RESEARCH ARTICLE

Heritage and Transformation: Evolution of Street Networks in the Xiangmen Area, China

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Abstract

Cultural heritage sites increasingly face challenges from rapid globalization and urban modernization, which often generate tensions between historical preservation and contemporary development needs. This study investigates the Xiangmen area in Suzhou, a historically significant urban district within the ancient core of the city, to explore how spatial structures and regional functions have evolved across nearly three centuries. Drawing on a diachronic analysis of historical maps from 1745, 1881, 1893, 1906, 1914, 1940, 1960, and 2024, the research employs space syntax theory and the DepthmapX software to evaluate changes in street network connectivity and integration. The results reveal a gradual yet continuous transformation of the spatial configuration, reflecting both morphological adaptations and shifts in socioeconomic functions across different historical stages. In particular, the study identifies patterns of spatial centrality migration, the decline of certain traditional streets, and the emergence of new functional corridors that mirror broader urbanization processes and planning interventions. By integrating morphological evidence with spatial metrics, the analysis not only offers new insights into Suzhou's urban evolution but also highlights the dynamic interplay between heritage conservation and urban growth. The findings contribute to the theoretical discourse on urban morphology, provide methodological support for space syntax applications in historical studies, and deliver practical implications for balancing cultural preservation with sustainable urban development.

Keywords: *Accessibility, Cultural heritage, Space syntax, Street network, Urban morphology*

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Introduction

Cultural heritage represents an invaluable and irreplaceable resource, yet it is increasingly threatened by the accelerating forces of globalization and modernization (Kim et al., 2023). As global cultural ecosystems undergo rapid transformation, heritage sites face growing risks (Cao and Tian, 2023; Durrant et al., 2023). Historic villages, ancient buildings, and monuments are particularly vulnerable to physical and cultural degradation, raising urgent questions about their protection and sustainable integration into contemporary urban life (Xiao, 2023).

In China, Suzhou stands out as a city of exceptional historical and cultural significance. Recognized as one of the first 24 National Historical and Cultural Cities, Suzhou is widely regarded as the birthplace of Wu culture and was named the world's first "World Heritage Model City" by the Organization of World Heritage

Cities (Chen et al., 2024; Huang and Yang, 2023). Situated near the Beijing-Hangzhou Grand Canal, Suzhou has historically been one of China's most dynamic and prosperous urban centres.

This study focuses on the Xiangmen area, a core district within Suzhou's ancient city. Amid rapid urban development, Xiangmen is facing increasing spatial and functional pressures that challenge the preservation of its historic fabric (Jiang et al., 2023). The area is notable for its traditional street network and architectural heritage, which together reflect the city's deep-rooted cultural identity. A representative photograph of the Xiangmen historic district is provided to illustrate these characteristics and clarify the study area (Figure 1).

To understand the evolution of Xiangmen's urban form and the tensions between heritage conservation and modernization, this study analyses the transformation of its street network and regional functions from 1745 to the present. A space syntax approach is employed to quantitatively assess spatial structure and accessibility patterns across different historical periods. The theoretical foundations and research background of space syntax are further elaborated in the following section.

The primary objective of this study is to trace the complex evolution of Xiangmen's street network across different historical periods, uncovering the key drivers behind the shifts in its regional core. By examining the evolution of Xiangmen's urban fabric, this research aims to identify how these changes are influenced by shifting urban planning models and significant sociopolitical and economic events. The analysis reveals the dynamic interplay between the preservation of cultural heritage and the demands of a rapidly modernizing urban environment. Through this case study, the paper seeks to contribute to broader discussions on balancing urban development with the protection of cultural heritage in historic Chinese cities.

Figure 1: The Xiangmen Historic District

Literature Review

Space syntax theory provides a critical analytical framework for understanding spatial configurations and their relationship to social, functional, and historical processes in the built environment. Developed in the 1970s at the Bartlett School of Architecture, University College London, the theory was primarily pioneered by Bill Hillier and his colleagues, aiming to decipher the rules and logic underlying spatial organization in human settlements (Hillier & Hanson, 1984; Westin, 2011).

Initially proposed in 1974, Hillier's early work introduced the concept of "syntax" as a means to analyse the structural logic of space, moving beyond purely visual or formalistic interpretations of urban form (Karimi, 2018). Over time, space syntax evolved into a comprehensive theory rooted in geometric topology and spatial ontology, enabling researchers to explore how spatial arrangements shape, and are shaped by, human behaviour, social interactions, and urban dynamics.

