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Post-utilization Evaluation of Public Space in Traditional Villages and Towns from the Perspective of Space Syntax*

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ABSTRACT: After the Rural Revitalization Strategy was formally put forward in the report of the 19th National Congress of the Communist Party of China in 2017, the conservation and utilization of traditional villages and towns have received significant attention from China's academic circle and society as an important aspect of the strategy. Although many Chinese traditional villages and towns have been reconstructed successfully, there are still relatively limited academic studies on the assessment of their performance after utilization. It is a challenge that has to be solved urgently for current academic studies on traditional village conservation and updating to develop village renovation techniques to provide a suitable living environment and protect traditional regional characteristics. Therefore, a systematic study on traditional village conservation in China based on demonstration areas has important academic and practical significance in implementing the rural revitalization strategy and promoting overall urban-rural development. A post-use quantitative evaluation system of traditional villages and towns was established in the present study by introducing the leading space syntax theoretical technology in the field of urban morphological analysis and combining with the AHP-fuzzy comprehensive method, combining existing qualitative and quantitative analysis means. Moreover, reconstruction strategies of traditional villages and towns were proposed according to feedback information from evaluation results. Results showed that (1) according to a case study based on typical traditional villages and towns in Shawan Ancient Town in Guangzhou City, the post-utilization evaluation system of public space in traditional villages and towns demonstrates applicability and generalizability. (2) From 2010 to 2020, the highly integrated network of Shawan Ancient Town formed a 'cross' pattern. The accessibility and traffic capacity of the road network improved to a certain extent after the renovation. (3) Public space in Shawan Ancient Town is ranked as 'good' concerning cultural construction, while the functional evaluation and economic, social effects are 'moderate'. Finally, a public space conservation and renewal framework of traditional villages and towns was established from the perspectives of an optimized spatial layout of ancient towns, enhancing users' satisfaction and actively conducting cultural activities. This study is expected to provide scientific references to rebuild rural images and inherit regional context.

KEY WORDS: traditional villages and towns; public space; post- utilization evaluation; Shawan Ancient Town; Space Syntax

Introduction

As precious assets of rural society, traditional villages and towns are the crystallization of Chinese history and the carrier of culture, bearing the memories of rural life and communication, and inheriting rich historical, cultural, and geographical information[1]. Since the proposal of

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the National Rural Revitalization Strategic Plan (2018-2022) in 2017, how to establish a theoretical foundation for rural revitalization planning that conforms to the basic characteristics and laws of rural development in China, and develop county-level rural revitalization planning methods and plans has gradually become an important topic and key task for academic research and government decision-making in China[2]. Under the principle of prioritizing the development of agriculture and rural areas, the conservation and development of traditional villages and towns in China will usher in significant historical opportunities. The rural revitalization strategy provides new ideas and implementation paths for the conservation and development of traditional villages and towns[3]. Conducting systematic research on the conservation of traditional Chinese villages and towns by combining existing qualitative and quantitative analysis methods, focusing on key traditional village and town case studies, can help to deeply implement the rural revitalization strategy and promote urban-rural coordinated development. The village renovation method that can provide a suitable living environment while protecting traditional regional characteristics is a difficult problem that the current academic community faces and urgently needs to solve in the field of traditional village and town conservation and renewal[4].

With the proposal of the rural revitalization strategy, the academic community in China has given high attention to the inheritance and conservation of traditional villages and towns in the context of rural revitalization. Protecting traditional villages and towns is beneficial for enhancing their vitality, promoting traditional ethnic culture, and maintaining the development of cultural diversity [5]. Although various parts of the country are widely practicing and exploring the conservation of traditional villages and towns in different ways, there is currently limited work on post use evaluation of traditional villages and towns, and there is generally a lack of objective evaluation of their performance after use. In addition, current research on the conservation of traditional villages and towns mainly focuses on qualitative analysis, lacks quantitative research, and has not proposed a complete analytical paradigm and framework. Therefore, this study introduces Spatial Syntax to quantitatively analyze the morphology of villages and towns. Spatial Syntax can visually express spatial forms that are difficult to describe in words, explore the evolution mechanism of space and the relationships between space and human activities, and has been widely applied to the study of traditional villages and towns [6]. The visual expression of spatial morphology through spatial syntax helps scholars to use graphical language to express abstract cultural landscapes, thus providing rational support for the continuity design of historical villages and towns. Therefore, the introduction of spatial syntax provides an important theoretical entry point and methodological support for studying and analyzing the post use evaluation of traditional villages and towns. As the core of the overall composition and public activities of traditional villages and towns, public space carries important functions of daily communication and external contact. [7] In addition to architectural behavior, its layout also reflects the profound significance of environmental behavior, sociology, psychology, and other aspects. However, with the changing times, new public spaces may not match the original spatial functions, leading to the loss of vitality in some traditional village and town spaces [8]. Therefore, it is necessary to conduct a post use evaluation of the conservation performance of the spatial structure of public spaces in traditional village and town, which can provide scientific reference for formulating scientific and reasonable transformation strategies in the future, and achieve the active inheritance and development of public spaces in traditional village and town[9]. As a typical representative of the conservation of traditional villages and towns in the Lingnan region, the Shawan Ancient Town in Guangzhou has undergone extensive research on its authenticity[10], spatial morphological evolution[11], and tourism development[12]. Based on the above background, this study intends to combine spatial syntax theory and take the public space of Shawan Ancient Town as the evaluation object. After clarifying the evaluation purpose and evaluation factor system, post use evaluation will be conducted using methods such as spatial syntax and AHP fuzzy synthesis. Through the study of this example, efforts will be made to construct a post use evaluation system for traditional villa-

ges and towns, providing feedback and guidance for subsequent conservation of traditional villages and towns.

