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Study on the Spatial Morphology of Manchu Tomb-guarding Village from the Perspective of Space Syntax: A Case Study of Huiyingfang Village in Zunhua

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ABSTRACT

As a regional village type with Chinese characteristics, tomb-guarding village carries a unique institutional culture and space construction logic, but the academic circles have paid little attention to it. This study takes Huiyingfang village as the research object, and uses the space syntax method to compare and quantitatively analyze the spatial form of the village in the late Qing Dynasty and 2023, it reveals the evolution characteristics and internal mechanism of its spatial structure. The study found that: (1) the core area of village integration has remained stable since the late Qing Dynasty, and the overall street skeleton continues the barracks road network pattern of the Qing Dynasty, showing a long-term inheritance of spatial inertia; (2) the village road choice shows a significant urban-rural polarization, and the peripheral historical resources are destroyed and idled due to the lack of protection, which weakens the overall visitability and attractiveness of the village (3) the intelligibility of villages has been significantly improved with the development of villages, and the spatial identification has been enhanced. However, in the process of urbanization, the traditional human texture is facing the dilemma of gradual deconstruction. This paper evaluates the spatial development trend and existing problems of tomb-guarding village from the perspective of time and space, and puts forward targeted development strategies in order to provide scientific reference for the protection and renewal of the same type of traditional villages.

KEYWORDS

Space Syntax; Manchu Tomb-Guarding Village; Space Form Evolution; Space Structure; Huiyingfang Village.

1. INTRODUCTION

Manchu tomb-guarding village is an important type of historical and cultural heritage in our country, which has witnessed the development track of our country's culture, and is also an important carrier of the inheritance of local culture, covering the historical precipitation of natural environment and human environment, with unique spatial characteristics [1,2] . As the settlement patterns evolved from the full-time barracks guarding the imperial tombs in the Qing Dynasty, these villages carry the unique institutional memory, the imprint of ethnic integration and the wisdom of space construction, and are the vivid carriers of regional history and cultural integration. Its spatial form reflects the complex interaction between ritual regulations and daily life, humanistic order and natural environment, and has high historical research value and tourism development potential.

In recent years, with the promotion of the rural revitalization strategy and the vigorous development of the cultural tourism industry, many traditional ancient villages have experienced continuous scale expansion and spatial reconstruction, and some villages have gradually deviated from the original

spatial pattern, the traditional villages have been gradually marginalized, and their protection and development are facing many crises and challenges [3,4] . How to realize the organic renewal of villages while protecting traditional spatial genes, has become a realistic proposition that needs to be answered urgently in the study of historical villages. Long bin and others stressed that the study of spatial form is the premise of the protection and development of traditional villages, and ensuring the surface characteristics and deep structure of space is an important starting point for the continuation and revival of traditional villages[5]. Chen Jianhua and Song Yingyu also pointed out that, the cognition and characteristic analysis of village public space form is the premise and foundation of its vitality improvement [6] . As a quantitative tool to analyze the relationship between spatial structure and social logic, space syntax provides an effective way to understand the essential characteristics of the spatial form of traditional villages, at present, it has been widely used in the study of the spatial form of traditional minority villages in the process of rapid urbanization. However, most of the existing research focuses on the description and induction of the overall form of the village under a single time section, and lacks a systematic investigation of the spatial evolution process of the Manchu tomb-guarding village from the depth of time.

This paper takes Huiyingfang village in Zunhua City, Hebei province as the research object, and uses the Axis analysis method in space syntax to quantitatively compare the spatial form of the two key time nodes of the late Qing Dynasty and 2023. The purpose of this study is to reveal the characteristics and evolution logic of the spatial form of tomb-guarding village at different temporal and spatial scales, and then to explore the degree of memory inheritance of spatial form to historical system and its response mechanism under the background of modern urbanization, in order to provide theoretical basis and practical reference for the protection and sustainable development of similar historical villages.

2. THE GENERAL SITUATION OF THE STUDY AREA AND RESEARCH METHODS

2.1. General Situation of the Study Area

Huiyingfang village is located in Malanyu Town, 25 km west of Zunhua City, at the foot of the Great Wall. As a typical Manchu tomb-guarding village, its spatial system is the core link and hub for carrying and connecting natural resources, public facilities, human behavior, cultural landscape and other subsystems [7] , in the long-term development process, the spatial pattern of the village still retains some of the characteristics of the barracks layout in the Qing Dynasty. The total area of the village is 114 mu, with a total of 569 people.

