

## **UNDER THE INFLUENCE OF HUIZHOU MERCHANT CULTURE, RESEARCH ON SPATIAL MORPHOLOGY OF HUIZHOU ANCIENT VILLAGE LANDSCAPE BASED ON SPATIAL INTELLIGENCE ANALYSIS**

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### **Abstract.**

The modularity of the spatial design vocabulary in new villages is a fairly common phenomenon in village landscape design, and it is one of the primary sources of problems like the deterioration of local features and the spatial incompatibility with spatial behaviour. The elements between homes in old villages are a product of the long-term adaptive growth of the villagers' daily life and village environment under mutual impact, and the study of the modularity of the elements between houses can aid in enhancing the vocabulary of the new village spatial design. Using the ancient villages in Huizhou as an example, the research methodology of the inter-house element pattern of ancient villages is examined from three viewpoints, namely, classification, illustration, and association with spatial behaviours of inter-house components. The Huizhou Maotian New Village's landscape design incorporates the inter-house element model, and the optimisation approach for village landscape design based on the inter-house element model of prehistoric communities is also covered. This is beneficial for developing and promoting the regional vocabulary of spatial design and avoiding over-reliance on the city's existing plazas, lawns, and tree pools, which could lead to indiscriminate design.

**Keywords:** Huizhou Merchant Culture; Landscape space; analysis

### **1 Background of the study**

#### **1.1 Modularity of new village space design vocabulary and the problem of a thousand villages.**

Geographical traits are the shared history and cultural sensibility of the communities in a small area, developed under the mutual influence of neighbourhood dwellers and the environment, and are a significant factor in determining the quality of life of the residents and the continuation of the development of the local landscape, with the capacity to transmit the landscape personality in the process of development and evolution of the regional landscape [1]. Experts and academics have been debating the issue of the new village's weakening regional characteristics for a long time, arguing that rather than slavishly replicating urban landscapes, the village should focus on maintaining its rural landscape qualities [2-3]. Instead of excavating along the regional characteristics of the situation's local

village space elements, village landscape design in the production of just regional, economical, simple material design plaza and tree pools and other urban design vocabulary. If the same design vocabulary is utilised for village landscape design across diverse provinces and towns, undermining regional uniqueness, the problem of "one side of a thousand villages" will necessarily occur as seen in figure.



Figure 1 Weakening of regional identity

### 1.2 The issue of inappropriate spatial behaviour in the new village space

The problem of spatial mismatch with spatial behaviour is pervasive in emerging settlements. In their assertion that "some problems in village design are usually caused by the designer's inadequate understanding of the villagers' way of life, for example, it is difficult to ensure daily agricultural production in new rural environments, and there is no place to store farming tools and raise livestock.....," Dong Jianhong and Shi Nan et al. specifically address this issue.[4]"Village landscape design must pay greater attention to the daily lives of villagers than to functional zoning and graphic design, and it must have a good understanding of the actual needs of residents [5] and the associated space kinds.

The villagers will autonomously alter the new village space in accordance with their own self-will because there aren't any spatial types that match their spatial behaviour in the new village. This will lead to even more disagreement and strife between the villagers and the management as well as among them, which is frequently only momentarily alleviated by the manager's force.

### 1.3 Research on the arrangement of inter-house components in prehistoric settlements aids in resolving the aforementioned issues

The term "inter-house elements" refers to the parts that make up village homes, including both structural and non-structural elements like scaffolding, enclosures, and lamps in the area that is within the settlement entity's boundary, such as levelling, sunbathing areas, alleyways, and other elements of public activities. In order to explore the composition of local village plan form and broaden the language of new village design, the inter-house element has been offered as a concept for the enhancement of the composition of village space form. It is intended to address the problem of spatially inappropriate behaviours caused by the overuse of contemporary community elements, such as plaza, lawn, tree pool, and other indistinguishable designs of the new village, as well as the weakening of regional characteristics.

The interstitial elements of ancient settlements reflect regional peculiarities. These elements of the houses have taken on new categories and forms, which in turn reflect the local characteristics of the settlements. Ancient village characteristics are the outcome of long-term adaptation and development of the villagers' everyday activities, cultural practises,

and natural surroundings under the influence of one another. In Huizhou ancient villages, inter-house elements include flatness, edges, preahu, mendang, tianleng, ports, sunbaths, vegetable gardens, creeks, drains, dripping ditches, etc.; in Shanxi ancient villages, inter-house elements include small hillsides, kiln courtyards, pingtian, sunbaths, stone mills, watchtowers, etc. Both historic settlements have distinctive regional characteristics.