1 Construction of post use evaluation system for public spaces in traditional village and town from the perspective of Space Syntax

Post Occupancy Evaluation (POE) is a method used to provide feedback on the evaluation of built environments [13]. The theoretical research on post use evaluation of built environments was introduced to China in the early 1980s, and as a newly added important link in the field of architecture, it was ranked after the planning-scheming- design - construction process. Friedman pointed out that "POE is a degree of evaluation: how the environment supports and meets people's clearly expressed or implicit needs after construction", and in-depth analysis of operational conditions and usage effects can help provide effective basis for design [14,15]. The study attempts to dynamically monitor the effectiveness of public space conservation in traditional village and town through post use evaluation, timely identify deviations, help identify various contradictions in conservation, propose corresponding strategies, mediate and balance the interests of all parties. The study first constructs a set of post use evaluation factors for public spaces, dividing the evaluation system into four major indicators: spatial structure, cultural, functional, and economic and social effects. Secondly, the evaluation criteria for each evaluation factor are determined. The spatial composition indicators are mainly based on the results of spatial syntax operations, while the cultural, functional, and economic and social benefits indicators determine the weighting coefficients for each indicator by constructing a judgment matrix.

1.1 Construction of evaluation factor set

By summarizing previous research, the post use evaluation of traditional village and town public spaces should focus on the following three aspects: improvement of spatial planning, conservation of public space characteristics, and socio-economic effects. Culture and functionality are the main characteristics of traditional village and town public spaces, and spatial structure, culture, functionality, and economic and social effects are considered as four evaluation factors for the post use evaluation of traditional village and town public spaces:

① Spatial structure: evaluating the effectiveness of the village and town spatial structure after re-planning and adjustment. The public spaces of villages and towns are divided into node space and linear space, mainly evaluated from the reachability, utilization rate, accessibility, traditional texture continuity, and other aspects of the two spaces. ② Cultural aspects: as one of the main characteristics of public spaces, cultural evaluation includes two aspects: architectural level and historical-cultural landscape. The evaluation work is carried out from the aspects of the conservation and utilization of traditional architectural artistic value, cultural heritage vitality, and traditional style preservation. ③Functionality: functionality is another major feature of public spaces, which mainly plays two roles: meeting the needs of the population and protecting folk culture. Therefore, it can be evaluated from the construction of infrastructure and service facilities, types of cultural activities, and continuity of traditional folk customs. ④ Economic and social effects: the social effects generated after conservation, including residents' participation, satisfaction, and sustainability. The sustainable growth of the economy is one of the important purposes of protecting traditional villages and towns. Without a solid economic foundation, the conservation of traditional villages and towns cannot be sustained for a long time. The economic benefits can be evaluated from the following aspects: one is the economic benefits of residents, and the other is that the conservation and development of traditional villages and towns are mostly accompanied by the growth of tourism, so the number of tourists and tourism development income are also considered as evaluation factors for economic benefits.

1.2 Evaluation criteria for determining evaluation factors

As shown in Figure 1, the four evaluation factors for post use evaluation of traditional villages and towns are spatial organization, cultural, functional, and economic and social effects. For the evaluation of spatial organization, this article will use spatial syntax analysis methods to study its related parameters, and the other three factors will be evaluated using AHP fuzzy synthesis method.

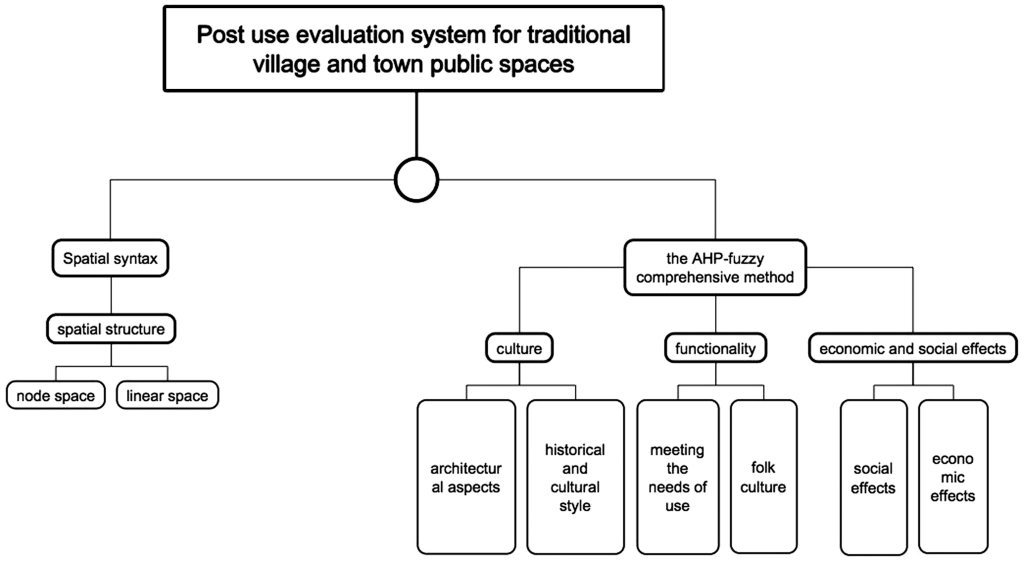


Figure 1 Post use evaluation system for traditional village and town public spaces

1.2.1 Post utilization evaluation based on Spatial Syntax

Spatial Syntax is a theory and method that studies the relationship between spatial organization and human society by quantitatively describing the structure of residential spaces, including buildings, settlements, cities, and even landscapes [16]. The research uses spatial syntax to study the spatial organization of traditional village and town public spaces, and select three parameters: integration degree, connectivity degree, and selection degree as evaluation factors for spatial organization. Qualitative post use evaluation of the factors is conducted according to the evaluation criteria in Table 1.

