

Research on the Promotion Path of Public Space Vitality of Traditional Villages based on GIS and Space Syntax

-- Take Nuhei Village as an Example

Jing Luo, Wei Chen, Huilin Wang, Shujing Li

Dianchi College, Yunnan University, Kunming 650228, China

Abstract

From the perspective of the three current situations of "social structure investigation - public space identification - spatial vitality status", and according to the logical idea of "element identification-analysis and evaluation-information spatialization-relationship establishment", syntactic analysis, GIS spatial distribution analysis, GIS status spatial vitality analysis are carried out, and the causes of the use of public space in the current villages are analyzed and continuously corrected, and the influence scheme of the vitality of traditional village public space is obtained in the analysis and feedback between the three plates. And propose an optimization path.

Keywords

Traditional Villages; GIS; Spatial Syntax; Vitality of Public Spaces; Lift Path.

1. Connotation of Public Space in Traditional Villages

The public space of the village is not only the place for the construction of public activities in the rural settlement, but also the form of public activities related to it. The development of public space in villages is influenced by many factors, such as social, economic and cultural. The renewal and reconstruction of space is not only the repair and reshaping of material space, but also the reorganization and strengthening of humanistic elements and language and social attributes.

From multiple perspectives, based on spatial and social attributes, and starting from the driving mechanism of public space utilization, the research reveals the factors at all levels that affect the vitality of public space in traditional villages. Traditional measures of the vitality of public spaces mostly use the "empirical method", or are based on scale, morphology and other aspects. Aiming at the organic and comprehensive village system, multi-perspective and multi-dimensional modeling and quantitative evaluation are studied, and a practical public space vitality measurement method is constructed and suggestions are made through systematic, comprehensive and quantitative cognition.

2. Research Ideas

From the three dimensions of "social structure investigation-public space identification-spatial vitality characteristics", GIS-syntactic analysis is carried out, the dynamic mechanism and causes of traditional village spatial vitality are studied, and optimization suggestions for the vitality of public space are put forward.

According to the analysis conclusion of GIS-space syntactic analysis, the optimization strategy of village public space is proposed, and the optimization strategy of implantation, adjustment, synthesis, reconstruction and replacement of the constituent elements of public space is proposed based on social attributes. The optimized public space components are substituted

into the GIS spatial multivariate correlation model operation and feedback, and the vitality distribution of village public space is deduced, and the optimization strategy combination with better model deduction results is obtained.

3. Research Methods

3.1. Spatial Syntactic Analysis ('Spatial Environmental Impact Elements' Analysis Submodule)

Spatial syntactic analysis is applied to the 'Spatial Environmental Impact Features' analysis submodule. Depthmap was used to generate visualization images of morphological variables in the spatial environment.

The spatial permeability, spatial accessibility, spatial visibility, spatial control value and spatial comprehensibility of the village public space system were measured by studying the connection value, control value, depth value, integration degree and viewport analysis of the village public space system.

3.2. GIS Spatial Analysis

Sub-module of "Social Structure Influencing Factors": Based on the data of traditional village kinship, population distribution, human-land relationship, ethnic culture and collective memory, GIS spatial interpolation analysis, kernel density analysis, and network analysis functions are used to generate a raster atlas of social structure elements.

"Distribution of spatial activity characteristics" submodule: statistics on the characteristics of activity groups and activity characteristics in each space within the research scope, and GIS multi-distance spatial clustering analysis, spatial autocorrelation analysis, and kriging spatial interpolation functions are used to generate a raster atlas of spatial activity characteristics.

4. Study the Site of the Evidence

The research object is traditional villages and their public spaces. According to the theoretical framework, the selection of empirical sites for research can be summarized as follows: 1) reflect the typical values and local characteristics of traditional villages in Yunnan. 2) It has a certain centralized construction scale and population scale. 3) The number of indigenous residents and households accounts for more than 95% of the total; 4) The settlement environment has a high degree of integrity. Therefore, the traditional village in Yunnan Province-Nuohei Village, a traditional village in Shilin County, Kunming, was used as a typical empirical site for research.