Ancient village inter-house components reflect the people' spatial behaviour. The villagers' way of life and spatial behaviour will be impacted by modifications to the inter-house features of the village [6]. Different spatial behaviours correspond to various inter-house elements, for instance, the ancient village inter-house element "Vegetable Garden" can meet the needs of the villagers for daily vegetable growing, "Preah Vihear" can meet the needs of the villagers for storing firewood and agricultural tools, "Cloister" can meet the needs of the villagers for raising livestock, and so on. Preah" can provide for the inhabitants' livestock-raising needs. The village space does not fit the inhabitants' spatial behaviour because it lacks components that relate to those habits. Some village landscape designs overly rely on existing inter-house components like squares, lawns, tree pools, etc. from the city, ignoring the need of preserving the inter-house aspects of nearby villages. The type of village spatial behaviour and the accompanying inter-house components must be identified in order to assist the village landscape design in meeting the needs of the villagers' spatial behaviour. Because of this, the issue that the new village does not accommodate the residents' spatial behaviour is actually that the new village landscape design does not preserve the inter-house aspects of the nearby ancient villages.

This information serves as the basis for this paper's optimisation strategy for village landscape design from the perspective of inter-house elements, which argues for the use of local village inter-house elements as the spatial design vocabulary in the process of landscape design of new villages and promotes a fix for the modularity of the spatial design vocabulary of the existing villages and the resulting weakening of the regional characteristics and spatial organisation. It is necessary to summarise the inter-house patterns in the various regional villages, using the inter-house components of region A to design the village space in region A and region B's inter-house components to build the village space in region B. Using the ancient villages in Huizhou as an example, the research methodology is developed from three aspects: classification of inter-house elements, illustration of inter-house elements, and correlation between inter-house elements and spatial behaviours. The analysis of classification and illustration of inter-house elements corresponds to the issues of weak regional characteristics and one-sidedness of thousands of villages, aiding designers in understanding which inter-house elements can be used in the design of new villages in local villages and what the elements' forms are. The investigation of the relationship between spatial behaviour and inter-house components relates to the problem of spatial mismatch.

## **2 Overview of the study**

The study of regional features encourages the preservation of local traits. For the sustainable development of local landscapes, UNESCO's "Recommendation on Historic Urban Landscapes" emphasises the necessity of locating and utilising local design elements [7]. This is because, in both design theory and design practise, the issue of "a thousand villages one-sided" has been highlighted. The "standard style of things" is called a pattern, and it has significant generalisation and popularisation[8], The importance of the discipline

of landscape architecture is expressed in the promotion of interaction between people and nature, the comprehension of how the natural environment affects the development of human settlements, the assessment of the landscape environment's quality, and the relationship between life and art, space and time, the past and the future, among other things[9]. The research and application of elemental patterns provide a method of thinking and technical route for the creation and continuation of the regional characteristics of the village landscape [10]. The study of local elements lacks attention to the elements between the houses of ancient villages. The excavation of local elements of villages focuses on the spatial morphology of ancient villages [11-12], architectural details and building materials [13], applicable technologies [14], the culture of farming and studying in ancient villages, clan culture, anecdotes of celebrities [15], as well as customary features, handicrafts, operas and special snacks [16], and the research on elements constituting the spatial morphology of the villages is comparatively less. The research on village spatial morphology involving village elements focuses less on the specific categories of spatial morphology making up elements of ancient villages (geomorphology, ohlao, pingdi, punto, dripping ditch, and water pond, etc.) and more on the characteristics of village spatial morphology with buildings and their enclosed lanes as the ontology [17]. Despite the fact that the study of buildings and lanes as elements can identify the spatial form structure of villages, it would be more beneficial to explore the spatial form characteristics of villages in detail, specifically, and systematically if the study of inter-house elements was supplemented on the basis of the existing studies. Landscape is a language [18], and the language of landscape design encompasses the discourse, grammar, and chapter of landscape design[19]. From the perspective of linguistics, elemental monolithic study (vocabulary) as the basic constituent content is a necessary step to study village spatial morphology (grammar).