Table 1 Post-use evaluation factor system of traditional village and town based on spatial syntax

Criterion layer	Factor layer	Indicator layer	Method for obtaining
B1 Spatial structure	C1 Node space	D1 Accessibility	Integration
		D2 Utilization	Selectivity
		D3 Spatial permeability	Connectivity
	C2 Linear space	D4 Accessibility	Integration
		D5 Traversal rate	Selectivity
		D6 Street reachability	Connectivity

1.2.2 Determination of index weights for evaluation system

The qualitatively analysis of the importance of indicator layers for cultural, functional, and economic and social benefits factors, is conducted to construct a judgment matrix, and ultimately determine the weight coefficients of each indicator. In this study, a combination of expert scoring, questionnaire surveys and relevant literature research methods is used to determine the weights of each indicator in the evaluation system. In the expert scoring method, a total of 20 experts with rich knowledge or practical experience in relevant fields are invited, including 17 scholars studying this field and 3 relevant government personnel. They are asked to treat the entire evaluation system as a fuzzy concept and the evaluation indicator system as a fuzzy set, each indicator as an element, scoring each indicator independently in an isolated state of ignorance. Subsequently, a percentage-based scoring system was adopted to determine the weight values of each indicator, and satisfactory results were obtained through continuous modification [17]; The questionnaire rule is to obtain the importance ranking of each evaluation factor by distributing weighted survey questionnaires on-site. Using the weight questionnaire statistics from both aspects, the relative weights and importance between the indicators were ultimately obtained for use in the post use evaluation system, with the indicator weights in parentheses (Table 2).

2 Post use evaluation of public space in Shawan Ancient Town

2.1 Overview of the research area

Shawan Ancient Town is located in the central-west part of Panyu District, Guangzhou City, adjacent to the central Shiqiao Street in Panyu District to the north and Nansha District to the south, boasting a favorable geo-

graphical location (Figure 2). As the only national-level historical and cultural town in Guangzhou, Shawan Ancient Town has a history of 800 years and is an important cultural heritage of Guangzhou[11]971. Since the issuance of the "Conservation and Political Plan for the Historical and Cultural Area of Shawan Ancient Town" in 2008, Shawan Ancient Town has embarked on the process of protecting and updating its public space. The conservation and updating content and projects involved include the renovation of the facades on both sides of the street and alley space, the sorting and resetting of the planning structure of the ancient town, etc.[18] As one of the typical representatives of traditional village and town conservation, Shawan Ancient Town deeply records and reflects the development of traditional village and town conservation and renewal work during the process of public space conservation and renewal. Post-use evaluation of it will have typical representative significance.

Table 2 AHP based post use evaluation factor system for traditional villages and towns

Criterion layer	Factor layer	Indicator layer	Definition of indicators
B2 Culture, (0.4934)	C3 Architectural aspects(0.1645)	D7 Traditional architectural art value(0.0562)	The traditional artistic value of preserved historical buildings (clusters) in terms of shape, structure, and detailed decoration after conservation
		D8 Traditional architecture Authenticity(0.0949)	The degree of conformity between the conservation and renewal of traditional buildings and their original state
		D9 Street facade appearance(0.0133) (0.0133)	Evaluation of the degree of conformity between the facade appearance and the original condition after street renovation
	C4 Historical and cultural style (0.3289)	D10 Cultural heritage vitality(0.1946)	Increase or decrease in the number of cultural heritage compared to the situation before conservation and update is its value dynamically protected and actively utilized
		D11 Traditional style preservation.(0.1096)	The increase or decrease in the retention of historical and traditional buildings compared to before conservation and renewal
		D12 Landscape level characteristics (0.0247)	living landscape environmental elementslike water system, memorial archway, wells and others
B3 Functionality (0.3108)	C5 Meeting the needs of use (0.1036)	D13 Infrastructure construction (0.0691)	Essential infrastructure for life
		D14 Service facility configuration (0.0345)	Service facility configuration
	C6 Folk culture (0.2072)	D15 Continuation of folk culture(0.1381)	Situation of villagers continuing traditional living customs, traditions and folk culture
		D16 Types of cultural activities(0.0691)	The increase in the number and types of cultural activities compared to the situation before the conservation update proves that the conservationand update has continued and continuously expanded its original cultural influence
B4 Economic and social effects (0.1958)	C7 Social effect (0.1305)	D17 Resident participation (0.0704)	Number of times villagers participate in management formulation, and conservation decisions
		D18 Residents' satisfaction (0.0388)	A survey of villagers' satisfaction with the effectiveness of conservation and renewal
		D19 Village and town social Order(0.0213)	Villager convention and rural autonomous organizations, public security situation
	C8 Economic effects (0.0653)	D20 Number of tourists (0.0049)	Annual increase or decrease in tourist volume during peak holiday days
		D21 Tourism development Benefits(0.0119)	The growth status of development efficiency in tourism management departments
		D22 Resident economic benefits(0.0484)	Annual increase and decrease in per capita income of villagers

2.2 Evaluation object

This article selects node spaces and linear spaces within typical public spaces in Shawan Ancient Town for post use evaluation [19]. Node spaces mainly include gathering spaces, recreational spaces, etc., such as open spaces like Anning Square and West Square, as well as surrounding spaces with important landmark buildings such as Wenfeng Pagoda and Liugengtang Square.

As a traditional village with a strong sense of clan, Shawan Ancient Town's ancestral halls and temples are very important landmark buildings, such as the Li Clan Ancestral Hall and the He Clan Ten-Generation Ancestral

Hall in Dongcun. As these important public buildings are often associated with the main street and alleys, when using spatial syntax for evaluation, the main street and alleys containing important public spaces are extracted as evaluation objects for linear space, such as the main entrance street Daxiangyong Road connecting the south gate, the tourist service center and the Qingshui well; the Anning West Street, connecting the core buildings of the ancient town such as Zhennan Temple and Sanren Hall; Anning Road serves as the core road of the ancient town, connecting major exhibition buildings such as He Shiliang Art Museum and He Binglin Academician Memorial Hall. The core commercial street of the ancient town also runs from Anning East Street to West Street, with Chengfangli Street connecting to Liugengtang, and parades such as worshipping gods are held in special holiday settlements. Therefore, the evaluation streets and alleys selected in this article have their corresponding value, either as the main transportation space or as connections to the core public space (Figure 3).