At its core, space syntax conceptualizes space not as a static, physical entity defined by traditional Euclidean geometry, but rather as a dynamic system of relational properties governed by topological rules (Hillier, 1996). It emphasizes the configurational relationships between spaces-such as connectivity, integration, and depth-thereby providing a framework for understanding how spatial form influences movement patterns, land use distribution, and social accessibility (Hillier & Vaughan, 2007; van Nes & Yamu, 2021).

Through a range of analytical techniques-including axial analysis, visibility graph analysis (VGA), and isovist fields-space syntax allows for the quantitative representation and simulation of spatial networks. These methods have been applied across various scales, from architectural layouts and neighbourhood structures to whole cities and historic settlements (Bafna, 2003). Notably, the approach has proved valuable in the study of urban morphology, particularly in analysing the persistence or transformation of street networks over time (Karimi, 2023).

As a computational language for representing urban spatial patterns, space syntax also integrates the notions of scale division and spatial segmentation, which are essential for interpreting how functional and social boundaries emerge within urban form (Karimi, 2018). By quantitatively describing the spatial structures of human settlements-including architecture, communities, cities, and landscapes-space syntax can be used to examine the relationship between spatial organization and human society (Lyu et al., 2023). Its capacity to bridge spatial structure with socio-cultural meaning has made it particularly useful in heritage studies.

Since urban space inherently integrates spatial and temporal dimensions (Vaughan & Griffiths, 2021), understanding the processes behind the evolution of urban form is essential for exploring spatial. The study of spatial history enables the decoding of diachronic properties of spatial systems. By employing space syntax, one can not only comprehend the historical significance of a specific street or area during a particular historical period within the overall spatial structure of a city (synchronic) but also trace the historical (diachronic) changes in the spatial configuration of the urban system. In contrast to fragmented analyses of urban space characteristics, the space syntax approach focuses on spatial networks, highlighting the interconnectedness of spaces. Streets, within this framework, are viewed as structural layers of the city and serve as the backbone of urban life (Hillier et al., 1993). By acknowledging the diachronic nature of space, the study of spatial history emphasizes the processes and dynamics that shape and transform urban spaces over time.

Previous research has demonstrated the value of employing historical methodologies in elucidating a comprehensive set of relationships covering the

past, present, and future of the subject matter (Fox, 2022). Space syntax research has long engaged with themes and case studies related to heritage, as well as syntactic analyses associated with urban history. Currently, some compelling cases are being made, particularly in preservation, urban design, and urban regeneration, for the integration of syntactic research to guide practices within the historic urban landscape.

Despite its growing global relevance, the application of space syntax in the context of Chinese historic urban areas remains relatively limited. Most existing studies have focused on issues such as pedestrian flow, traffic accessibility, and commercial activity, often overlooking its potential to reveal deeper insights into the long-term morphological evolution of heritage spaces (Cao & Tian, 2023; Chen et al., 2024; Jiang et al., 2023). This study addresses this gap by applying space syntax to analyse historical maps of Suzhou's Xiangmen area from 1745 to the present, thereby uncovering the spatial logics that have shaped its transformation across different socio-political and economic contexts.

In sum, space syntax serves as a powerful theoretical and methodological tool for analysing urban change in historical environments. By foregrounding spatial configuration as a key factor in urban development and cultural continuity, it contributes to a more nuanced understanding of urban evolution in historic urban areas.

Methodology

Overview of the Case Study Area

Xiangmen, historically referred to as the "Craftsman Gate," is situated in the eastern part of Suzhou, China. Originally home to various skilled artisans, the area derived its name from this legacy. Located near Ganjiang East Road, a key thoroughfare, Xiangmen benefits from both convenient waterway and land transportation, resulting in consistently high levels of pedestrian and vehicular traffic. The study area, approximately 50 hectares in size, lies on the southeastern side of the Xiangmen area, bordered by Ganjiang East Road to the north, a section of Suzhou University to the south, residential neighbourhoods to the west, and Suzhou's ancient moat to the east (Figure 2). This area includes the Tangjiaxiang community and parts of Suzhou University.