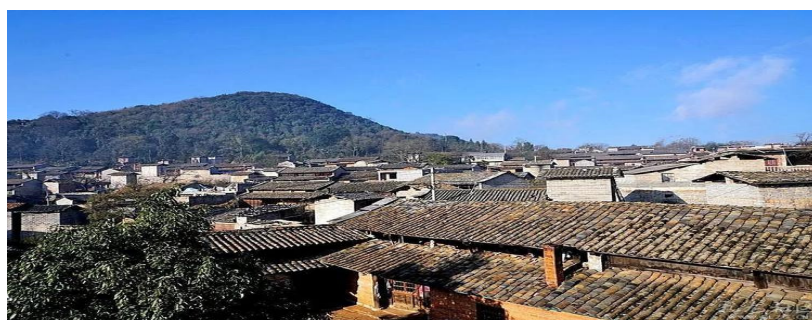


Fig 1. Landscape of Nuohei village

5. Analysis of Social Attributes and Spatial Characteristics of Public Space

5.1. Village Population Density Analysis

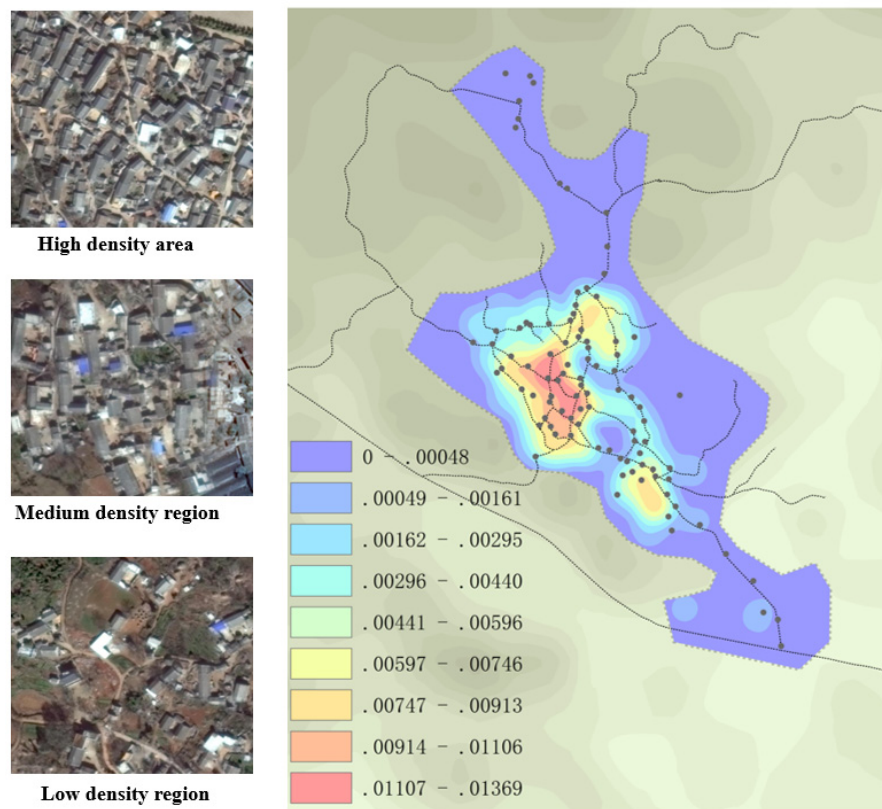


Fig 2. Analysis of village population density

Studies have shown that the main factors of crowd gathering in Nuohei Village mainly exist in the following aspects: (1) the density of buildings: buildings are places where people live, and the density of buildings determines the density of population; (2) Regional centrality: (3) Perfect supporting facilities, intensive activities attract a large number of people; (4) The need for work: In a certain area, due to the agglomeration of industries, the population is dense. (5) Comfortable environment: comfortable and safe living environment, rest environment attracts a large number of people to gather.

Research and analysis have shown that the main reason for the difference in population density in this village is the density of buildings and the center of the area. The area with the highest population density is the village center, followed by the south and north of the village, and the lowest density is the circumferential area of the village.

5.2. Village Integrated Memory Analysis

The main factors for villagers to form memories of public space include the following aspects: (1) Spaces with historical monumental significance: spaces such as the border headquarters and the former site of Panjiang Daily have historical commemorative significance and have formed memories in the hearts of all generations. (2) Frequently used space: The space used in the village for events or daily life, such as the dense branches, is the place where the village holds the annual Maze Festival, which deepens people's memories of this place. (3) Large-scale space: Therefore, public space occupies a large scale, which forms a visual impact on people and strengthens memory. (4) Space within the range of normal activities: the space next to the

village entrance, triangular intersection, etc. forms a strong memory for people and belongs to the repetitive memory type.

After research and analysis, it is found that most of the public spaces in the memory of the villagers are historically monumental and often used. The spaces with strong integrated memories are the folk square, the beacon tower, the entrance of the dense branch, the former site of Panjiang Daily, the Wang Family Courtyard, the former site of the border longitudinal headquarters, the monkey pond, the tourist reception center, and the village committee.