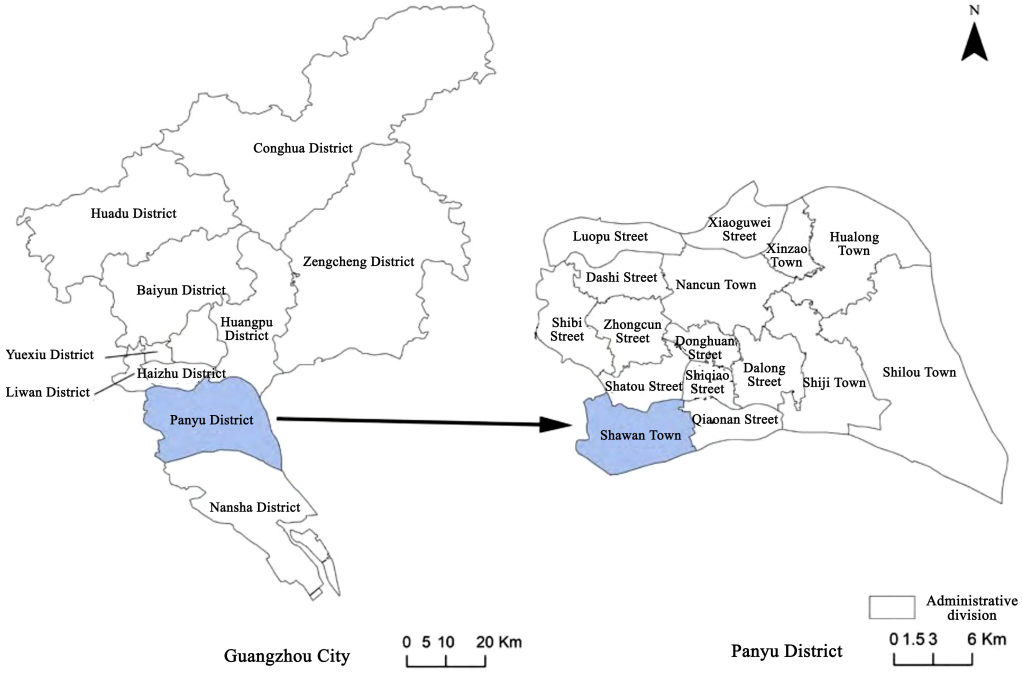


Figure 2 Location map of Shawan Ancient Town

2.3 Analysis of the spatial evolution in Shawan Ancient Town

Integration is a measure of the ability of a space to attract traffic, that is, the accessibility of the space. The higher the numerical value, the higher its integration and accessibility. From Figure 4a, it can be seen that in 2010, the high integration value area of Shawan Ancient Town formed a "cross shaped" distribution pattern from Anning West Road to Anning East Road, and from Daxiangyong Road to Zhonghua Avenue, which is a manifestation of concentrated pedestrian flow and high-frequency of commercial activities. The area from Anning West Road to Anning East Road was the ancient commercial center of Shawan Ancient Town, while the main commercial street currently in use is Daxiangyong Road to Zhonghua Avenue, which undertakes important economic, political, and cultural functions. However, the traditional residential areas in the west and east of the ancient town are relatively less integrated, presenting a relatively closed state. The connectivity reflects the number of nodes directly connected to other node spaces through straight lines, with higher values indicating higher values and better spatial permeability. A higher degree of selectivity indicates that the frequency of spatial units being selected is higher, which can be used to express the probability of the population passing through the space [19]. The axis with higher selection values in Shawan Ancient Town is located on Zhonghua Avenue and Daxiangyong Road (Figure 5a). These two roads, as the main roads that run through the north, south, and east, bear the main transportation functions and are the main

roads people choose for travel. The degree of choice represents the possibility of space being traversed, reflecting the potential of space to attract "traffic". The higher the value, the higher the degree of choice. An analysis of the road connectivity in Shawan Ancient Town (Figure 6a) revealed that the high value axis distribution of the town's connectivity was relatively scattered, mainly distributed in the vicinity of Wenlinfang Street and Shawan Street Office, forming a small range of high-value areas. This indicates that these roads have strong connectivity and accessibility, and play a role in traffic evacuation, and are also concentrated areas for people's daily activities [20].

