. M. (2019). Cultural ecosystem of the seediq’s traditional weaving techniques—a comparison of the learning differences between urban and indigenous communities. Sustainability, 11(6), 1519.
9. Xue, M. M. (2024). High-value work and the rise of women: The cotton revolution and gender equality in China. Available at SSRN 2389218.
10. Abou Hashish, H. Z. (2017). Handicrafts role in the development of the contemporary creative economy. In 1st International Conference of the Faculty of Specific Education Kafrelsheikh University, Egypt (Vol. 1, pp. 838-879).
11. Yadav, U. S., Tripathi, R., & Tripathi, M. A. (2022). Global handicraft index: a pioneering approach and developing strategies for promotion completion and Welfare of Artisan in the Digital World. Bank and policy, 2(1), 59-80.
12. Ying, X. (2023). Study on the Innovative Application of Virtual Simulation Technology in the Protection and Inheritance of Needlework Art. Revista Ibérica de Sistemas e Tecnologias de Informação, (E55), 494-503.
13. Lonchinskaya, T. E., & Nosan, T. M. (2021). Understanding the integration of needle and bobbin lace in works of applied art. Problems of education and teaching in the era of digital society: Collection of Scientific Articles, 8, 51.

14. Adolfo Molada-Tebar, Ángel Marqués-Mateu, José Luis Lerma & Stephen Westland. (2020). Dominant Color Extraction with K-Means for Camera Characterization in Cultural Heritage Documentation. Remote Sensing,12(3),520-520.
15. Araya Kahsay. (2024). Application of Fuzzy Analytical Hierarchy Process in Land Suitability Evaluation for Faba Bean Crop. Agricultural Research,(prepublish),1-13.