The village was formed by merging the original Xintaiyingfang village and Huilingyingfang village. It still retains some cultural relics and ancient buildings and rich traditional Manchu customs. It has distinctive ethnic cultural characteristics and rich historical and cultural resources, it has high cultural protection value. The village layout was updated and adjusted on the basis of the original barracks regulations of the Qing Dynasty. The streets and lanes in the village basically retained the chessboard layout of the Qing Dynasty, and planned the whole production, however, due to insufficient protection and improper construction methods, the village is now facing the problem of balancing the contradiction between protection and renewal with healthy and reasonable development. It has the common characteristics of many historical ancient villages in eastern Hebei, it is representative to take it as a case to study the spatial form of traditional ancient villages under the background of contemporary urbanization[8].

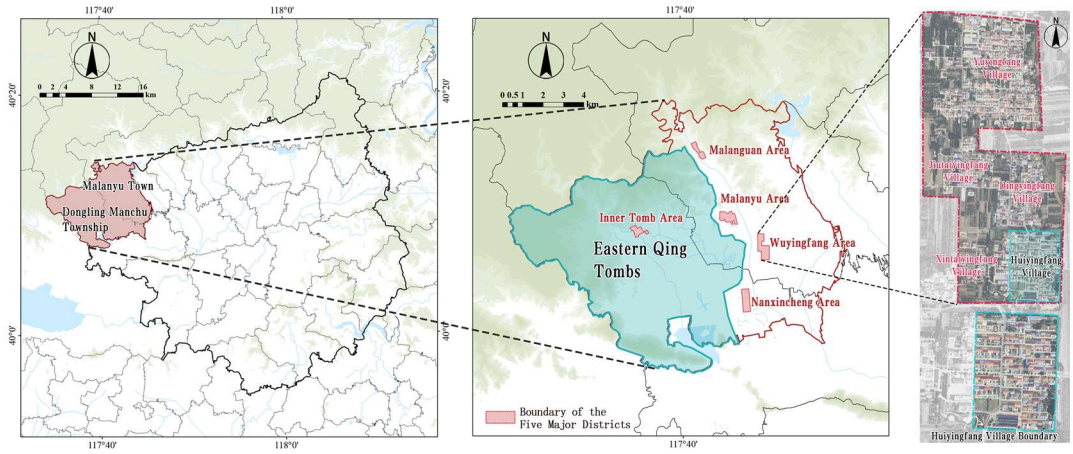

Figure 1. Location analysis

Figure 2. Aerial view of Huiyingfang village

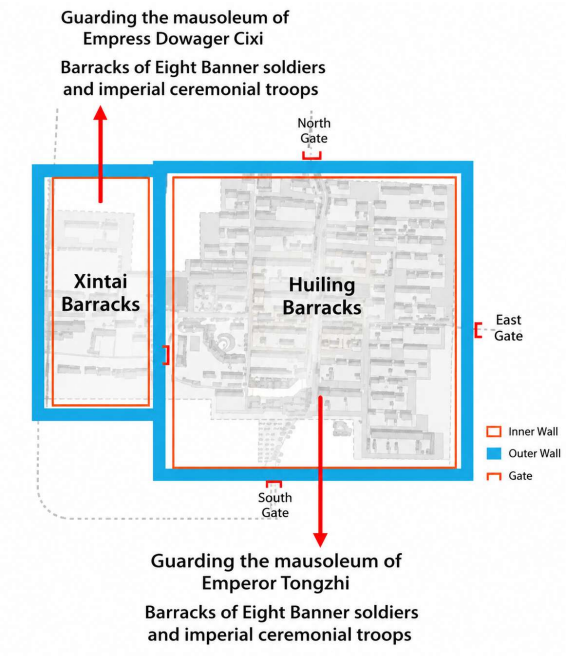

Figure 3. Historical background of the village

2.2. Space Syntax Theory and Index System

Space syntax was put forward by Bill Hillier, Professor of Bartlett School of Architecture, University of London in the 1970s. Now it has formed a complete theoretical system and specialized technical methods. Based on geometric topology, this method aims to explore the internal relationship between human settlement space structure and human society through the quantitative analysis of the internal structure of buildings, landscapes and settlements. Based on a large number of literature, we can know that space syntax has three kinds of space segmentation methods: convex space, horizon and Axis [9] . Among them, the Axis map analysis is the most commonly used method in the study of urban and settlement space, and then further developed into an analysis model based on line segment map.