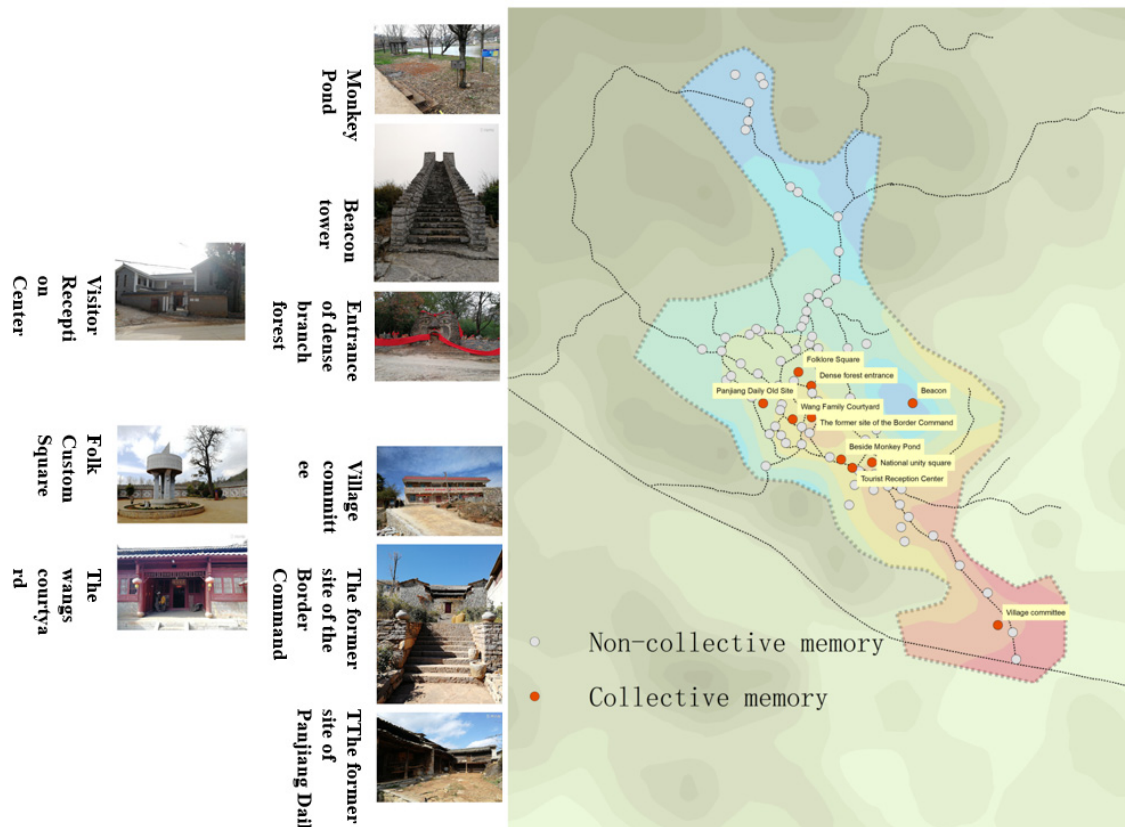


Fig 3. Village integrated memory analysis

5.3. The Intensity of Activity in the Village at Each Time

The main factors for the high-intensity use of public space by village people are as follows: (1) Comfortable and safe environment: A comfortable and safe rest and play environment will attract people. (2) The need for work: People gathers in a certain space because of the need for work collaboration. (3) Characteristics of crowd activities: Activities determine the number of crowds, and the number of people required for each activity is different, resulting in different intensity of space use. (4) Perfect facilities: Public spaces with perfect facilities will attract people, such as umbrellas, seats, game equipment, etc

After research and analysis, it is found that the main reasons for the difference in the intensity of public space activities in this village are the need for work and the characteristics of crowd activities. (1) The area with high intensity of morning activities is organized in the southern part of the village, and the typical representative public space is: the village committee farm. It is mainly the villagers' workplace, followed by the folk square and unity square in the center of the village. (2) The areas with high intensity of noon activities are grouped in the middle and south of the village, and the typical representative public spaces are: the village committee, the main road of the village, followed by the folk square. (3) The area with a large intensity of evening activities is grouped in the middle of the village, and the typical representative public space is: Folk Square.