Iconography is a schematic symbol that serves as a shorthand for images and has the ability to express creativity and design skills as well as to comprehend and analyse a particular form [20]. In addition to being a design tool, iconography also serves as a language for the expression and communication of design [21], and if it is neglected during the design process, it may hinder effective communication between design participants [22-23]. It is a common research strategy in many fields to use diagrams to represent actual forms, as demonstrated by the use of diagrams by Michael Conzeen to represent the "flat unit" in town morphology [24], Bill Hillier to express the axes abstracted from the street space and further generated configurations in the study of spatial syntax [25], and Christopher Alexander to visually represent a total of 253 patterns of towns, neighbourhoods, houses, etc. [26]. Diagrams are helpful for understanding the formal properties of the non-regular geometry of the inter-house elements of ancient villages. They are also crucial for the study of these inter-house components. Related studies on the spatial forms of ancient villages include describing and analysing the spatial forms of centralised, clustered, banded, radiating, symbolic, and flexible types of ancient villages through diagrams and textual analyses [27], analysing the categories and forms of public open spaces in Huizhou ancient villages through diagrams [28], and describing the village house maps in the clan atlas of Huizhou ancient villages through diagrams. Additionally, research on village spatial behaviour is primarily focused on describing and discussing rural social production and life, etc, and theoretical research on the

study of spatial behaviour related to spatial elements is still in its early stages and requires further development.

In conclusion, this paper explores the research methodology of the element pattern and its use as a design vocabulary in village landscape design. It does this by using the element pattern between houses in ancient villages as its research object and by looking at three aspects of the element pattern—classification of the elements, illustration of the elements, and correlation between the elements and spatial behaviour.

### **3 Research Methods**

#### **3.1 Selection of Cases**

As an illustration, consider the study of the inter-house elements in three prehistoric Chinese villages—Guanlu Village, Guxi Village, and Fengwu Village—on their classification, spatial forms, and spatial behaviours. We give the paper's thoughts on the investigation and use of the inter-house element patterns found in the ancient villages as well as a summary and explanation of the regional inter-house element patterns. The villages of Guanlu, Guxi, and Fengwu are located in China's Huizhou area, and each has a rich historical heritage. However, the architectural and spatial patterns of Guanlu Village, Guxi Village, and Fengwu Village have been effectively preserved. Rapid urbanisation, spontaneous construction by villagers, and the growth of tourism have disrupted the architectural and spatial patterns of several historical villages. There are approximately 230 permanent residents in Guanlu Village, 120 permanent residents in Guxi Village, and 200 permanent residents in Fengwu Village. It was discovered through on-site observation that the local villagers essentially continue the local production and way of life over the course of nearly 20 days of village research in each village. The well-preserved architectural and spatial patterns, as well as the continuation of the daily life style are the main reasons for choosing the above three villages as research cases.

#### **3.2 Classification of inter-house elements**

In ancient villages, inter-house features were categorised in order to find the many types of elements that may be employed in the planning of village spaces and prevent relying too much on already existing elements from the city. There are three primary steps in the classification of inter-house components in prehistoric settlements. 1) Counting and classifying the inter-house element categories by speaking with and interviewing senior residents, including past village heads, clerks, and retired teachers. They were chosen because the importance of local heritage has been disregarded in the name of urbanisation, and the village's past has been steadily forgotten. These villagers are more knowledgeable about the village's history than children and other villagers, which makes it easier to classify the inter-house aspects and comprehend what each element means in each location. 2) Conduct fieldwork with these people to complete the unmarked categories of the elements and to mark the numbered categories of the elements using the method of map marking. 3) Conduct fieldwork with these people to add map markings to the unmarked categories of the elements and to label the numbered categories of the elements. basic categories with labels. 4) Conduct an exhaustive review of the literature, including county records, walks, monographs, and theses, to further compile the inter-house element classifications.

