

## The Research Evolution and Frontier Analysis of Historical Districts in Ancient Villages by Space Syntax

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### ABSTRACT

The article uses CNKI and Google Scholar as the main document search methods. Through induction and analysis, it can be found that the call for urban renewal in Zhuhai has been sounded at this stage. The ancient villages in different areas of the city, such as Tangjiahuitong Village, Doumen Nanmen Village, and Nanping Beishan Village, have been given a certain degree by related scholars. For in-depth research, many journals and master and doctoral papers already have relevant documents available for retrieval. Through the analysis of relevant literature, we can see that the research method is a combination of quantitative and qualitative analysis, and some new results have been obtained through the analysis. In recent years, Qianshan Cuiwei Village also has some related literature studies, but there are few literatures. The literature is mainly It is a qualitative analysis and research, and there is no quantitative analysis. In the future, relevant scholars can start with quantitative analysis, and space syntax may be a good method. In the feasibility study of Cuiwei Village using this method, it was found that the spatial syntax has certain limitations at the geographic scale. Therefore, how to apply the spatial syntax scientifically, rationally and effectively in the village research is a question worthy of discussion in the future.

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## INTRODUCTION

In 1970, Professor Bill Hillier put forward the concept of "spatial syntax", which is a theory about spatial structure and social relations. He regarded space as a part of social life, and the core theory is "spatial organization", which is interpreted as the combination relationship in space. With the book *Space is a Machine - Architectural Fabric Theory*, a complete system has been formed. In the analysis, the topology and geometry related factors are considered, and applied between people and vehicles and places, social abuses and crimes. A model is built to study the operation of the city, and identify the land use potential and micro attributes in the local grid. The space syntax and urban planning edited by Duan Jin discussed the internal idea of space syntax: when thinking about space, we can regard space as the background wall of people's activities and natural objects, the internal attribute of human actions, and reshape and integrate space to make it more humane.

## LITERATURE REVIEW

### **A Survey of Researches on Spatial Syntax at Home and Abroad**

#### *Exploration on the practice of protection and organic renewal of domestic historical districts*

The protection and renewal of historical blocks has always been the top priority in urban reconstruction and renewal. Because the buildings in the blocks are in disrepair for a long time and the planned plot ratio is low, it is required to revitalize the stock at this stage, and the total number of buildings should be strictly controlled. If the government is short of funds, relying solely on the urban texture of the market led and historical blocks, the cultural connotation of villages will be seriously damaged, which will have an irreversible impact.

Liede Village is located in an area to the south of Zhujiang New City, with a total area of 33.6 hectares to be reconstructed. As a historical block, Liede Village did not retain the overall style and features of Lingnan Water Village in the process of reconstruction. Instead, Liede New Village with high-rise residential buildings was replaced. In the reconstruction plan of the village, the architect retained some of the original historical landscape. The village ancestral temple cultural area covers a large area. The reconstruction method is to remove the original ancestral temple, select a new area and focus on the reconstruction of representative ancestral halls. The Guangzhou Municipal Government has preserved the important ancestral halls and temples in Liede Village with the Dragon Mother Temple as the center, and restored the original valuable dwellings. Although the traditional Lingnan style has disappeared in front of people's eyes, and the original village texture has also been exhausted, the existing ancestral halls and temples can also awaken the good memories of the original Liede Village villagers in Guangzhou.

In the reconstruction and design of Liede Village, although the traditional Lingnan water town culture has not been retained, it is still a relatively successful case in the reconstruction of historical blocks. The main reason is that Liede Village has a good geographical location and market value. At this stage, Guangzhou is

building CBD and improving infrastructure construction, which also provides a lot of support for the reconstruction and design of Liede Village.

Yangji Village is located near Taixingzhi Street, Yuexiu District, Guangzhou City, Guangdong Province, with a reconstruction area of 11.5 hectares. Yangji Village Ancestral Temple Cultural Area covers an area of 6800 m<sup>2</sup>. The reconstruction method is to demolish the original ancestral hall, relocate and focus on the reconstruction of representative ancestral halls.

Wenchong Village is located in Huangpu District, Guangzhou, with a reconstruction area of 47.3 hectares. The reconstruction focuses on preserving the original pond layout and natural environment. The transformation method is to focus on the protection of historical relics and partially relocate some cultural relics.