In this study, the Axis analysis method is used to translate the spatial structure of the village into an axis map, which is an abstract expression of human spatial experience and behavior, thus it can more intuitively reflect the movement trajectory and functional organization logic in the spatial system [8] .

In view of the small spatial scale and regular layout of the village, this study uses the Axis method to quantitatively analyze the two time sections of the late Qing Dynasty and the current situation in 2023. In terms of variable choice, the following three core morphological variables are used:

Integration is the most widely used variable in syntax. It indicates the degree of aggregation or dispersion of a space with respect to other spaces in the system [10] . When a spatial system is integrated or aggregated, all the units in the system are close to each other, and there are few obstacles between them. On the contrary, the units in the system are far apart, there are more obstacles affecting their connections [11] . The calculation is as in (1) :

$$Int=\frac{n\text{-}2}{2(MD\text{-}1)} \tag{1}$$

Where: Int is the degree of integration, n is the total number of axes or the number of nodes,MD_i is the average value of the distance between a node in space, and its nearest axis, the average depth value,d_{ij} is the shortest topological distance from a node i to a node j. The formula MD_i is as in (2) :

$$MD_i=\frac{\sum_{j=1}^{n} d_{ij}}{n\text{-}1} \tag{2}$$

Choice measures the likelihood of a space being used as a travel path. The higher the degree of choice, the more likely the space is to be traversed by traffic and people [9] . The calculation method of choice is to count the number of times the space is used as the shortest path, that is, when a space is used as the shortest path between multiple starting points and target points, its choice will increase. The original (unstandardized) choice is given by formula (3) :

$$C(x)=\sum_{i=1}^{k}\sum_{j=1}^{k}\sigma(i,x,j) \tag{3}$$

Where: i, x and j denote the different nodes in the axis space, respectively, $\sigma(i,x,j)$ denote the shortest topological path from x the Axis space to j, where, if $\sigma(i,x,j)=1$and only if the node x, is on the shortest topological path from the node i to j (and $i\neq x\neq j$) , otherwise 0.

If the normalized choice is used, as in Equation (4) :

$$X=\frac{\log(C(x)+1)}{\log(TotalDepth+3)} \tag{4}$$

Where: X represents the choice value, the numerator and denominator should use the same base logarithm, and the TotalDepth is the sum of the total depths from node x to all other nodes $\Sigma d(x,j)$.

Intelligibility is a measure of people's ability to perceive the whole through the connectivity of local spaces, it can be obtained by calculating the connection degree between local spaces, the regularity of spatial form and the organization of overall space. *Intelligibility* is the square of the linear correlation coefficient between *Local Integration* and *Global Integration*. The formula is as in (5) :

$$R^2=\frac{[\Sigma(I_{(2)}-\overline{I_{(2)}})(I_{(n)}-\overline{I_{(n)}})]^2}{\Sigma(I_{(2)}-\overline{I_{(2)}})^2 \cdot \Sigma(I_{(n)}-\overline{I_{(n)}})^2} \tag{5}$$

Where: R^2 for the fitting degree, $I_{(2)}$ for the number of steps n = 2, when the local integration value, $\overline{I_{(2)}}$ for the average of two-step integration value, $I_{(n)}$ for the global integration value, $\overline{I_{(n)}}$ for the average of the global integration value. When R^2 is greater than 0.5, it can be considered that the horizontal axis and the vertical axis, that is, the global integration degree and the local integration degree, are correlated. When R^2 is greater than 0.7, it means that the horizontal and vertical axes are significantly correlated. When R^2 is less than 0.5, it means that the horizontal and vertical axes are not correlated.

2.3. Data Sources and Modeling Methods

In terms of data collection and data sources, this study restores the basic layout sketch of Huiyingfang village in the late Qing Dynasty by combing relevant literature and historical archives At the same time, the basic spatial data of the current situation of the village in 2023 is obtained with the help of Google image. Through village reconnaissance, surveying and mapping of buildings and streets, and in-depth interviews with villagers, first-hand information such as building functions, street scales, and historical site locations were obtained, and the original data were corrected. Finally, the reconstruction map of the village in the late Qing Dynasty (figure 4) and the current situation of the village in 2023(figure 5) are obtained.