#### **3.3 Drawing of inter-house elements**

Drawing illustrations of the elements between houses in ancient villages can help to accurately summarise and outline the specific morphological characteristics of the elements, provide designers with a foundation for their designs, and prevent the designers' lack of familiarity with the shapes and sizes of the elements between houses in ancient villages from having an impact on the village's regional landscape qualities. When drawing diagrams of the components between houses in old communities, it can be difficult to determine the limits of the elements between buildings in non-regular geometric patterns. The procedure comprises scanning the village's plane with a drone first, then utilising Agisoft Photoscan to produce a high-resolution replica of the plan. The high-resolution plan is then printed, and the drawings are then printed in colour at a scale of 1:200 (which can be done in blocks). Finally, the paper maps are marked with the following symbols: "Ancient villages between houses," "Ancient villages between houses," "Ancient villages between. In accordance with the "list of elements between houses in ancient villages," the boundaries of the elements were depicted on the paper map using field research and map marking techniques. The paper file was then converted into an AutoCAD electronic file before we left the village, making it convenient for us to return to the site later and add the missing information while mapping.

### **3.4 Analysis of the statistical relationship between inter-house components and spatial behaviour**

For village landscape design, understanding the relationship between inter-house elements and spatial behaviours is crucial because it reveals the kinds of spatial behaviours that are most directly tied to villagers' daily lives and their relationships with the components. According to Dong Jianhong and Shi Nan et al., "Some problems in village design are usually caused by the designers' inadequate understanding of villagers' lifestyles," regarding how village spaces can't keep up with the needs of spatial activities[4]. "Village landscape design can only meet the actual demands of villagers by comprehending the many forms of spatial behaviour of villagers and their interaction with inter-house features. The main methods for collecting spatial behaviour data are field observation and map marking, and since the data collection approach clearly identifies the location where the spatial behaviour occurs, the gathered spatial behaviour data corresponds to specific inter-house components. By comparing spatial behaviour data with inter-house elements, a data table of the relationship between inter-house elements and spatial behaviour can be produced. The relationship between inter-house elements and spatial behaviour can then be determined through further quantitative analysis of the data.

## **4 Findings from the Study: Inter-house Element Patterns in Huizhou Ancient Villages**

### **4.1 Classification of inter-house elements**

A total of 23 types of inter-house features were categorised and summarised for three historic villages—Guanlu Village, Guxi Village, and Fengwu Village—of which one is now being demolished; the other three are recently built elements in the development of village tourism. The categorical list of inter-house elements in Huizhou's historic villages highlights the significant differences between the inter-house elements of the old villages and the established design elements of the modern villages. It is difficult to see how these inter-house local features are incorporated into the landscape design of new villages in the region, despite

the fact that Huizhou villages include features like flatness, edge, port, preahu, and dripping ditches that demonstrate the regional characteristics of spatial patterns.

#### 4.2 Element Icons

Due to the elimination of these components during village expansion, only 22 different types of inter-house characteristics are shown in the existing pictures of Huizhou old villages. An overview of the shape characteristics of the inter-house components in Huizhou's historic villages is given by the images of the inter-house components in Guanlu Village, Guxi Village, and Fengwu Village while also emphasising the differences between these components and the regular geometric inter-house components in new villages as shown in figure 2-4. Design professionals can utilise the images of the inter-house components as a guide, and village planning can be improved with their guidance. Because the current method of village landscape design prioritises subjective experience to guide the design, resulting in the uneven quality of the many village landscape design practises, the degree of the designer directly affects the design quality. An objective basis for village space design is provided by depicting elements between buildings in older villages, which also ensures that local village characteristics will be preserved when new village landscapes are being developed.