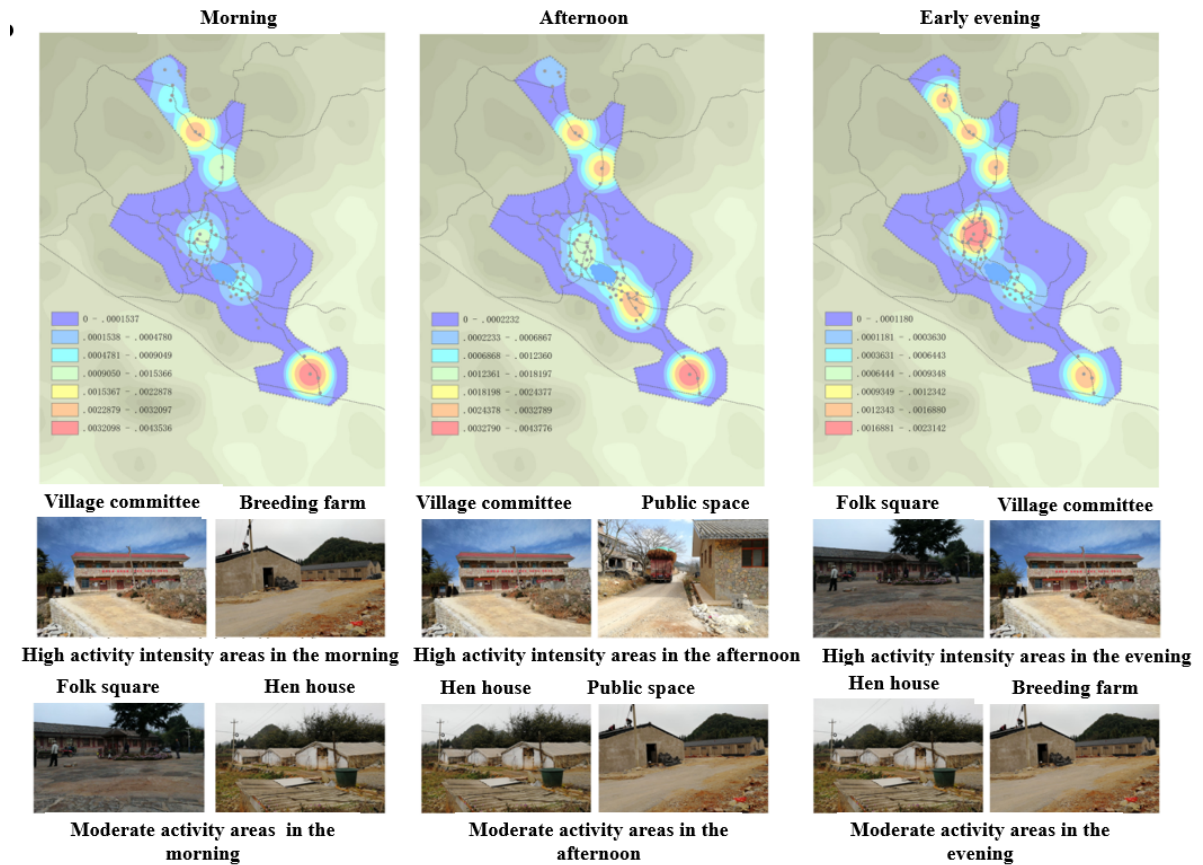


Fig 4. Activity intensity of villages at each time period

5.4. Public Space Visibility Analysis

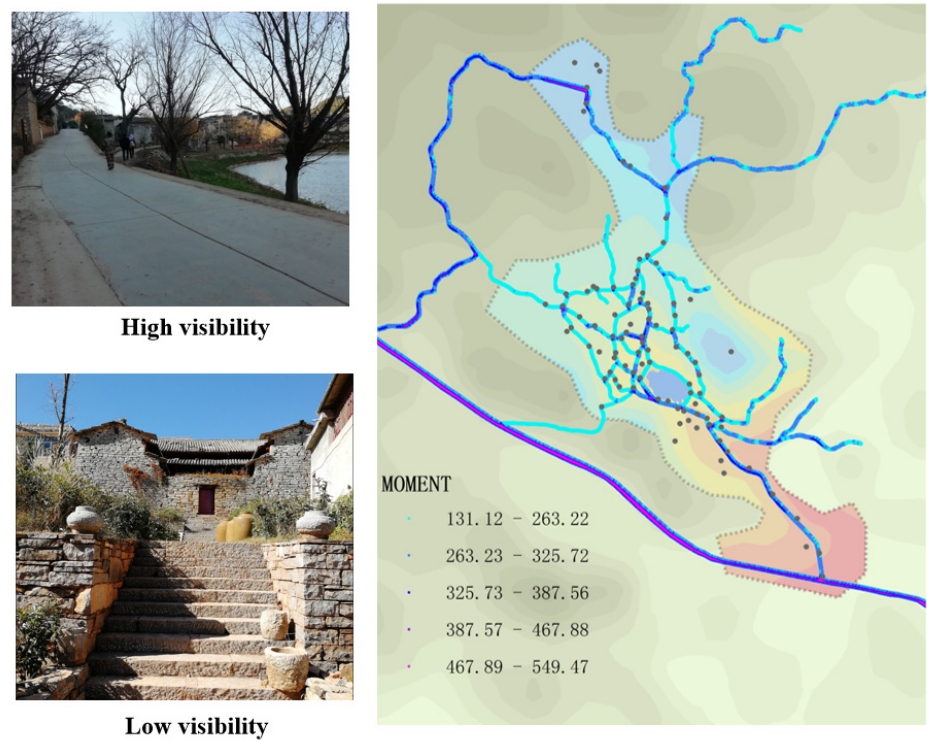


Fig 5. Analysis of public space visibility

The visibility of public space in villages can be divided into three levels: (1) High visibility: there is no shelter from buildings and trees, and the road is smooth and straight. (2) Medium visibility: In the case of less shelter such as buildings and trees, and more convenient roads. (3) Low visibility: In the case of building density and more shelters such as trees, there are fewer roads and curves.