Figure 4. Reconstruction of the late Qing Dynasty

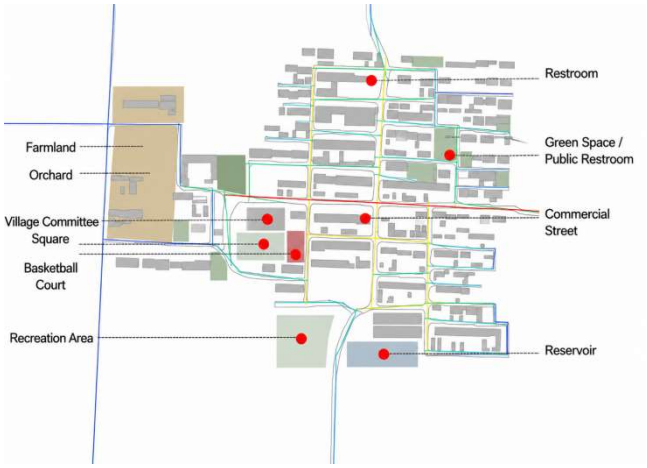

Figure 5. Status in 2023

In order to accurately extract the topological structure of the village street network, this study uses CAD software to vectorize the above base map. By extracting a set of the least and longest line segments, the overall street skeleton is summarized, and the spatial axis map of the village in the late Qing Dynasty and 2023 is generated (figures 6 , figures 7) . Considering the small scale of the village and the short and dense axes of some living roadways, in order to focus on the macro evolution trend of the overall spatial structure, the local over-dense short axes were moderately screened in the modeling process. The axis map of DXF format is imported into DepthMap software, and the space syntax Axis model is established. Finally, the model maps of integration degree, choice degree and comprehensibility degree are generated.

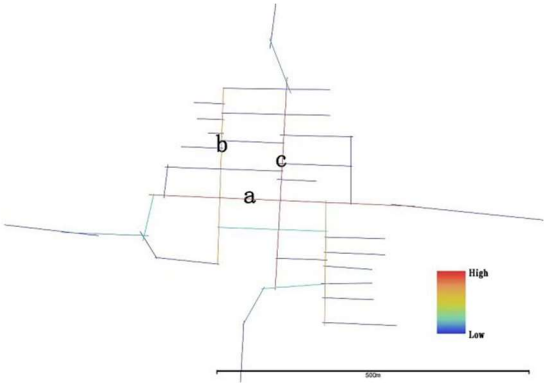

Figure 6. Axis map of the late Qing Dynasty

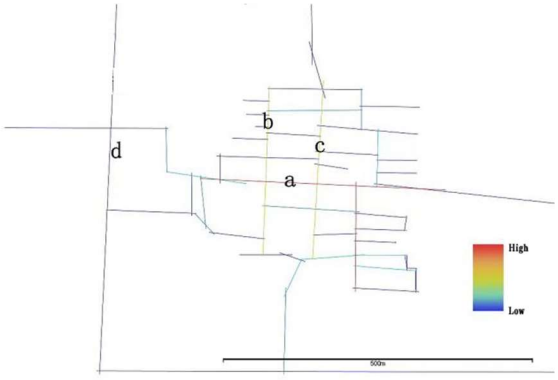

Figure 7. 2023 axis map

3. SPATIAL SYNTAX ANALYSIS OF HUIYINGFANG VILLAGE

3.1. Integration Analysis

3.1.1. Global Integration Analysis in the Late Qing Dynasty

According to the calculation results of Huiyingfang Village's global integration degree in the late Qing Dynasty (figure 8) , the value of village spatial integration degree is distributed between 0.781 and 2.935, and the average value of global integration degree is 1.477. The Axis whose integration degree is higher than the average value accounts for 47.22% of the total axis, which is not more than half, indicating that the degree of spatial integration within the village is concentrated but overall balanced. The most globally integrated areas (shown in red, orange, and yellow) are concentrated in the center of the village, with a street having the highest integration (2.935) , followed by C Street (2.484) and B Street (2.201) . These areas have the best traffic accessibility and constitute the structural core of the village spatial system. In contrast, the less integrated areas (the blue axis) are located in the external streets outside the village and the end-of-the-road alleys with less internal connectivity.

Huiyingfang village was gradually evolved from the barracks of the Military Department of the Eastern Qing Dynasty. In history, there were defensive facilities such as city walls, moats and five city gates. Under the influence of the barracks system, the settlement adopts a rectangular block layout, and the number of east-west streets is more than that of north-south streets, reflecting a clear militarized organizational logic. A Street in the village, as the core trunk road that runs through the whole village vertically, connects many horizontal streets and alleys to form a“Centipede-type” traffic framework as a whole. Both sides of B Street and C Street are concentrated with religious sacrificial places, shops, clubs and workshops, which bear important functions of commerce and social interaction. Its high integration value is highly consistent with its public functions. With the gradual outward expansion of the village scale, the topological distance between the new peripheral area and

the core area increases, the permeability of people flow and traffic flow decreases, and the global integration and accessibility decrease accordingly. The outer lane of the village is mostly a living road, which is flanked by residential courtyards with strong privacy and low spatial openness, further weakening the integration effect of external space [9] .