Over centuries of urban evolution, Xiangmen has undergone significant changes in its street network, driven by varying sociopolitical and economic influences across historical periods. Notably, shifts in the street layout often coincided with transformations in the area's core functions, whether military, commercial, or religious, reflecting the dynamic nature of Xiangmen's development. Therefore, this study utilizes historical maps of Suzhou to analyse the evolution of Xiangmen's road network, focusing on the social, political, and economic influences driving these transformations. Additionally, it examines the spatial shifts in the area's functional core, offering insights into the historical forces that have shaped Xiangmen's urban morphology.

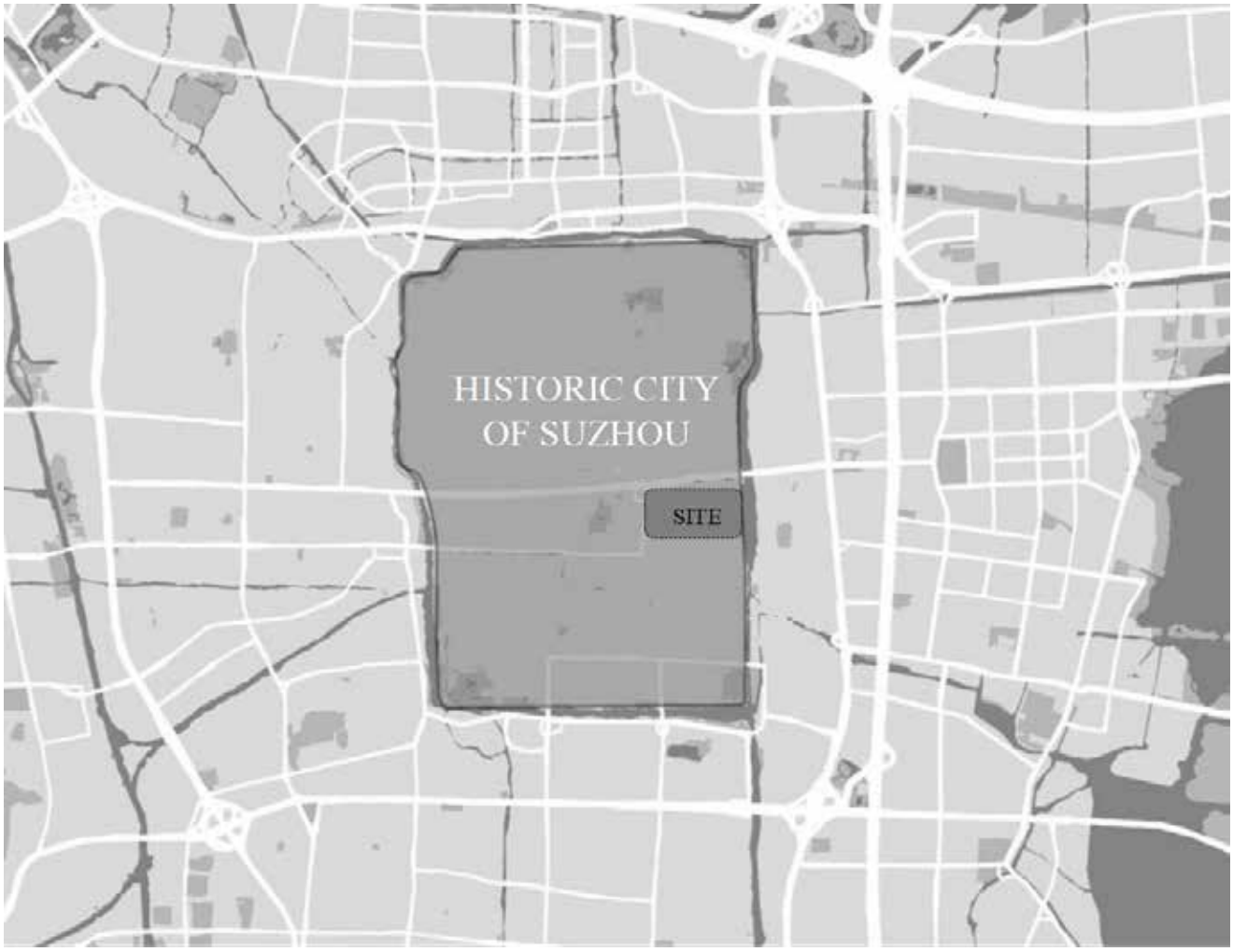


Figure 2: Study Area

Source: Openstreetmap Platform (2024).