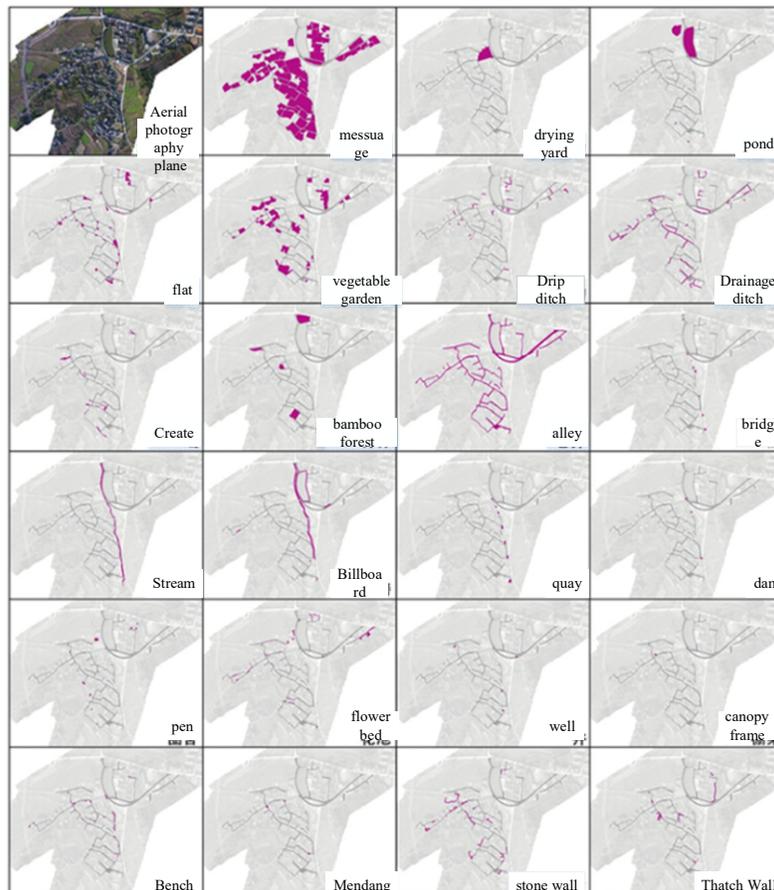


Figure 2 Element icon

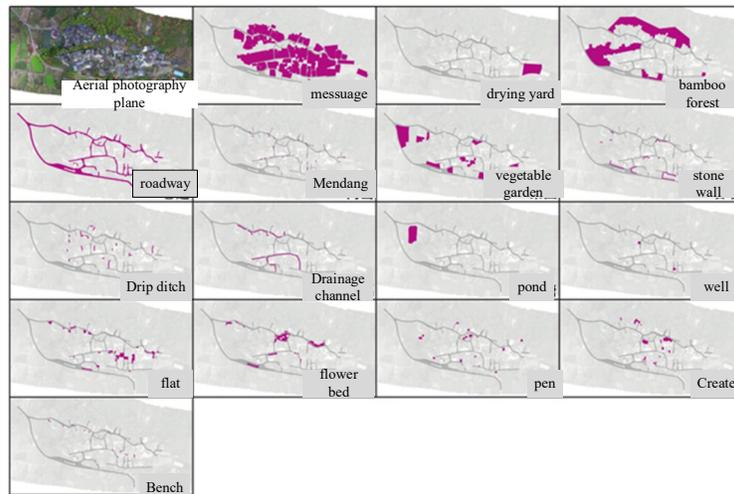


Figure 3 Element icon

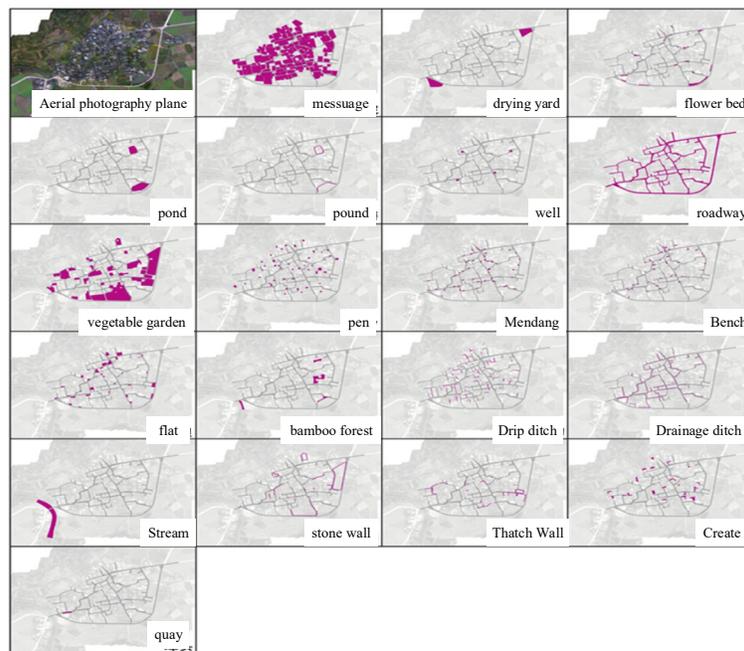


Figure 4 Element icon

### 4.3 The association between inter-house elements and spatial behavior

The study recorded a total of 25 spatial behaviours in three historic Huizhou villages: Guanlu Village, Guxi Village, and Fengwu Village. These behaviours included stopping and chatting, eating outside, strolling, farming, washing produce, washing clothes, selling produce, tending to produce, drying clothes in the sun, drying grains, tending to livestock, rearing children, sweeping streets, motorised vehicles, repairing farm tools, and using non-motorized transportation. The association between inter-house components and spatial behaviours was depicted using the statistical data, with the thickness of the lines representing the intensity of the related values. Seven different types of spatial behaviours were used to disperse the frequency of statistics: sitting and talking, eating outside, walking, halting to