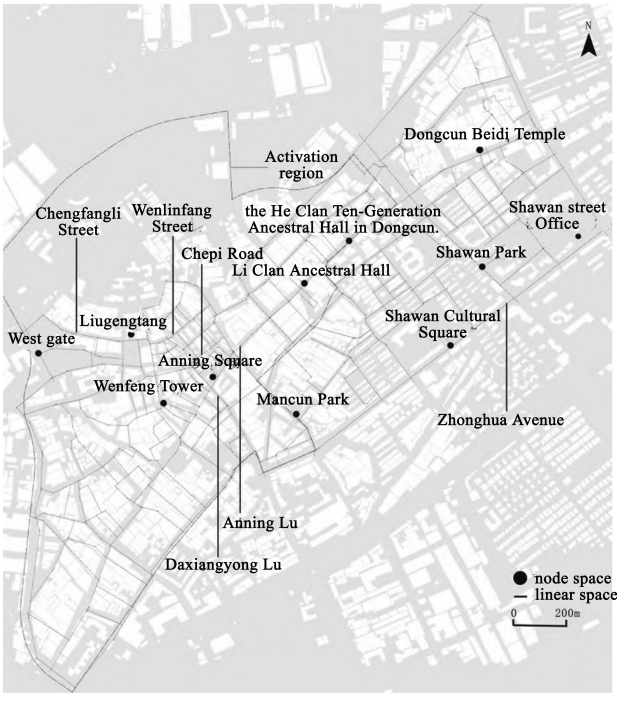


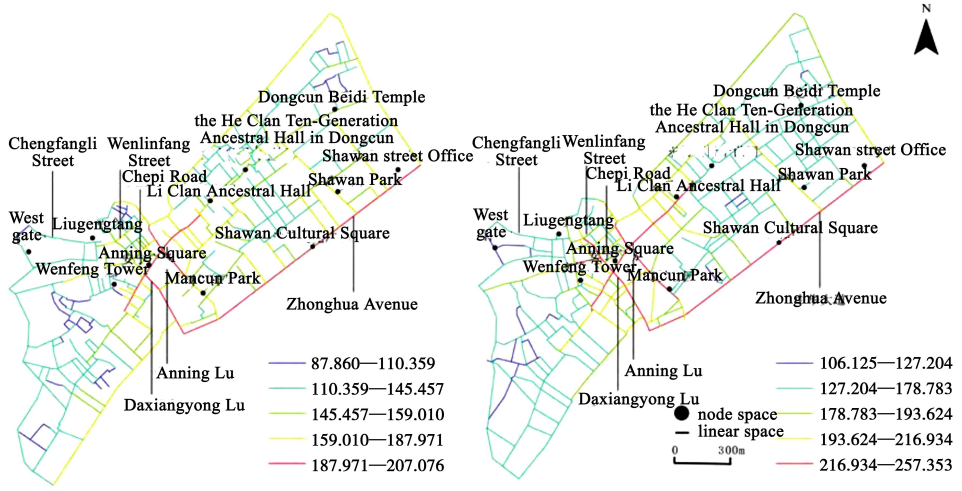
Figure 3 Axis map and public space schematic diagram of Shawan Ancient Town

After the public space conservation update of Shawan Ancient Town in 2020, the overall integration degree of the town has been improved, and the core of the integration degree continues to expand (Figure 5b), extending along the northern end of Daxiangyong Road to Wenlinfang Street, and along Anning East Road to Li's Ancestral Hall, showing a trend of outward expansion. In terms of selectivity, the road selection of Shawan Ancient Town has further improved, forming a high selectivity road grid with Anning Square as the core and radiating around the ancient town, with continuously increasing traffic potential (Figure 5b). This indicates that the historical development of Gusheng Village has not been significantly disrupted in recent years, and the effects of updating and improving streets and alleys have been apparent, ensuring the potential for attracting primary and secondary streets and alleys in the village [21]. However, at the same time, there is still room for improvement in the cross-traversal potential of ancient town streets. The high connectivity axis of the ancient town is also constantly increasing (Figure 6b), gradually forming a high value area of connectivity, especially in the areas near Anning East Road, Daxiangyong Road, and Dongcun Beidi Temple, where the connectivity of the axis has been significantly improved, further enhancing the spatial attractiveness.

2.4 Post use evaluation based on Spatial Syntax

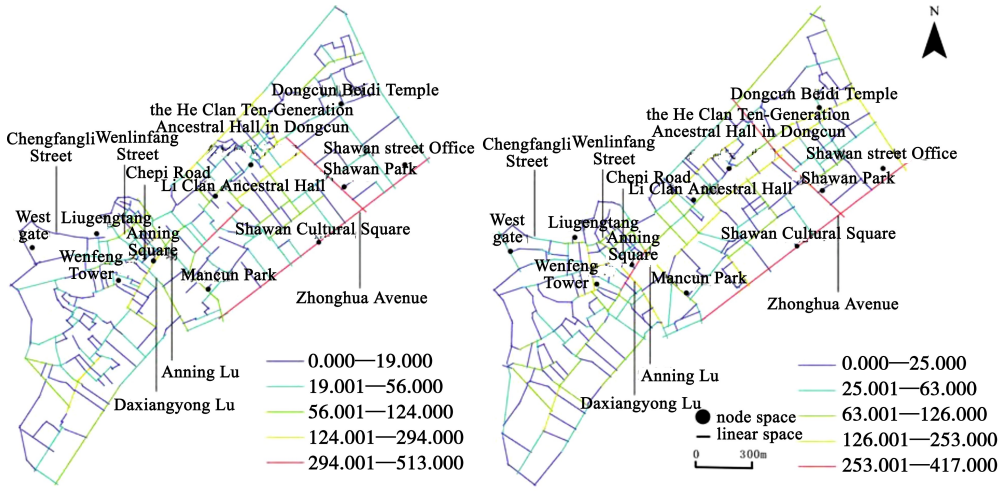
Evaluating the spatial structure of the selected public space nodes in Shawan Ancient Town resulted in the assessment in Table 3. By comparing the integration parameters of node space and linear space in the public space selected in the axis map before and after the conservation and update of Shawan Ancient Town, and evaluating the D1 and D4 factors based on the changes in integration degree, the accessibility of D1 node space and D4 linear space is evaluated. The integration degree is significantly improved after the conservation and update, and the accessibility is further improved. The core space of the updated ancient town has the greatest increase in accessibility, such as Anning Square, Liugengtang, Wenfeng Tower, and surrounding street and alley spaces such as ancestral halls, including Daxiangyong Road and Anning Road; From a planning perspective, although the integration data of the public space formed during the conservation and renovation process has been improved, its accessibility is still not strong. It is necessary to strengthen guidance to improve its accessibility, such as the West Entrance Square.

By comparing the selection parameters of node space and linear space in the public space selected in the axis map of Shawan Ancient Town before and after the conservation and update, and evaluating the D2 and D5 factors based on the changes in selection, the utilization rate of node space D2 and the traversal rate of linear space D5 were evaluated. The selection degree was significantly improved after the conservation and update, and the utilization rate and traversal rate were both improved.