Research Design and Methods

The primary analytical approach of this study involves constructing spatial models on the basis of a sequence of historical maps, with space syntax theory as the foundational framework. This theory provides quantitative measures for analysing spatial configurations, enabling a systematic examination of how the street network in the Xiangmen area has transformed across different historical periods. It also facilitates the investigation of how shifts in connectivity and spatial accessibility correspond to changing regional functions.

To investigate the spatial evolution of the Xiangmen area, this study adopts a multi-stage methodology integrating historical cartographic analysis with space syntax theory. The workflow comprises four main stages: (1) historical map collection and digitization, (2) axial map construction, (3) space syntax computation, and (4) spatial interpretation and diachronic comparison.

This study employs the spatial analysis software Depthmap to create axial maps for each historical period represented. In space syntax theory, topological relationships among spatial elements are modelled through graph-based representations, enabling the quantitative assessment of spatial morphology (Hillier, 2009). Two fundamental variables employed in axial map analysis are connectivity and integration, both of which provide insight into the degree of spatial accessibility and configurational centrality of a given space within the urban network.

Connectivity refers to the number of immediate connections a spatial element (node) has with its directly adjacent elements in the axial map (van Nes & Yamu, 2021). It captures local relational properties and reflects how easily a space can be reached from its immediate neighbours. Mathematically, the connectivity of a street *i is defined as:*

$$C_i = k(i) \quad (1)$$

i represents a particular street in the system (*i = 1, 2, . . ., n*); *k* represents the total number of streets that directly neighbour street *i*.

Integration, on the other hand, assesses the degree to which a spatial unit is embedded within the entire system. It quantifies how many steps are needed to reach all other nodes from a given node and how close it is, on average, to all others in the network (Giannopoulou et al., 2012). Areas with high integration values often indicate core regions with greater accessibility and social activity potential (Hillier et al., 1993). Mathematically, the Integration *is defined as:*

$$INT_i = \frac{n\left(log_2\left((n+2)/3\right)-1\right)+1}{(n-1)(MD_i-1)} \quad (2)$$

INT_i refers to the degree of aggregation or dispersion between the i space and other spaces., is the aforementioned mean depth value.

This study conducts a systematic investigation into the transformation of the street network structure in the Xiangmen area by analysing eight historical maps spanning from 1745 to 2024 (see Table 1 and Figure 3). To facilitate a diachronic analysis of urban morphological change, these maps are categorized into four chronological phases based on significant historical and political transitions. The first phase is represented by the 1745 map of Gusu City, which reflects the spatial characteristics of Suzhou during the Qing Dynasty and serves as a baseline for comparison. The second phase includes the 1881 Suzhou Geographic Map, the 1893 Suzhou Chamber of Commerce Map, and the 1906 Suzhou Patrol Subdivision Map. The third phase encompasses the 1914 Detailed Map of Suzhou and the 1940 Suzhou Tourism Map. The final phase comprises the 1960 Suzhou Tourism Map and a 2024 high-resolution satellite image, providing insights into the transformation of the urban fabric during the socialist and post-reform periods, as well as its current spatial configuration. Through this phased approach, the study aims to reveal long-term patterns of continuity and change in the Xiangmen street network, thereby contributing to a deeper understanding of the spatial logic underlying the area's historical evolution.

Table 1: Phased Analysis of Historical Maps of the Xiangmen Area (1745-2024)

Phase	Time Period	Historical Map(s)	Description
Phase 1	1745	Gusu City Map (1745)	Represents the early urban structure of Suzhou, focusing on traditional street networks.
Phase 2	1881-1906	Suzhou Geographic Map (1881) Suzhou Chamber of Commerce Map (1893) Suzhou Patrol Subdivision Map (1906)	Reflects changes during the late Qing dynasty, emphasizing commercial and administrative developments.
Phase 3	1914–1940	Detailed Map of Suzhou (1914) Suzhou Tourism Map (1940)	Shows early 20th-century changes, including industrialization and tourism development.
Phase 4	1960–2024	Suzhou Tourism Map (1960) Satellite Map (2024)	Captures modern urban transformations and the integration of heritage with modern infrastructure.