After research and analysis, it is concluded that the north-central group of the village has low visibility due to high building density, curved and narrow roads. The southwest of the village is highly visible due to the low density of buildings and the straightness and width of the roads.

5.5. Public Space Integration

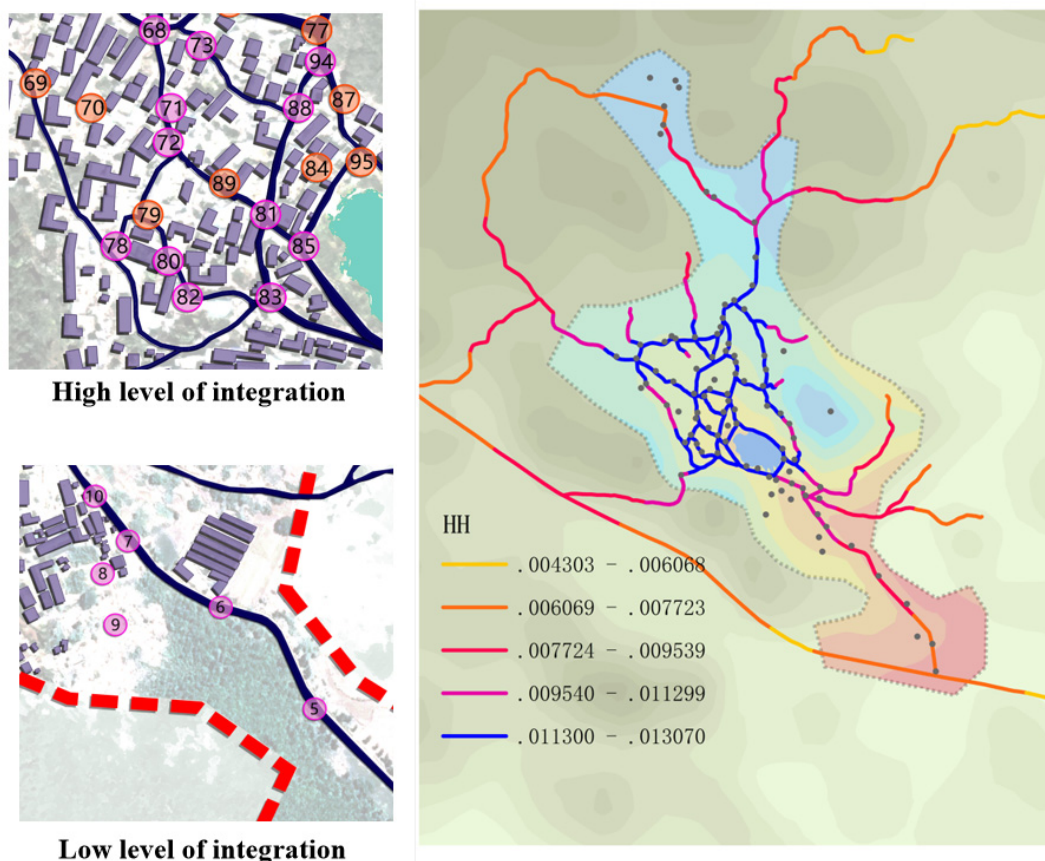


Fig 6. Integration degree analysis of public space

The integration degree of public space in Nuohei Village can be divided into three levels: (1) high integration: close distance between various spaces and high road density. (2) Medium integration: the distance between each space is closer, and the road is more convenient. (3) Low integration: the distance between various spaces is long and the road density is low.

After research and analysis, it is concluded that the central part of the village has a low degree of integration because of the high density of roads, more public spaces and close distances between spaces. The area around the village is less integrated due to the low density of roads and the distance between spaces.

6. Research on the Path of Vitality Improvement of Public Space

6.1. Village Public Space Enhancement Type

Combined with Maslow's demand theory, the psychological needs of villagers and their corresponding public space activities are analyzed. According to the villagers' public space

activities, the public space of Nuohei Village mainly includes five categories: living public space, communication public space, ritual public space, commemorative public space and cultural public space.