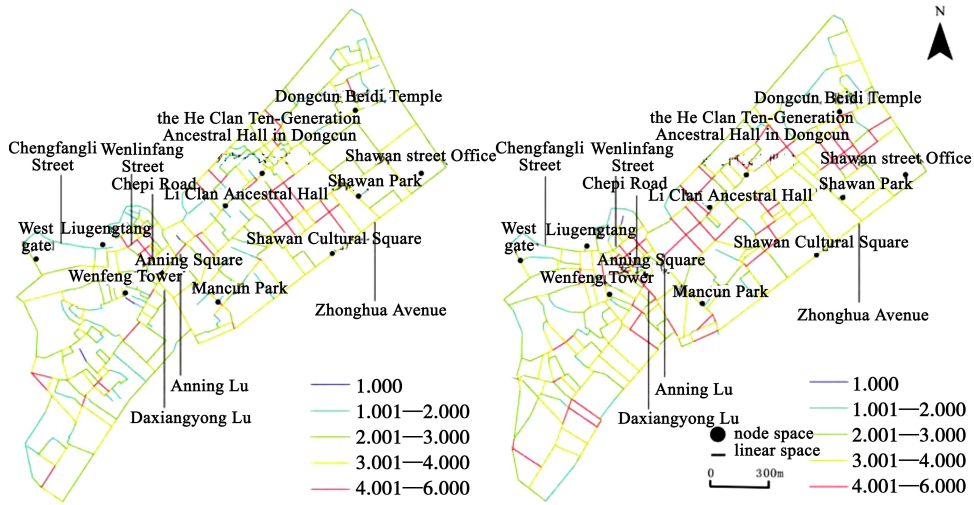
(a) 2010 (b) 2020

Figure 4 Integration degree of Shawan Ancient Town



(a) 2010 (b) 2020

Figure 5 Selection of Shawan Ancient Town



(a) 2010 (b) 2020

Figure 6 Connectivity of Shawan Ancient Town

Table 3 Space syntax parameter values before and after the conservation and update of public space in Shawan Ancient Town

Axis map parameter value		Integration degree		Selectivity		Connectivity	
		2010	2020	2010	2020	2010	2020
C1 Node space	Anning Square	209.3	243.4	300	418	4	5
	Wenfeng Tower Square	110.4	171.5	10	25	2	3
	West Entrance Square	118.3	125.8	12	30	3	3
	Liugengtang Square	122.3	161.6	22	104	2	4
	Li Clan Ancestral Hall	136.9	178.5	92	94	2	2
	The He Clan Ten-Generation Ancestral Hall in Dongcun	160.1	166.8	19	54	2	3
Evaluation results of indicator layer		D1 Accessibility: overall improvement, enhanced accessibility		D2 Utilization rate: overall improvement, high utilization rate		D3 Space permeability: partial improvement, average permeability	
C2 Linear space	Daxiangyong Road	205.4	252	37	172	4	5
	Anning west street	200.7	241.6	185	418	5	5
	Anning Road	206.7	245.3	416	300	4	5
	Anning East Street	202.5	240.3	76	89	6	6
	Chepi Road	178.2	196.7	50	219	5	5
	Anzhaili	153.0	224.3	30	73	3	4
	Wenlinfang Street	161.9	170.9	201	100	5	4
	Chengfangli Street	121.4	157.9	6	33	2	3
Evaluation results of indicator layer		D4 Accessibility: Overall improvement, enhanced accessibility		D5 Penetration rate: overall improvement, high penetration rate		D6 Street accessibility: partial Improvement, average accessibility	

In the node space, except for the Li Clan Ancestral Hall, there has been a significant increase in its selectivity, especially the Anning Square located in the conservation and renewal center area and the Liugengtang Square, a key project. Regarding the linear space section, Daxiangyong Road, as the main entrance to the core area of Shawan Ancient Town, connects the central and peripheral areas, and is the path with the most dense basic service facilities. Anning West Road, Anning East Road, and Chepi Street are commercial and service gathering areas, as well as the central area of Shawan Ancient Town, and people's activities are the most frequent places there. As shown in Table 3, their selectivity has greatly improved, although the selectivity of Anning Road and Wenlinfang Street has decreased after they been protected and updated compared to before the conservation and update, their overall selection distribution became more even.

Furthermore, by comparing the connectivity parameters of node space and linear space in the public space selected in the axis map before and after the conservation and update of Shawan Ancient Town, and evaluating the D3 and D6 factors based on the changes in selectivity, the permeability of D3 node space and the accessibility of D6 linear space were evaluated. The connectivity was slightly improved, while the permeability and accessibility were generally moderate. Before and after the update of node space conservation, its connectivity has been partially improved, while some have remained unchanged. For example, the central spaces such as Anning Square, Wenfeng Tower Square, and Liugengtang Square have significantly improved. Similarly, the connectivity of the linear space before and after the conservation and update has also been partially improved, while some remain unchanged. For example, the connectivity of the entrance road, Daxiangyong Road, and the main connecting roads, Anzhaili and Anning Road, saw a slight increase after the conservation and update. However, the improvement in the accessibility of the streets and alleys is not significant, which is also related to the fact that the original village texture is still preserved after the conservation and update of Shawan Ancient Town.

2.5 Post use evaluation based on fuzzy comprehensive method

The fuzzy evaluation method was created by American automatic control expert Zadeh. It is based on fuzzy mathematics, which was born in 1965, and adopts a comprehensive evaluation method. Based on the membership theory of fuzzy mathematics, qualitative evaluation is transformed into quantitative evaluation. The fuzzy comprehensive evaluation method determines the membership matrix and uses it to assign the rating levels, and ultimately reaches the evaluation conclusion [22].