3.1.2. Global Integration Analysis in 2023

Based on the calculation results of the current axis map of the village in 2023(figure 9) , the global integration value is distributed between 0.858 and 2.573, with a mean of 1.371. The proportion of axes with integration above the mean was 44.44% , which was slightly lower than that in the late Qing Dynasty. This change shows that the spatial scale of the village has expanded after the merger of the Hui Barracks and the Xintai Barracks, but the accessibility and aggregation of the overall space have decreased slightly.

The areas with higher integration degree are still mainly concentrated in A street (2.574) , C Street (2.161) and B Street (2.083) . The core spatial pattern is highly consistent with the late Qing Dynasty, showing significant spatial path dependence. Field research further confirms this conclusion: with its geographical advantages and topological centrality throughout the village, a street still bears the most important functions of villagers' daily life and commuting; Along B Street and C Street, a large number of commercial service facilities are gathered. However, it is worth noting that administrative buildings such as village committees are also distributed in the highly integrated areas along B Street, there is a potential conflict between this function configuration and the space demand of cultural and tourism development. The administrative office function occupies the best section of commercial accessibility, which may restrict the agglomeration and expansion of tourism service facilities to a certain extent. It is suggested that in the future, in the adjustment of village functional layout, such non-tourism-oriented functions should be gradually moved out of the core high-integration area to release the service potential of public space.

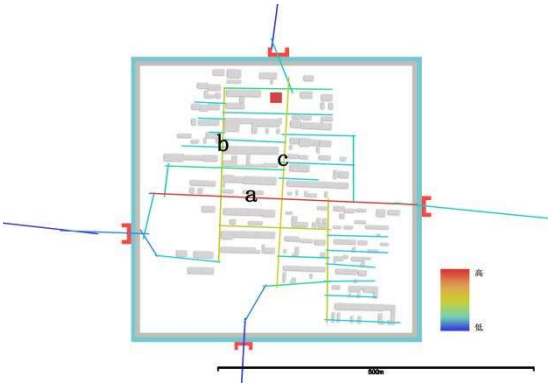

Figure 8. Global integration analysis in the late Qing Dynasty

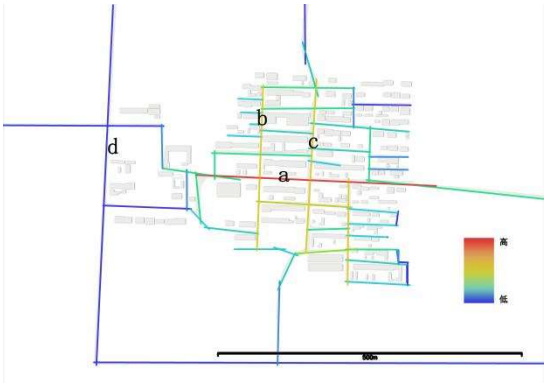

Figure 9. Global integration analysis in 2023

3.2. Choice Analysis

3.2.1. Analysis of Village Choice in the Late Qing Dynasty

The results of the calculation of the village choice in the late Qing Dynasty (figure 10) show that the roads with higher choice (warm color axis in the figure) are mainly a street (454) and C Street (448) , it shows that these two streets are the most frequently crossed as the shortest path, and bear the most important traffic flow. This result is highly consistent with the actual situation: as the core traffic skeleton of the ancient city, A and C streets connect multiple public functions such as commerce, religion and handicraft industry, and become the most densely populated areas. In contrast, the streets

with low choice often have the problem of excessive longitudinal depth, poor topological accessibility, low pedestrian passing probability, and relatively insufficient spatial openness and public vitality.

3.2.2. Analysis of Village Choice in the 2023

The choice analysis for 2023 shows (figure 11) that the road with the highest crossing capacity remains A street (998) , followed by C Street (741) and B Street (733) . Compared with the late Qing Dynasty, the absolute value of the choice of the three main streets has been greatly improved, reflecting that the overall traffic demand has increased significantly with the increase of the village population and the expansion of functions. As the main traffic artery running through the whole village, A street plays the role of the core link connecting various functional groups; B Street and C Street are distributed on both sides because of a large number of commercial services, leisure and entertainment and living space, it has become a must-pass for villagers' daily travel.