#### *Overview of domestic research on the protection and renewal of historic districts based on space syntax*

This research input keywords such as "space syntax", "historical blocks" and "village transformation" on CNKI and Wanfang data, looked up journals and master's dissertations in the past seven years, read books on space syntax, village space morphology, historical and cultural village protection at home and abroad, sort out, summarize and summarize the research objects, contents, methods and conclusions of journals and papers, and found that space syntax in villages, towns The protection, utilization and renewal of historical and cultural blocks and famous historical cities have become more and more mature, and more high-quality papers have been published.

In the field of space research in historic districts, the researchers have summarized the contents of important master's theses and literatures in China, which are mainly reflected in the following aspects:

- a) Research on the conservation and renewal of historical villages based on space syntax theory;
- b) Based on the spatial syntax and intentionality theory, the spatial morphological characteristics of historical villages are analyzed;
- c) Cognitive and analytical research on street system and public space of historical villages based on space syntax theory;
- d) Based on the combination of spatial syntax and GIS, the spatial characteristics of historical streets are analyzed. In recent years, the literature related to the space research of historical blocks has been increasing. In addition to qualitative research, scholars have also made quantitative research on space syntax and GIS, making the research results more convincing.

It is not completely correct to predict that the streets and alleys with large population flow in three-dimensional space-time have better accessibility and are easier to be recognized by people, because three-dimensional space-time not only has angle change and Euclid distance, but also has many social and geographical factors. Therefore, using spatial syntax to study ancient villages in two-

dimensional space needs to be combined with angle distance and metric distance, and human customs, Feng Shui and other theories are considered together.

Wang Sicheng's discussion focus in 2012 *Research on the Transformation and Analysis of Urban Villages Based on Spatial Syntax Theory*: based on spatial syntax theory, he practiced the transformation of villages in towns from two aspects: the transformation of linear space inside villages and the transformation of important node space, and proposed "reshaping the village space core" for street space system and main node space respectively, Relevant strategies of "enhancing the accessibility of blocks" and "focusing on the visibility and concentration of node space".

Research methods: field investigation, literature analysis, statistical analysis, comparative analysis, questionnaire survey, summary and analysis.

The focus of Quanshui's discussion in 2012 *Related Research on the Spatial Characteristics of Kashgar Street and Lane Systems Based on Spatial Syntax Theory*: based on the spatial syntax theory, by comparing the surrounding environment, spatial structure and the main walking directions and main gathering locations of foreign tourists in the block space of historical blocks, Quanshui found the spatial differences between local population and foreign population, from macro to micro, from overall to local, Based on the analysis of the commonness and individuality of the space use of foreign tourists and local residents, Kashgar historical and cultural blocks are faced with such problems as a large number of tourists passing through the old urban area without entering, the protection of streets and alleys still stays at the architectural level, and the block transformation has not started from the perspective of urban space, and the transformation strategies such as defining the level of streets and alleys and reducing fragmented space are proposed.

Key points of He Bin's discussion in 2013 *Analysis and Research on Adaptive Protection Strategy of Taiping Street in Changsha City, Hunan Province Based on Analytic Hierarchy Process*: Based on Analytic Hierarchy Process, the article proposed an adaptive protection theory for Taiping Street historical street, selected Taiping Street historical street vitality, safety and accessibility and spatial vitality for evaluation, adopted Analytic Hierarchy Process, and proposed the spatial integration of historical and cultural street and street integration, Improve infrastructure, historic building protection and other strategies.

Tao Jianhua's discussion focus in 2014 *Research on the Protection and Renewal Strategy of Zhongshan Road Section in Qingdao City Based on Spatial Syntax Theory*: based on the spatial syntax theory, he analyzed and studied the spatial morphology of Zhongshan Road Section in Qingdao City from the macro to the micro level, put forward suggestions on the transformation and renewal of the internal functions of buildings, the restoration of facades, and the demolition of buildings with no historical value. In the renewal goals, principles and models, he proposed the optimization of traffic, Landscape reconstruction and other strategies.

The focus of Hu Sisi's discussion in 2014 *Analysis of Street Space of Qingdao Historic Blocks*: the article analyzes the adaptability and space scale of

the historical blocks from the macro, meso and micro levels, combining with the actual measurement data, and discusses morphology, design, roads and traffic; In terms of street protection and renewal, strategies such as strengthening the consolidation and shaping of districts and enhancing the humanistic care of neighbors are proposed.