The questionnaire developed around fuzzy evaluation

covers 6 major items and 16 minor items. In order to facilitate tourists and villagers to evaluate the level of factors and indicators in the questionnaire, a 5-level Likert scale method was introduced, where "5" corresponds to "excellent", "4" corresponds to "good", "3" corresponds to "medium", "2" corresponds to "poor", and "1" corresponds to "very poor". The author conducted a questionnaire survey from May to October 2019 and distributed a total of 100 questionnaires. Excluding repetitive or incomplete responses, 69 valid questionnaires were obtained, with an effectiveness rate of 69%. Based on the weight of each factor, the fuzzy comprehensive evaluation method was applied to calculate the fuzzy comprehensive score of each factor in Shawan Ancient Town according to the questionnaire results, and the membership degree of each evaluation level was determined. Based on this, a comprehensive and scientific evaluation result is obtained. The fuzzy comprehensive evaluation results of the target layer and criterion layer are shown in Table 6. The overall fuzzy comprehensive evaluation of the public space conservation and renewal in Shawan Ancient Town is 3.7373, which falls within the "medium" but very close to the "good" range. Among the three major criterion layer elements, B2 cultural level is at the "good" level, B3 functional level falls within the "poor" close to the "medium" range, and B4 economic and social effect is at the "medium" level.

Based on the comprehensive weight and evaluation (Table 4), the public space of Shawan Ancient Town is at a "good" level in terms of cultural construction, conservation, and renewal. This indicates that Shawan Ancient Town has been effective in protecting traditional buildings and maintaining its historical style during the conservation and renewal process. There are many traditional buildings of various dynasties and their rich spatial forms that serve as public spaces in the ancient town, which have been fully respected, preserved and inherited during the conservation and renewal process, such as using coastal materials to construct oyster shell walls and rammed earth houses, vividly reflects the authenticity of cultural conservation. Of course, there are also some areas that require to be discussed in the process of protecting and updating public spaces. For example, some ancestral halls have been renovated with gorgeous paintings, sculptures, and colorful paint decorations, which cannot accurately and truly restore the decoration and techniques of traditional public buildings.

Table 4 Fuzzy comprehensive evaluation scores for the target and criterion layers of Shawan Ancient Town

Target layer	Criterion layer	Score	Factor layer	Score
Fuzzy comprehensive evaluation scores 3.7373	B2 culture	4.4144	C3 architectural aspects	4.5769
			C4 historical and cultural style	4.3332
	B3 functionality	2.7778	C5 meeting the needs of use	3.6667
			C6 folk culture	2.3333
	B4 economic and social effects	3.5542	C7 social effects	3.4604
			C8 economic effects	3.7418

The evaluation of functionality is within the range of "poor" to "medium", which is the lowest-scoring item in the criteria layer. Shawan Ancient Town has historically become the commercial center of Panyu due to its convenient waterways, with bustling commerce and numerous rural areas. Although the public space of Shawan Ancient Town still follows its original functional distribution during the conservation and renovation process, and Anning Road is built as the main commercial street, its functionality is still slightly monotonous. Some node public spaces, such as squares and ancestral halls, are only used for recreational and exhibition purposes, with short stays for tourists and residents and weak interactivity. Through the evaluation results, it can be seen that although its functionality can meet the basic usage needs of most tourists and residents, its functionality in promoting and carrying out the conservation and updating of folk culture is clearly insufficient.

The economic and social effects are at a relatively high level within the "medium" range, reflecting the high participation of villagers in the process of protecting and updating the public space in Shawan Ancient Town, and their satisfaction with the results of the conservation and updating. At the same time, it fully affirms that the public space in Shawan Ancient Town has to some extent driven the development of local tourism after the conservation and updating, and the number of tourists and tourism development revenue are steadily increasing, contributing to the improvement of the local residents' income levels to a certain extent.

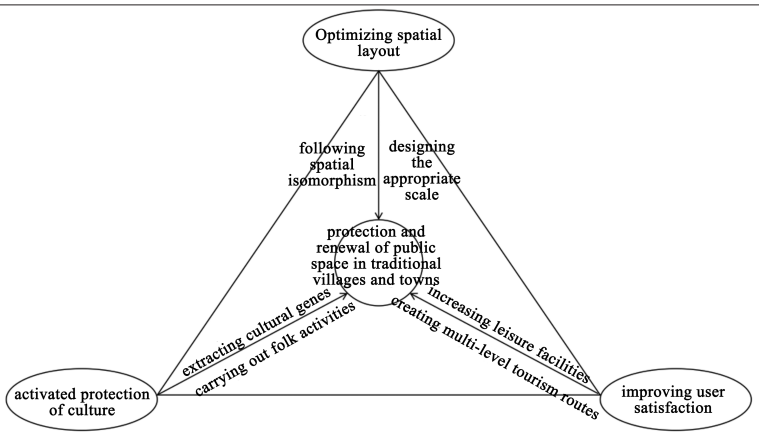


Figure 7 Block diagram of traditional village and town public space conservation and update

3 Strategies and implications

From three aspects: optimizing the spatial layout of ancient towns, improving user satisfaction, and actively carrying out cultural activities, a framework for the conservation and renewal of public spaces for traditional village and town is constructed (Figure 7), in order to provide references for the conservation, renewal, and inheritance of public spaces for traditional village and town.

(1)Properly following spatial isomorphism and optimizing the spatial layout of ancient towns.

In the renewal and renovation of traditional villages and towns, it is necessary to understand the old spatial sequence of traditional villages and towns, and use reasonable planning and layout to ensure the good continuation and development of the spatial form of traditional villages and towns [11] 977. Due to the influence of street spatial scale on the length of time users stay in the space and the speed of sightseeing, it is necessary to design appropriate street spatial scale to better create a rich scenic experience for space users. At the same time, the design of traditional village and town street spaces should be based on the premise of not changing the main layout of streets and alleys. Through the similarity of materials and the unity of construction methods, the positions that affect the continuity of the interface should be supplementally designed to maintain the continuity of the horizontal and vertical interfaces, thereby maintaining the continuity of the street space interface [23].