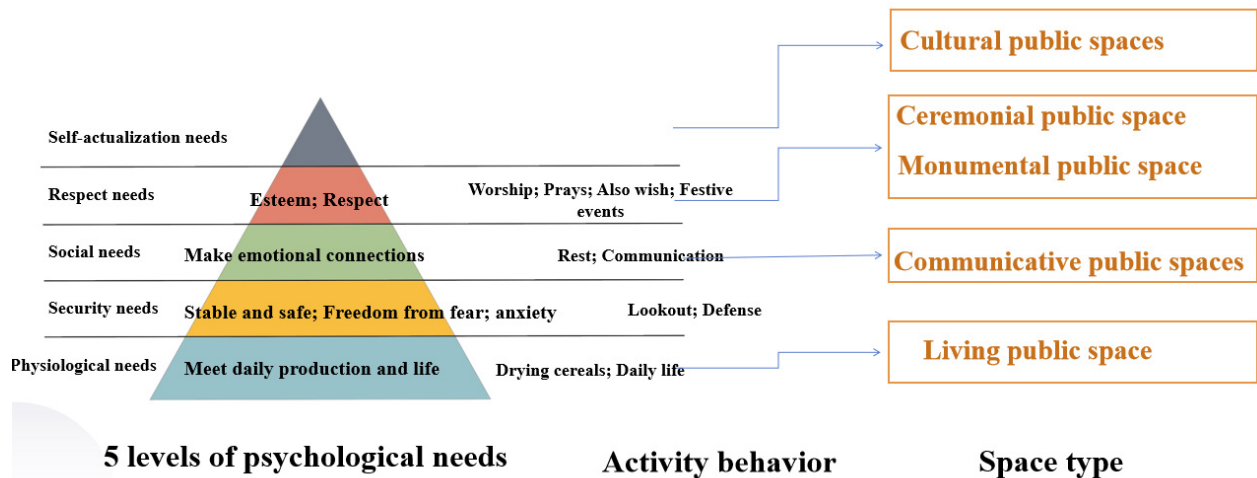


Fig 7. Public space elevation type

Five different types of public activity spaces correspond to the following village public space locations.

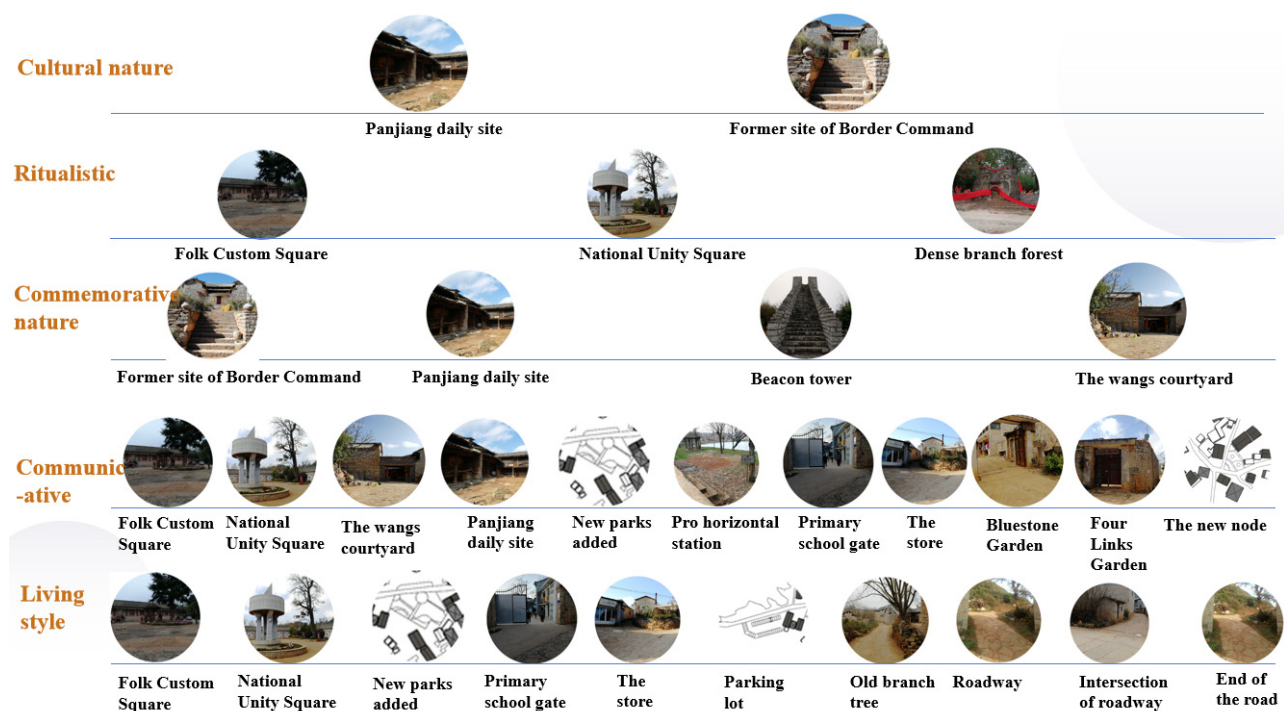


Fig 8. Types of public space promotion

6.2. Strategies for Enhancing Public Spaces in Villages

6.2.1. Strengthen the Structural Relationship of Public Space

The public space structure of Nuohei Village was upgraded from "two-sided, two-axis multi-node" to "two-sided, three-axis and multi-node".