Zhang Shuhan's discussion focus in 2015 "Research on the Transformation and Analysis of the Space System of Dayan Settlement Streets and Lanes Based on the Theory of Space Syntax" is to combine space syntax and questionnaire analysis, conduct quantitative analysis on the streets and lanes of Lijiang settlement space in Yunnan, and propose to strengthen each space feature, respect the historical culture of Dayan settlement space, continue the historical culture of streets and lanes, and reasonably protect the natural environment and artificial landscape environment.

Xu Hui's discussion focus in 2015 "Research on Spatial Morphological Characteristics of Nanjing Gaochun Hejia Wujia Village Based on Spatial Syntax Theory": based on spatial syntax theory, quantitative analysis of different spatial forms of several villages in Nanjing was carried out. Through building traditional spatial axis and convex space models of different villages, and through relevant case studies, the spatial core structure of Wujia Village was built based on spatial syntax Repair and readjust the village street system, and integrate the village space nodes.

Cao Yinwen's discussion focus in 2015 "Research on Spatial Renewal of Binjingyu Historic Block in Harbin City Based on Spatial Syntax Theory": using Depthmap software to extract the topological network of Jingyu block axis, including integration, entropy value and horizon analysis, as well as GIS statistics related data, analyze its interaction and relationship with the old city, discuss the different characteristics of the block space in different periods, and discuss the spatial structure, layout Put forward corresponding strategies for visualization of intention elements.

The focus of Feng Yaocong's discussion in 2016 Research on Quantitative and Cognitive Analysis of Public Space Morphology in Shunde Water Towns: based on spatial morphology quantification and spatial cognitive theory, based on network density, spatial syntax and urban image theory, he made quantitative and cognitive analysis of the public space in simple villages in Shunde District, built an overall intention map, and made a comparative analysis of quantitative space and cognitive space. In the integration of street space, he widened the road width The space optimization strategy of upgrading shops along the street, improving commercial facilities, improving integration, and repairing buildings in the area.

The focus of Lin Nan's discussion in 2016 "Analysis and Research on the Countermeasures for the Planning and Renewal of Guangzhou's Village Space System under the Spatial Syntax Theory": based on the spatial syntax and urban renewal theory, he made a quantitative analysis of the public space planning of Guangzhou's public villages, deeply understood its connotation, and proposed the renovation and reactivation of ancient buildings, optimized the levels between streets and alleys, reconstructed the relationship between streets and

alleys, and improved its accessibility, Integrate and dismantle the street space with low degree of integration and control in series, optimize the node space and other solutions.

Cao Yunjia's discussion focus in 2016 "Analysis and Research of Chengdu's Historic Blocks Based on the Theory of Space Syntax": using space syntax, he made an in-depth analysis of the plane shape layout, spatial relationship diagram, and the overall street axis of the three major historical and cultural blocks in Chengdu, and made an analysis of the convex space of the main space nodes. He proposed that scenic spots should go hand in hand with life, restore the whole street space, improve the street functions, and continue the cultural characteristics, Create a diversified space.

The focus of Hu Yiran's discussion in 2017's "Relevant Application of the Spatial Syntax Theory in the Study of Historical Villages" was to compare and analyze the spatial attributes of Huitong Village in Zhuhai and Huangpu Village in Guangzhou by using spatial syntax, and to compare and analyze the differences in the degree of protection and the type of protection in terms of spatial attributes through the axis map, core density and understandability, and propose optimization strategies such as the separation of people and vehicles, and the simplification of the core design of roads.

Chen Pan's discussion focus in 2017 "Analysis of the Spatial Structure and Characteristics of Nanchang Longevity Palace Historic Block Based on the Spatial Syntax Theory": taking Nanchang Longevity Palace Historic Block as an example, based on the spatial syntax theory, he made a quantitative analysis of the network system of the historical block from four aspects: macro, meso, micro, and different periods, and constructed corresponding parameter models, and drew corresponding conclusions respectively.