(2)Emphasizing the communication function of public spaces and improving user satisfaction.

The conservation and renewal of traditional villages and towns should also focus on promoting community management, organizing activities, cultural and folk promotion, and the core concept of conservation and renewal is to promote the sustainable development of village and town society through various means such as economic and cultural recovery. Therefore, in the conservation and renewal of traditional villages and towns, it is necessary to attach importance to the participation of villagers and promptly inform them and let them understand, to enhance their sense of participation. In traditional villages and towns, public spaces are often spaces where people engage in frequent activities and engage in frequent communication. Leisure facility installations such as benches and landscape elements can be provided to increase the duration of people's stay in the space and enhance the social interaction function of public spaces[24]. For tourists, it is necessary to restore the traditional architectural traces from different periods in the core tourist area and create a primitive atmosphere of cultural authenticity. And by creating multi-level tourism routes, tourists can not only experience the real-life situations of residents while traveling, but also have a richer scenic experience.

(3)Extracting cultural genes from ancient towns and actively carrying out cultural activities.

The public spaces in traditional villages and towns have functions such as worship, gatherings, daily life, and transportation, and are closely related to the lives of villagers and the activities of tourists, they are precious material cultural heritage of traditional villages and towns, and also carriers of intangible culture. Therefore, in the process of conservation and renewal, in addition to adhering to the principle of authenticity and guided by cultural active conservation, it is also necessary to fully understand

the spatiotemporal characteristics of heritage resources in traditional villages and towns, extract cultural genes from ancient towns, explore deep cultural structures, actively carry out activities related to folk culture, and moderately increase their publicity efforts. In the future, it can attract socio-economic investment and implement industrial operation through cultural inheritance and innovation.

Conclusion and discussion

This article uses Depthmap software to compare the axis maps of public spaces in Shawan Ancient Town before and after conservation and update. Combining spatial syntax theory and related parameters, the spatial composition factors are evaluated after use. From the perspective of spatial structure, the effectiveness of conservation and update of public spaces in Shawan Ancient Town is systematically sorted and summarized, and the AHP fuzzy comprehensive method is used to conduct post use evaluation on the cultural, functional, and economic and social effects evaluation factors of public spaces for traditional village and town, and constructs a post use evaluation system for public spaces in traditional village and town. The main conclusions of this study are as follows:

Firstly, this article constructs a post use evaluation system for public spaces based on spatial syntax and AHP fuzzy synthesis method. The evaluation system is divided into four major indicators: spatial structure, culture, functionality, and economic and social effects, and their respective weight coefficients are determined. The applicability of the evaluation system is verified through a case study of Shawan Ancient Town in Guangzhou. Overall, the model has good generalizability and application value, providing scientific references for the subsequent conservation and update evaluation of traditional villages and towns.

Secondly, the results of spatial syntax analysis indicate that from 2010 to 2020, the high integration value area of Shawan Ancient Town continued to extend outward on the basis of the original "cross shaped" distribution formed by Anning West Road to Anning East Road and Daxiangyong Road to Zhonghua Avenue. Its integration degree has significantly improved after conservation and updating, and its accessibility has further improved. Although the axis with higher selectivity values is still located on Zhonghua Avenue and Daxiangyong Road, the overall distribution of selectivity is more even, and the transportation potential of the ancient town continues to increase. The high connectivity axis of the ancient town is also constantly increasing, gradually forming a connected high value area, further enhancing the spatial attractiveness.

Thirdly, based on the AHP fuzzy comprehensive method, the evaluation of the effectiveness of public space conservation and updating in Shawan Ancient Town was conducted. It was found that the cultural construction and conservation of public space in Shawan Ancient Town are at the "good" level, while the functional evaluation and economic and social effects are at the "medium" level. This reflects that the cultural authenticity of Shawan Ancient Town has been well preserved during the conservation and renewal process, and the maintenance efforts have been fruitful. Public spaces can meet the basic needs of most tourists and residents, but their functionality in disseminating and carrying out folk culture inheritance is clearly insufficient. At the same time, the villagers also highly appreciate the achievements of conservation and renewal, believing that the conservation and renewal of ancient towns have promoted the development of local tourism to some extent. The rural revitalization strategy, as the top priority of the entire Party's work, is a new landmark that guides rural construction in the new era. In response to the gradual disappearance of the value of rural space, the cohesion and geographical relationship of rural areas continue to differentiate, leading to issues such as the failure to protect and update traditional cultural village spaces [25]. We should actively respond to the advocacy of rural revitalization strategy, implement the strategy in the construction of traditional villages and towns, and evaluate the effectiveness of protecting and updating public spaces in traditional villages and towns, in order to provide scientific reference for reshaping the image of rural areas and continuing regional cultural heritage of township.

Although this article constructs a post use evaluation system for public spaces from four aspects: spatial structure, culture, functionality, and socio-economic benefits, and proposes detailed conservation and renewal strategies, implementing it is a more complex task involving many variable factors, such as policy orientation, negotiation and game of interests, and so on. At the same time, the conser-

vation and renewal of public spaces in traditional villages and towns is a relatively broad and complex research topic, involving multiple disciplines such as planning, architecture, ecology, sociology, etc. In the future, a multidisciplinary approach can be adopted and more experts from different fields are to be invited to grade and conduct in-depth research on the analysis of traditional village and town conservation and renewal strategies, leading to a more comprehensive understanding of traditional village and town conservation and renewal.

Figure and table sources

The figures and tables in the text were all drawn by the author.

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