However, the choice gap between the core area inside the village and the peripheral road shows a very significant polarization trend. The root cause of this spatial imbalance lies in the failure of the peripheral areas to form corresponding service functions and spatial attraction. On the one hand, the historical and cultural resources around the villages have not been protected and rationally utilized for a long time, on the other hand, the planning of tourist routes relies too much on the core blocks and fails to effectively extend to the peripheral historical resource points, as a result, tourism nodes are single, tourists stay for a short time, and the depth of consumption is insufficient. This fault of spatial attraction not only reduces the enthusiasm of tourists, but also aggravates the bearing pressure of the core area in the peak tourism season, which is not conducive to the improvement of the overall tourism quality and sustainable development of the village.

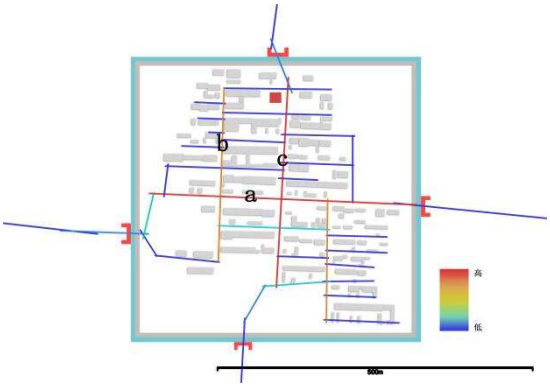

Figure 10. Analysis of village choice in the late Qing Dynasty

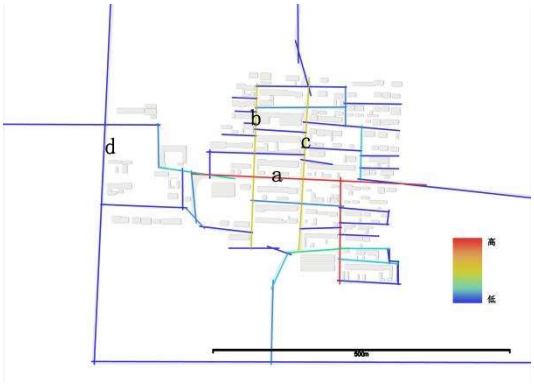

Figure 11. Analysis of village choice in the 2023

3.3. Spatial Intelligibility Analysis

3.3.1. Analysis of Village Intelligibility in Late Qing Dynasty

The comprehensibility calculation of the village axis map in the late Qing Dynasty (figure 12) shows that, between 0.4 and 0.7, indicating that there is a moderate-high correlation between local integration and global integration. This means that in the late Qing Dynasty, villagers and visitors have been able to form a clearer understanding of the overall spatial structure of the village through local spatial experience. Combined with the analysis of the historical pattern of the village, the internal roads of Huiyingfang village are clearly classified, and the main roads and secondary alleys constitute a well-ordered chessboard network, and the function division of each street is clear. This spatial organization model of“The trunk as the bone and the alley as the vein” is the most typical street form of military barracks settlements in the Qing Dynasty, which reflects the strict hierarchical

order and military management logic under the barracks system, at the same time, it also gave the space a high degree of structural identification.

3.3.2. Analysis of Village Intelligibility in 2023

Through the analysis of the Axis map of the current ancient village (figure 13) , it is concluded that the intelligibility is greater than 0.7, which has exceeded the threshold of 0.7, indicating that there is a highly significant correlation between local and global integration. This improvement shows that with the expansion of the scale and function of the village, the identifiability of the spatial structure is further enhanced. On the basis of maintaining the stability of the original core block, the village has added a number of functional spaces for leisure and recreation, cultural display, and life services, which has enriched the public space system, it also strengthens the logical consistency between the local space and the overall pattern. The improvement of spatial intelligibility helps to enhance the spatial identity of villagers, and makes it easier for tourists to establish a cognitive framework for the overall village form through limited spatial experience. Although the comprehensibility of quantification has been improved, the original historical spatial texture of the village, including the traditional courtyard pattern, the scale of historical streets and lanes, and the style and features of cultural relics buildings, has also been improved, however, they have been destroyed in varying degrees in the process of village development. The new buildings lack coordination with the original style in terms of volume, material and style. Some historic streets have been widened or cut off, and the relationship between the enclosure and scale of the traditional courtyard has been broken. The increase in comprehensibility numerically reflects the increased logical consistency of the spatial structure, but this consistency is based on the gradual degradation of traditional spatial genes, to some extent, it is at the expense of the cultural uniqueness and authenticity of tomb-guarding village. In other words, although the reconstruction of modern space improves the structural identification, it may weaken the narrative ability of the village as a historical witness. This paradox reminds us that in the protection of traditional villages, we should not only pay attention to the optimization of spatial topological relations, but also pay attention to the material bearing and style continuation of historical information.