The focus of Zheng Lei's discussion in 2017 Research on Spatial Cognition and Syntax of Huizhou Traditional Settlements: four representative villages with different contexts and cores in Huizhou were selected to transform the space of settlements into straight lines and horizon models, which verified the coupling of spatial syntax to spatial cognition, summarized the syntactic features of different elements, and proposed "enhanced accessibility" based on spatial cognition, The street protection and development strategy of "improving identifiability and sociability".

Cheng Zan's discussion focus in 2018 Correlation Analysis of Spatial Accessibility of Shuidong Historic Block in Xuancheng City Based on Spatial Syntax: to analyze the spatial accessibility of Shuidong Historic Block, including roads, buildings and different node spaces, analyze its influencing factors, and propose road integration, replacement and reuse of architectural space, and replacement, reset and transformation of important space in the block.

Xu Xufan's discussion focus in 2018 "Research on Spatial Morphological Characteristics and Spatial Cognitive Analysis of Chaji Traditional Villages in Southern Anhui Based on Spatial Syntax Analysis": taking southern Anhui villages as the research object, he conducted research from the dual perspectives of spatial form and cognition to verify their coupling, and then used the dual theory of spatial syntax and urban intention to describe the spatial attributes of

villages subjectively and objectively. For traditional streets left over by tradition, Narrow width, unobvious signs, vague street signs and insufficient guidance lead to weak public awareness. In terms of optimization strategies, solutions such as improving road identification, increasing road accessibility, optimizing signs and node elements, and improving environmental quality are proposed.

Yin Yi's discussion focus in 2018 "Analysis of Spatial Morphological Characteristics of Egret Historical and Cultural Villages Based on Spatial Syntax Theory": based on the principle of catalyst, integration and adaptability, analyze street space, node space, whole and part. In the space protection and development strategy, in the street space, connect the dead end road, increase the number of main streets and lanes, widen the main streets and lanes to enhance the traffic accessibility, increase the road network density, and improve the spatial integration and understandability.

Jiao Yanhong's discussion focus in the 2019 Analysis and Research on the Spatial Characteristics of Baoding Historic Districts Based on the Spatial Syntax Theory: in view of the improper management of streets and alleys in Baoding's ancient city, the lack of culture, the extinction of humanity, the large spatial population density, the serious congestion and other problems, Jiao Yanhong used the spatial syntax theory to build the axis and line segment model of the ancient city in different periods, and discussed the connection with Baoding's historical and cultural streets, Through the analysis of the syntactic variables such as the integration degree and selection degree of Baoding historical and cultural blocks, it is found that there are problems such as poor understanding and spatial confusion, and it is proposed to adjust the land use layout and improve the spatial vitality.

Wang Chengfang and Sun Yimin's discussion focus in 2012 "Research and Analysis on the Planning Method of Protection and Renewal of Jiangmen Historic Districts Based on Geospatial System and Spatial Syntax": build a data base for quantitative analysis of buildings, spatial nodes and roads in Jiangmen Historic Districts, obtain maps in different years, establish axis models, draw many linear correlation conclusions, and propose to sort out traffic, The strategy of building demolition and consolidation.

Zhang Guiling and others focused on the discussion in 2017 "Analysis and Research on the Space System of Shangxiahang Historic Streets and Lanes Based on Space Syntax": based on the space syntax theory, they made a quantitative analysis on the integration, connectivity, visual integration and field entropy of Shangxiahang Historic Streets. Under the theory of "micro renewal", they proposed that it is necessary to cultivate the spatial vitality of special streets and lanes, strictly control the scale of streets and lanes, excavate the traditional culture of streets and create landscape nodes, Strategies to improve street and lane identifiability.

Zhu Yifan and others discussed in 2018 "Analysis and Research on the Updating Method of Non protected Historic Blocks in Hualou Street Historic Area in Wuhan Based on Space Syntax", focusing on building the topological relationship model of Hankou Old Town and Hualou Street Historic Area based on space syntax, and putting forward the updating requirements from the

perspective of context inheritance, function bearing, block transparency and transformation mode.

Liu Hao and Zhong Yanfen focused on the discussion in 2019 "Analysis and Research on the Spatial Morphology Syntax of Streets and Lanes in Anyi Ancient Village and Qunluotian Village Based on the Spatial Syntax Theory": based on the spatial syntax theory, they conducted quantitative analysis and research on the overall integration, local integration, connectivity and average depth of Luotian Village, and concluded that Anyi Ancient Village and Qunluotian Village need to improve the spatial comprehensibility and enhance the spatial identifiability of streets and lanes.