talk, washing clothing, washing vegetables, and working in agriculture. As seen in figure 5, the 23 different inter-house features that make up the old villages of Huizhou include alleyways, stone benches, flats, ports, sunbathing yards, and vegetable beds. These six different categories of inter-house features make up 93.9% of all spatial behaviour. The statistical results only display the aspects that are currently directly associated to the daily spatial behaviours of the villagers, which does not suggest that features like water ponds and drippy ditches are irrelevant to spatial behaviours.

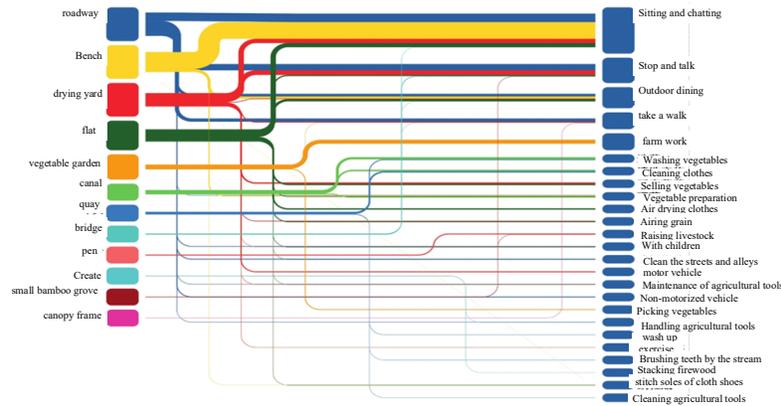


Figure 5 The relationship between home elements and idle behavior

## 5 Landscape Design of Local New Villages Utilising Inter-house Elements from Ancient Huizhou Villages

### 5.1 Application of inter-house elements

18 different local inter-house component kinds, including flat, dripping ditch, enclosure, and vegetable garden, were first selected for the Huizhou Mao Tian New Village's landscaping. Rebuild the demolished ancestral halls, temples, timber lights, and other structures. The ancestral halls, temples, and other components served as the venues for the expression and interaction of the villagers' beliefs and spiritual life over the period of the village's growth, which spanned hundreds of years. The water pond on the property is kept in tact, and bamboo trees have been planted all the way around the perimeter to offer a resting spot close to the village's entrance. Contrarily, imposing the design of features like streams and wells will not only raise the expense of construction and upkeep but also be unrelated to the way that space is being used right now. Therefore, in order to avoid becoming dogmatic, the choice and application of this portion of the elements is omitted, as indicated in figure 6.



Figure 6 New Village Landscape Design Plan

Second, when selecting and putting into place inter-house components, daily needs of the people are taken into account. The requirements of the Huizhou people have an impact on the landscape design of Mao Tian New Village. For instance, 78.7% of the statistics for the seven distinct types of spatial activities, such as sitting and speaking outside and dining outside, were carried by inter-house components such as lanes and flatness and accounted for 93.9% of the spatial behaviours. To ensure that the majority of spatial behaviours could be satisfied and to prevent the issue of mismatch between the design and spatial behavioural needs, these seven types of spatial behaviours were first planned, and the proportion of six elements in the landscape design of the new village was strengthened.

Once more, several components were added to and modified in accordance with the actual requirements of modern living. The majority of the alleys in Huizhou's historic villages are 1/2-meter walkways, making it challenging to accommodate the people's need for motorised mobility. Two-way roads are planned and developed along the community's perimeter, separating people and cars between within and outside the village in order to suit the inhabitants' needs for modern mobility and to ensure a quiet living environment inside the town. Additionally, it is mandated that homeowners walk fewer than five minutes to reach the driveway. When it's essential, widen the interior lanes so that cars can sometimes enter residences. To accommodate community meetings, the flat area near to the ancestral halls and temples has been enlarged. These kinds of components act as the centre of attention for a crowd. The flat space and sunbathing ground in front of the ancestral hall also give locals a location for square dancing, which is a favourite public activity of modern middle-aged and senior villagers.