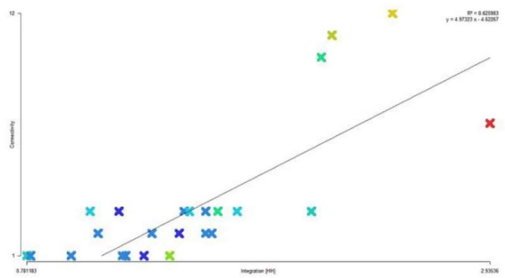

Figure 12. Analysis of village intelligibility in late Qing Dynasty

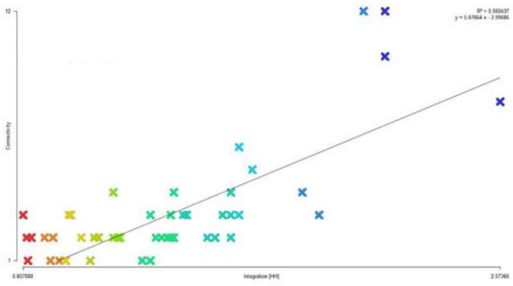

Figure 13. Analysis of village intelligibility in 2023

4. SUMMARY AND OUTLOOK

4.1. Research Findings

This study uses space syntax method to make a comparative quantitative analysis of the spatial form of the two time nodes in the late Qing Dynasty and 2023. The main conclusions are as follows:

First, the stability of the spatial skeleton and the persistence of the institutional imprint. The integration core area of Huiyingfang village has not been substantially displaced in the scale of more

than 100 years, and the street, street and street have always constituted the topological center of the village. The overall street structure basically continued the“Chessboard” road network pattern of the barracks in the Qing Dynasty, showing the“Centipede” spatial skeleton characteristics. The long-term stability of this spatial form shows that the spatial order laid by the barracks system has a strong path-dependent effect, which has become the deep structural inertia of the evolution of the village form. Although the functional composition of the core area of the village has been adjusted, the spatial logic of functional agglomeration still follows the historical pattern.

Second, the structural imbalance of spatial accessibility. In 2023, the choice of village roads has been greatly improved compared with the late Qing Dynasty, indicating that the overall traffic activity has increased. However, there is a serious polarization between the core area and the outer space in the village: the choice of roads in the core area can reach 998, while the choice of roads in the outer part is only 61, a difference of more than 15 times. The root of this imbalance is that the peripheral historical and cultural resources have been destroyed and left unused due to long-term inadequate protection, and have failed to form an effective spatial attraction node. As a result, the tourist routes are over-dependent on the core blocks, the nodes are single and the depth is insufficient, which seriously restricts the overall tourism value of the village and the willingness of tourists to stay.

Third, the improvement of spatial recognition and the deconstruction of traditional texture. The intelligibility of villages increased from 0.626 in the late Qing Dynasty to 0.789 in 2023, and the spatial identification was significantly enhanced. However, this change is not completely positive: with the advancement of urbanization, the original historical space texture of the village is gradually deconstructed and replaced by modern construction. Although the villagers' sense of spatial identity has been improved due to the improvement of public services, the cultural uniqueness and historical authenticity of tomb-guarding village are quietly losing, and they are facing the problem of how to coexist protection and development.

4.2. Discussion and Insights

4.2.1. Limitations of the Study

Based on the spatial syntax axis model, this study quantitatively compared the spatial morphology of Huiyingfang Village in the late Qing period and two time nodes in 2023. However, the following shortcomings still exist: first, the spatial restoration of villages during the late Qing period was mainly based on historical documents, oral interviews, and site exploration, and was constrained by historical sources. The restoration map contained certain errors in terms of street and alley sizes, architectural boundaries, and so on, which may have a slight impact on the accuracy of the axis model. Second, the explanatory power of spatial syntax for small-scale settlements was limited. The social construction of space at the village scale often transcended the single logic of topological reachability. Social and cultural factors such as clan relations, neighborhood networks, and ritual paths also deeply influenced the spatial usage patterns. It is difficult to fully explain the spatial generation mechanism of mausoleum-guarding villages solely by relying on syntax variables. Third, the study selected only two time nodes, the late Qing period and 2023. There was a lack of continuous tracking of key transitional stages such as the period of the Republic, the early founding ceremony of the People‘s Republic of China, and reform and opening up. It is difficult to fully present the dynamic process and phase characteristics of spatial evolution.