Wang Xiangkai and Xie Jingbo focused on the discussion in 2019 "Analysis and Research on the Spatial Morphology of the Streets and Lanes in Guangfu Ancient City Based on the Spatial Syntax Theory": taking the streets and lanes in Guangfu Ancient City as the research object, based on the spatial syntax theory, build the functional relationship between the overall comprehensibility, the flow of people and the local integration, the distribution of the internal and external forms of the streets and lanes in the ancient city and the flow of people, and analyze the relationship between the external and internal spaces, Many positive correlation conclusions are drawn, which are consistent with the expected results.

Ma Hao and others focused on the discussion in the 2019 Analysis and Research on Haikou Arcade Historic and Cultural Block Based on the Spatial Syntax Theory, and finally put forward the renewal strategy: use Depthmap software to make choices and wisdom on Haikou Arcade Block, and propose strategies such as enhancing people's perception of space, building visual corridors, and integrating spatial effects.

Wang Xinzheng and Guan Jiayi focused on the discussion in the 2019 Quantitative Analysis of the Street and Lane Space System in the Ancient Kiln District of Jingdezhen Based on the Spatial Syntax Theory: based on the spatial syntax theory, they made three summary tables of the overall, local integration and average depth, constructed R2 equation, and proposed strategies such as increasing protective measures and dismantling illegal buildings.

Chen Yuwei and Sun Junqiao focused on the discussion in 2019 "Quantitative Analysis and Research on the Street and Lane Morphology of Qingtongliang Anju Ancient Town Based on the Spatial Syntax Theory": based on the Depthmap software, they analyzed the integration, selection and comprehensibility of Tongliang Anju Ancient Town, opened shops, accommodation, etc. in densely populated areas to facilitate visitors, and need to continue the street and lane space context and other strategies.

Liu Yixi, Ma Zhiyao and others focused on the discussion in 2020 "Research on the Strategy of Protection and Inheritance Optimization of Yongjia Furong Village Based on the Theory of Space Syntax": using the perspective and axis method of space syntax to analyze the spatial morphology of Furong Village, and in the level of protection strategy, reconstruct the community of elements in the landmark historical buildings and component villages; In the repair strategy,

optimize the node layout, delimit the core protection area, and strengthen the axis relationship between the overall and local levels.

Li Ran, Liu Mengchen and Wei Yi discussed the key point in the 2020 Quantitative Analysis and Research on the Spatial Morphology of the Huaihe Road Pedestrian Block in Hefei based on the Spatial Syntax Theory: with the Huaihe Road Pedestrian Block as the center, expand the axis map by 1000 meters. Through the color of lines and relevant data, we found that the linear nodes with high integration can not make good use of the characteristics of shape clustering in space creation, and the spatial recognition is low, The landscape features are insufficient, so it is necessary to activate the network space of the street system.

### 2.3 Overview of the application of space syntax and the protection of historical blocks abroad

Foreign countries began to study spatial syntax from the 1970s to the 1980s, and published relevant books and literature. The book with the highest citation rate of foreign space syntax is Bill Hillier's "Space is a Machine" written in 1996 and 2007; Carlo Ratti and Alasdair Turner respectively published the topic "Harmony but difference between urban texture and space syntax" in the environment and planting journal *B* in 2004 and 2007, and on the basis of harmony but difference, from the axis to the road centerline, became a new spatial expression method; In 2002, Jiang Bin published an article on introducing spatial syntactic integration into geospatial systems from a new perspective of morphology; Sonit Bafna's introduction to spatial syntax and articles on logical analysis technology published in 2003 have all made reasonable explanations of spatial syntax within their respective cognitive scope.

In recent years, foreign scholars have also published papers on space syntax in foreign journals and conferences. The main direction is to conduct a comparative study of urban morphology, explore the relationship between urban transformation and social activities, gradually preserve historical buildings in villages, improve integration and extract historical elements, revitalize historical districts through functional replacement and the introduction of new commercial activities, and follow the principle of people-oriented and local conditions, And then improve the attraction of the village.