- (1) Divide the "two sides" into primary and secondary surface spaces to strengthen the center.
- (2) A total of three new communicative public spaces will be added in densely populated areas

to enhance the structural relationship of public spaces. (3) Classify the node space into a hierarchy, with the monumental and cultural space as the high-level space; Use simple living, communicative, and small-scale spaces as low-level spaces.

6.2.2. Enhance Public Spaces based on Population Density

Combined with the population distribution, according to the population density, the public space is improved. (1) There are three densely populated points in the village, and through research and analysis, it is concluded that the communicative public space in the densely populated area needs to be optimized. (2) There is a lack of space for resting in various public spaces in densely populated areas, and public spaces are not equipped with facilities such as shades and seats, resulting in high-density people unable to use public spaces better.

6.2.3. Increase Public Space based on the Intensity of Public Space Use

From the analysis of the intensity of public space use, the north and south of the village are productive activities and are not included in the scope of the study. (1) The highest heat in the morning, afternoon and evening is always located around the Folk Square and the National Unity Square. (2) The villagers' use of space except for the two squares is relatively low, because other public spaces make people feel uncomfortable, and some public spaces cannot be used. (3) In the evening, the intensity of use of the folk square is high, and the study shows that there may be assembly activities in the evening of the folk square. (4) Strengthen the integrated memory of public space.

6.2.4. Strengthen the Integration of Public Spaces

According to the integration degree of public space, the research and analysis show that the central department of Nuohei Village has a low integration degree because of the high road density, more public space and close distance between each space. The area around the village is less integrated due to the low density of roads and the distance between spaces.

(1) In the central part of the village, there are a small number of buildings that are more broken, generally piling up debris or auxiliary houses, which can increase the density of public space and improve road density by demolishing dilapidated buildings, enhance road accessibility, and improve the integration of public space. (2) Strengthen the structural relationship of public space, sort out the sense of spatial hierarchy, and improve the integration of public space.

6.2.5. Enhance the Visualization of Public Spaces

According to the visual analysis of public space, the research and analysis show that the north-central group of the village has low visibility because of the high building density, curved and narrow roads. The southwest of the village is highly visible due to the low density of buildings and the straightness and width of the roads.

(1) In the dense part of the central part of the village, a small number of buildings are relatively broken, generally piling up debris or auxiliary buildings, and the visualization of public space can be enhanced by demolishing dilapidated buildings and repairing roads. (2) In the central area of the village, through the upgrading and transformation of public space, the obstruction is cleared and the visualization of public space is improved.

6.3. Optimized Design of Village Public Space

Based on the above analysis and research, the public space of Nuohei Village is optimized to enhance the attractiveness of the public space of the village and increase the vitality of the public space. Through the optimization design, the spatial environment is improved, and the public space plan optimization design, the public space optimization design effect and the overall optimization design effect of the village are as follows.