4.2.2. Implications for Future Research

At the methodological level, it is recommended to combine visual field analysis with axis analysis to capture the visibility and sense of encirclement of face-shaped public nodes such as squares, ancient wells, and temple front spaces, making up for the deficiencies of axis models in node spatial quantification; at the same time, using GIS spatial analysis and multi-time-phase remote-sensing images, further improve the spatial accuracy and temporal resolution of historical spatial restoration. At the theoretical level, it is recommended to introduce the research perspective of social spatial

integration, cross-validate the syntactical quantification results with the spatial perception and behavioral activity data of villagers, and reveal the interconstruction mechanisms between spatial morphologies and social practices through qualitative methods such as deep interviews and participatory observations; in addition, institutional history should be connected to spatial morphologies, tracing the landing process of institutional forces such as the Qing Dynasty mausoleum-guarding system, the Eight Flags Garrison System, and the mausoleum rites system in specific spaces. This is a key path to understanding the spatial genes of mausoleum-guarding villages, and is to be continuously advanced in subsequent research.

4.2.3. Conclusion

The case of Huiyingfang Village demonstrates that the spatial morphology of mausoleum-guarding villages is not the result of random settlement growth, but rather a spatial text co-written by institutional discipline, military organization, and daily life. Their spatial genes have maintained astonishing stability for more than a hundred years, but this stability is facing challenges from traditional muscle-understanding in the urbanization process. Under the dual mission of conservation and development, only a deep understanding of the institutional logic and social mechanisms behind spatial morphology can make updated decisions that both respect the historical context and respond to real-world needs. This conclusion has reference significance for conservation practices in similar mausoleum-guarding villages and historical villages in the Ji Dong region.

REFERENCES

[1] Tang, T., Wei, J., Cui, Y., et al. (2022). A study on the spatial morphology of traditional villages based on Space Synta--a case study of xiongcun village in Guilin. Scientific and Technological Innovation and Productivity, 12, 40-43, 47.

[2] Chen, C., Li, B., Yuan, J., et al. (2018). Spatial morphology cognition of traditional villages based on Space Syntax--taking Qinchuan village in Hangzhou as an example. Economic Geography, 38(10), 234-240.

[3] Zhang, R., & Bai, X. (2021). Research on the spatial morphology of traditional villages based on Space Syntax. Urban Architecture, 18(6), 74-76.

[4] Zhou, M., & Deng, H. (2023). Research on the micro-renewal design of public space in traditional villages under the background of rural revitalization--taking Houzhai village as an example. Sci-Tech News, 21(2), 34-37.

[5] Long, B., Xiong, M., & Zhang, J. (2022). Analysis of spatial morphology of traditional villages based on Space Syntax--taking Baotun village in Anshun City as an example. Huazhong Architecture, 40(12), 137-141.

[6] Chen, J., & Song, Y. (2024). Cognitive research on the form of public space in Guangfu traditional villages based on Space Syntax: a case study of Shenjing ancient village in Guangzhou. Huazhong Architecture, 42(3), 102-108.

[7] Zhuang, L. (2022). Research on spatial resilience analysis and promotion strategy of residential historic blocks based on space syntax [Doctoral dissertation]. Shandong Jianzhu University.

[8] Li, J., & Peng, C. (2023). A study on the spatial morphology of traditional villages in the Pearl River Delta from the perspective of syntax: A case study of Panyu Nancun village in Guangzhou. Architecture and Culture, 8, 93-95.

[9] Li, T., Cong, Z., & Yu, H. (2021). Research on the spatial morphology of ancient towns based on Space Syntax--a case study of Pu City in Hunan Province. Geographic Information World, 28(6), 28-33.

[10] Lin, Y., & Long, C. (2010). Analysis of urban spatial morphology based on Axis model--a case study of Guanshan area in Wuhan. Economist, 9, 45-47.

[11] Li, J., & Guo, Q. (2003). Quantitative Study of Urban Spatial Morphology based on Syntactic Analysis. Journal of Wuhan University (Engineering), 2, 69-73.