ENDER, D.E. & Gigi, Y. 2010 In the "Reading Urban Spaces by the Space-SYNTAX METHOD: A Proposal for the South Haliç Region", interpret the physical and social issues of urban space in the southern region to interpret the south. The area is connected and a parking lot is set up between the highway and the wall. In order to improve the overall experience of the area in the inner and outer wall of the city wall, the overall experience of the region will increase the global integration by 0.01. Integration increased by 0.04.

Griffiths, S. In 2012 "The USE of Space Syntax in Historial Research: Current Practice and Future Possibilities" can be used to promote the historical model of the city's community spatial organization in the space. The possibility of urban public life. Comparing the urban forms to study and explore the relationship between urban transformation and social activities.

Zhao,L., &LOU,L. In 2012 "The Road of Complexity,The Road of Rehabilitation— Discussion of Detailed Planning for Protection and Renovation

of the Southeast Area in the Ancient City of Liaocheng". The most important factor in the regional structure re-positioning is the traditional style of protecting the old street; improving the living conditions of the ancient house; restoration and continuation of ancient historical and culture is a complex road and process, which requires the attention of the whole society.

Tian,Z., &He,H. In 2014 "Method of protection and renewal on Nanyang Historical Street District - An example on town hall historical street district in the center of Nanyang town hall", Reasonably explore the protection and update methods of historical districts. The first is to locate the protection object and propose protection methods; the second is to combine relevant protection cases in historical districts at home and abroad, including the protection methods, methods and means to conduct field research and analysis, and propose the method of extracting historical elements in the historical district of Nanyang. The design method puts forward new requirements.

Zhang,R.,Li,H.Y.,Bi,L., &Cui,J.Q.. In 2014 "Research on Conservation and Regeneration of Historic District in the Background of Fast Urbanization—Case Study of Xi'an Sanxue Alley Historic District", In the analysis of the protection and renewal policy of Xuexiang History District, the concept of "progressive preservation" was proposed to the street space system in the policy, that is, retaining local residents, and maintaining integrity and authenticity; through functional replacement and new commercial activities Come to revitalize historical blocks.

Li, Y., xiao, L.Z., YE, Y., xu, W.T.T.A. & Law.a. In 2016 "UNDERSTANDING TOURIST Space at a Historic Site Through Syntax Analysis: The Case of Gulangyu, China The tourism space of Gulangyu Historical Sites is quantified and cognitive. Through data mining, the relationship between street network integration and urban texture and tourist preferences were discussed and verified. Then, compare the results of the analysis of space clauses with the planned historical site planning, and provide suggestions for the planning evaluation.

Mansouri, m., & Ujang, n. In 2016 In the "Space Syntax Analysis of Tourist' Movement Patterns in The Historial of Kuala Lumpur, Malaysia, the connection of the Walking Network Walking Network of Kuala Lumpur is supported to support the walking network to support walking. The method used in this study is mainly to analyze the integration of observation and spatial sentence method. The environment with step behavior -oriented environment can improve the walkability of urban centers by integrating different places and street activities.

Alkamali,N., Alhadhrami,N., &Alalouch,C. In 2017 "Muscat City Expansion and Accessibility to the Historical Core:Space Syntax Analysis"Integration radius, where  $R = 3$ , a total of 39 streets, and statistical analysis. The results show that: urban expansion has a positive impact on the accessibility of the old city, and at the same time has also changed the space structure inside the old city. The article aims to explain the spatial characteristics of the street network of the old city and its impact on city's accessibility and tourism attraction.

Liu,S.P. In 2018"Research on Spatial Morphology and Protection of Traditional Rural Settlements Based on Space Syntax: Taking Xiazhuang Village and Shijia Village in Huzhou as Example"Citizens are easy to approach the internal space of Xiazhuang Village. At the same time, the village is blocked by the building inside and outside, and the space changes are extremely huge, producing strong visual stimuli, making tourists feel confused. In the future planning construction, the characteristics and functions of civil construction must be considered

Qi,L.H.,Liang,W.I., &Xi,M.B. In 2019 "The Public Space Pattern research of Guangfu Traditional Villages Based on Spatial Syntax: A Case Study of Huangpu Village in Guangzhou City, China",There are insufficient cultural space utilization in Huangpu Village; the lack of cultural atmosphere, lack of social space, tourism and sustainable development planning issues caused by the inconsistency of the color inconsistency of the building space and the incompleteness of historical space. The distribution of inside and outside the space on tourists continues the cultural space.