7. Optimized Design of Public Space Plan

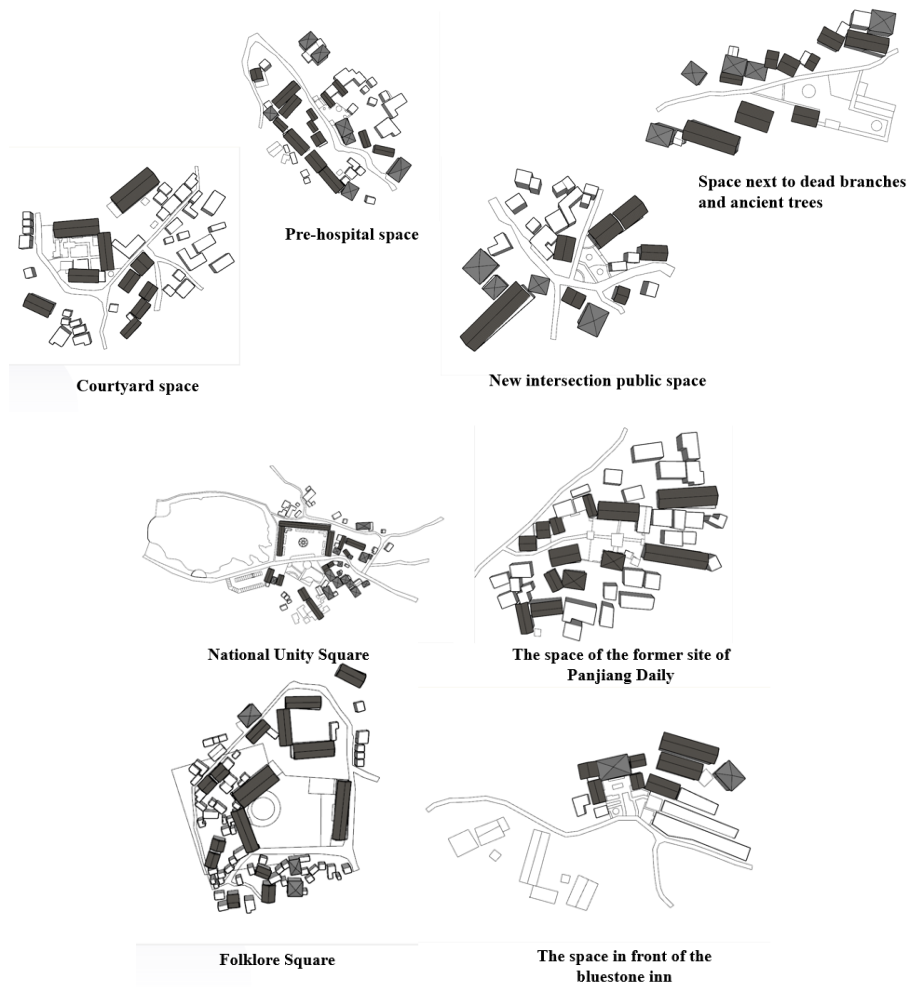


Fig 9. Optimized design of the public space of Nuohei Village

8. Public Spaces Optimize Design Effects



a

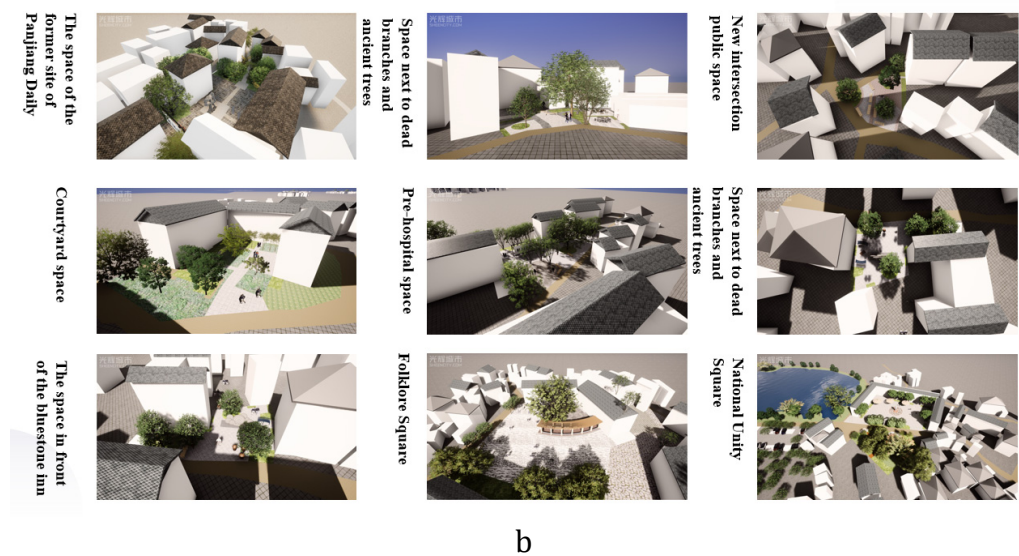


Fig 10. Renderings of local optimization design of public space in Nuoxi Village

9. The Overall Optimization Design Effect of the Village



Fig 11. The overall optimization design effect of the village

Acknowledgments

Funded by the base project of Philosophy and Social Sciences of Yunnan Province, “Research on the Vitality of Public Space in Traditional Villages in Yunnan Based on GIS and Space Syntax” (JD2018YB12).

References

- [1] Zhan Heping. Nanjing:Southeast University Press,2006:24.
- [2] Cai Ling. Traditional villages and architecture in Dong inhabited areas[M].Beijing:China Architecture and Architecture Press,2007,8:17.).
- [3] GUO Qi, YANG Xinhai. Calling for the spirit of place in the construction of new countryside:A case study of Puqian Village, Xixiashu Town, Changzhou City[J].Planner,2008,24(3):33-36.).
- [4] OUYANG Yongfeng, HUANG Hanli, TAIPING. Rural landscape design with land first:A case study of environmental design of new rural construction pilot village in Napo County, Baise City[J].Chinese Garden Architecture,2008,(8):28-31.).