## 5.2 Programmatic review

Regarding the overall spatial layout of the hamlet, the design respects and preserves the natural arrangement of the neighbouring ancient village while also taking into account the needs of the populace for contemporary transportation systems. The element diagram mainly follows their characteristics and distributional principles as it continues to distribute the 18 diverse external spatial element sorts of the adjacent old communities. The layout of the plan is modelled around the adjacent, naturally existing historic communities. The settlements' edges are used to designate two-way roads, and sideways parking is utilised to meet local demand for automobiles. Regarding the variety of village space types and how well they meet

spatial needs, as shown in figure 7, the diversified space types not only uphold the regional characteristics of the local villages and satisfy the villagers' original needs, but also transform the space to meet modern needs, fulfilling the functional needs of the villagers' life on the villages' exterior spaces. As a result, the design of the village's outdoor areas not only incorporates elements of adjacent historic villages, but it also provides a variety of rich spatial types to meet the different spatial needs of the inhabitants.

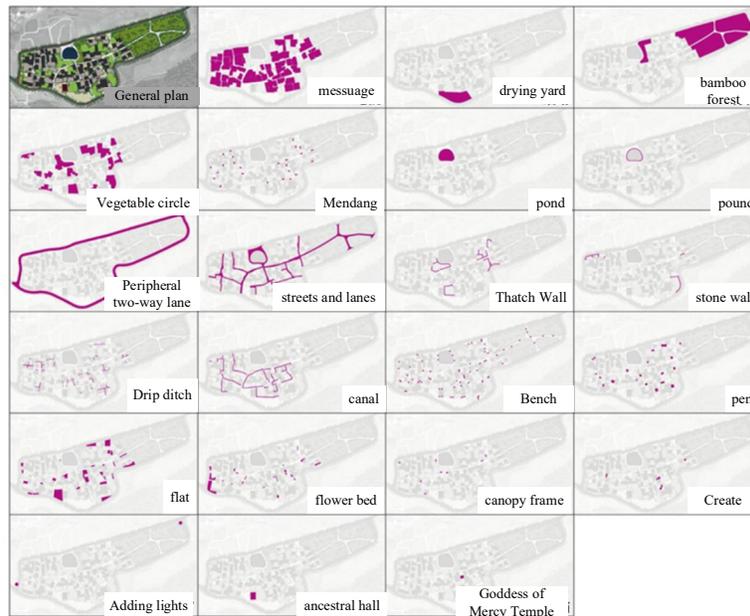


Figure 7 New Village House Elements

## 6 Conclusion

This article suggests a village landscape design optimisation technique based on the inter-house element layout of nearby old villages. It describes the inter-house element pattern of the historic Huizhou villages and how it is used as a spatial design vocabulary in the landscape design of nearby modern communities. The modularity of new settlements' spatial design vocabulary is the main topic of the article. In order to address the issue of the weakening of regional characteristics, it is important to categorise and illustrate the elements of ancient villages. The relationship between the elements and spatial behaviours establishes the types of spatial behaviours in the villagers' daily lives and the correspondence with the elements of h Different local village landscape designs need to have local design vocabularies in order to support the resolution of the design vocabulary modularity problem already present in the village landscape design, as well as to respect and maintain the regional characteristics of the village landscape design and to provide an objective basis. The village landscape design vocabulary is perfectly complementary to and suitable for the model that summaries the nearby old villages between the home elements. The inter-house element model requires regular updating and development. The element mode is the end result of long-term adaptive evolution of elements and villagers' daily living needs, even though for a while the morphological qualities of elements and villagers' space needs remained consistent. The elements of ancient villages between houses must be regularly updated and improved during the process of village landscape design since villagers' spatial needs change as society

develops. The use of the elements can help the village maintain its regional identity while better serving the actual needs of the residents.

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### **Author contributions**

The authors confirm contribution to the paper as follows: study conception and design: Xueping Tang; data collection: Xueping Tang; analysis and interpretation of results: Xueping Tang; draft manuscript preparation: Xueping Tang.

Consent for publication

All authors reviewed the results, approved the final version of the manuscript and agreed to publish it.

### **Data Availability**

The experimental data used to support the findings of this study are available from the corresponding author upon request.

### **Conflicts of Interest**

The authors declared that they have no conflicts of interest regarding this work.

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