Yang, x.j., kong, z, q., & Li, x, y. The quantification of Baihe Village with regional characteristics, based on a new perspective, conducts research and analysis of the relationship between space and society. Including the morphological analysis of the overall space, the analysis of the street space system. You can obtain the space characteristics of the village and the inherent relationship between the space and the behavior of people, and explore the relationship between space and human behavior in a more scientific and humane way. Adhering to the principle of "people -oriented" and "adapting to local conditions", it can not only protect the original spatial structure of the village, but also effectively improve the internal unreasonable spatial form.

Zhang,X.J., &Yang,Z.W. In 2019 "A study on the Evolution of Morphological Vitality of Ancient City along the Silk Road Based on Space Syntax—Taking Zhangye as an example",The change of structure is the core position of the overall space structure of the city. At the same time, analysis and discussion of the public space system, road network structure and space elements of Zhangye Historical District. Especially the inherent connection of traditional buildings, landscapes, business, etc. On this basis, a specific strategy of improving the vitality and attractiveness of Zhangye's historical space is proposed to provide a research basis for the protection and sustainable development of future historical cities.

XU, Y., Rollo, J., Jones, D.V., Esteban, Y., Tong, H., & Mu, Q. In 2020 "Towards Sustainable Heritage Tourism: A Space syntax-based analyod to improVe Tourist In the Chinese articles in the Chinese articles "in Chinese history, trying to explore the correlation between space syntax and environmental psychology. Combining, promoting the sustainability of historical districts, and existing tourism heritage put forward feasibility suggestions.

Esposito,D., Santoro,S., &Camarda,D. In 2020 "Agent-Based Analysis of Urban Spaces Using SpaceSyntax and Spatial Cognition Approaches: A Case Study in Bari, Italy",The comparison of the qualitative experiments of the method

of knowing the method reflect on the wisdom of wisdom in the urban space environment, and there is a large correlation between the results obtained from the results and the prediction of the spatial sentence method.

## **METHODOLOGY**

The article takes CNKI and Google Academic as the main literature search methods, reads the relevant news reports on ancient villages in the original Zhuhai News, reads the master's degree, journal papers and foreign literature, and looks up the materials related to ancient villages, collates and analyzes them, understands the internal situation of the village blocks at this stage, and summarizes the research problems, objects, technologies and different research methods and means in the literature; Collect and sort out the relevant literature on the application of space syntax to historical blocks, and clarify the corresponding characteristics of the method application to the research object. The relevant literature has brought a lot of inspiration to the future research, and has provided a lot of reference value for the future research direction, framework and technical methods of villages, and laid a good theoretical foundation for researchers to use space syntax to conduct research and practice on ancient villages in the future, as well as the topic selection research of the article.

## **RESEARCH FINDINGS**

From the existing research content, the research basically focuses on the protected historical blocks with relatively complete village morphology, clear current situation and relatively high historical value. Through the above literature, we can find that there are some limitations in the study of spatial syntax at the geographical scale. First of all, in the process of using the axis to analyze the research area, different people have a large proportion of subjectivity in their understanding of map cognition and syntax calculus. In CAD, different people draw different lines according to the length and angle of the road, so the analysis results are not unique. Then, when the area of the area to be analyzed changes, from ancient villages to urban areas, the integration value will also change greatly. The place with high integration will be transferred from the central area to the new area formed by adding connecting lines, and the data of integration, understandability, average depth, etc. obtained from the final analysis will change to some extent. Then, the interior of the space itself has a certain change, but the range of change is small. The integration of the results from the axis analysis has a large change. Therefore, when the analysis is introduced into Depthmap later, different people draw different angles and lengths of straight lines according to their own cognition, and the final results will have a certain deviation from the reality. Therefore, relevant scholars need to strengthen their ability to expand and apply spatial syntax in historical villages. First of all, it is necessary to ensure the uniqueness of the axis. First, when drawing the axis map, the principle of "minimum and maximum" shall be followed. The straight lines of the main roads shall be represented in the form of single line on CAD, and the detailed zigzag roads shall be simplified as much as possible. To achieve the goal of minimum axis, wide coverage and representativeness. Step 2, also use the "least and longest" axis to represent any

convex space in a space environment, so that the axis map automatically generated by Depthmap is unique.

Then, angle weighting method can be used to capture the small differences in the spatial layout of ancient villages. When setting the radius, the Mean Depth value can be calculated by angle weighting, so as to obtain the degree of integration from one point to another. Then, the spatial syntax can be combined with the commercial function interest points distributed on both sides of the street. Point of interest (POI) is a geographical entity closely related to the life of urban residents, such as wholesale stores, savings offices, primary and secondary schools, etc. The more points of interest, the richer the business functions of the street. When ArcGIS is used to analyze the core density of interest points with commercial functions, the darker the density map is, the richer the business functions of this section are. At the same time, if this section of road passes the axis analysis method at Depthmap, the road integration degree analyzed is also high. It shows that the results obtained by combining ArcGIS with Depthmap are highly consistent. Therefore, the combination of these two softwares is of great significance for the study of historical villages. In recent years, there have been many village transformations in Zhuhai. The literature tends to be qualitative analysis, and there is almost no quantitative analysis.

Cuiwei Village, as the largest ancient village in Zhuhai, has a history of thousands of years. The research found that there were few relevant studies on Cuiwei Village. In 2018, there were only two master's theses on it. One was *Research on Spatial Integration Strategy of Cuiwei Village in Zhuhai in the Context of Urban Renewal*, written by Li Wei, a master's student of Hunan University. Based on the urban renewal theory, The requirements of all stakeholders in the transformation process were analyzed. In the integration method, different countermeasures for land use, different methods for optimizing the composition of different functions and spatial integration were proposed. Finally, the continuation strategy of traditional building protection and village regional factors was proposed (Li Wei, 2018). The full text belongs to macro and qualitative research.

The other is *"Research on the Transformation Mode of Urban Villages -- Taking Cuiwei Village in Zhuhai as an Example"* written by Huang Ming, a master student of Jinan University. Based on the theory of urban village transformation, the full text analyzes the interests of the government functional units, developers and villagers faced by Cuiwei Village in Zhuhai in the process of transformation, and puts forward the idea that the functional units should play a leading role and the villagers should spontaneously transform. The mixed transformation mode dominated by developers and supplemented by cooperative transformation of the three parties, analyzed the SWOT among them, and proposed a semi market-oriented operation mode of "policy guidance+capital investment promotion" through comparison (Huang Ming, 2018).

In the future research, the full text should start from the characteristics of the spatial structure and spatial form of Cuiwei historic district itself, based on the spatial syntax theory, and on the basis of quantitative analysis of Cuiwei

ancient villages, put forward new requirements for the protection and renewal of the historical district, and provide better reference value and significance for quantitative research of other ancient villages in Zhuhai.



Figure 1. Ancient villages in Zhuhai

## DISCUSSION

Although spatial syntax was introduced into China in the late 1980s, it was not widely popularized and applied for a long time. It was not until the 21st century that spatial syntax was gradually recognized. Relevant scholars began to learn the operation of Depthmap software and apply it to urban research. This paper summarizes and analyzes the literature related to the study of spatial syntax in ancient villages in recent years. It is found that there are more researches on spatial syntax outside Guangdong than in Guangdong. Among them, Wuhan, Qingdao, Chongqing, Hebei, and Beijing have many master's theses. Because these cities have relatively high development levels, and the pace of urban renewal is faster than that in Guangdong, there are a large number of historical and cultural villages, and there are many historical buildings inside, which are large in area and have good research value. Many students applied the theory of space syntax to their master's thesis, studied and analyzed the historical blocks, and made quantitative analysis of the existing ancient villages through space syntax.

## CONCLUSIONS AND RECOMMENDATIONS

Through field research, they found that space syntax was in great agreement with reality. The economic development on both sides of the street was closely related to the number of people, with high concentration, integration, comprehensibility. Places with low visual depth can attract a large number of people, which also provides a good reference value for the ways and means used

for the protection and renewal of historical districts in the future. Although some scholars at this stage still disagree with space syntax, generally speaking, it is controversial, but space syntax has good research value in the future.

### **FURTHER RESEARCH**

With the arrival of the age of big data, the change and development of cities, including expansion and migration of people, still need to be simulated by relevant software. Therefore, relevant scholars need to have a certain degree of inclusiveness and tolerance of space syntax theory, so that they can better serve the city and the people.

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