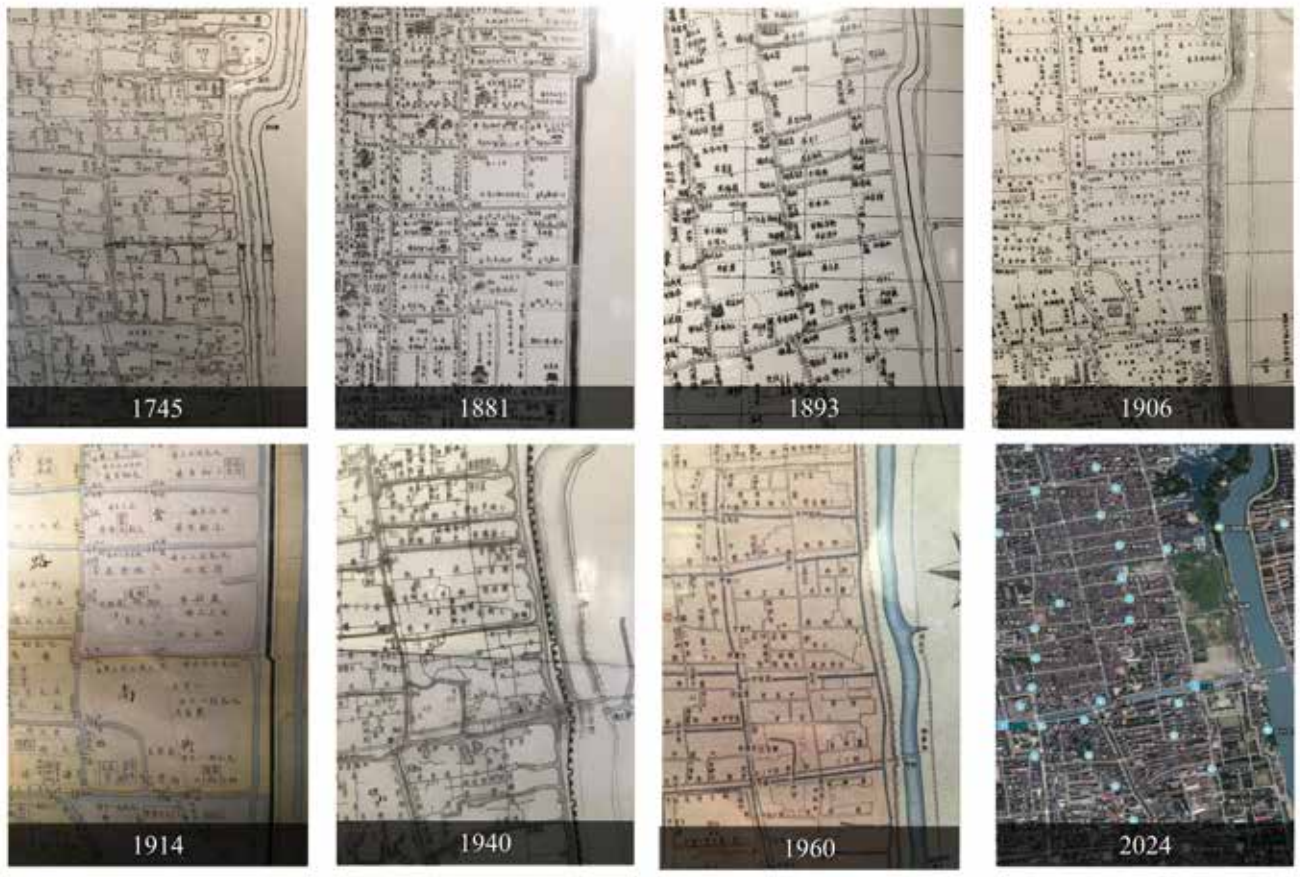


Figure 3: The Historical Maps of the Xiangmen Area

Source: Suzhou Municipal Archives (2024)

By analysing these spatial variables over time, this approach offers a detailed representation of the network's spatial structure, yielding deeper insights into the evolution of Xiangmen's street network and its relationship with regional functions. This methodological framework enhances the understanding of the historical forces shaping Xiangmen's development and provides valuable perspectives for interpreting urban morphology within heritage areas.

Results

The Changes of the Street Network in the Xiangmen Area

Using the 1745 map of Gusu as a reference, the study area is outlined within the yellow boundary in Figure 4 below. For this study, the axial analysis specifically focuses on the red rectangular zone, with a 500-meter buffer applied beyond this area to reduce data distortion. To improve the clarity of the analysis results, the axial map of the primary study area has been extracted and isolated, allowing for a more focused presentation and examination of key findings.

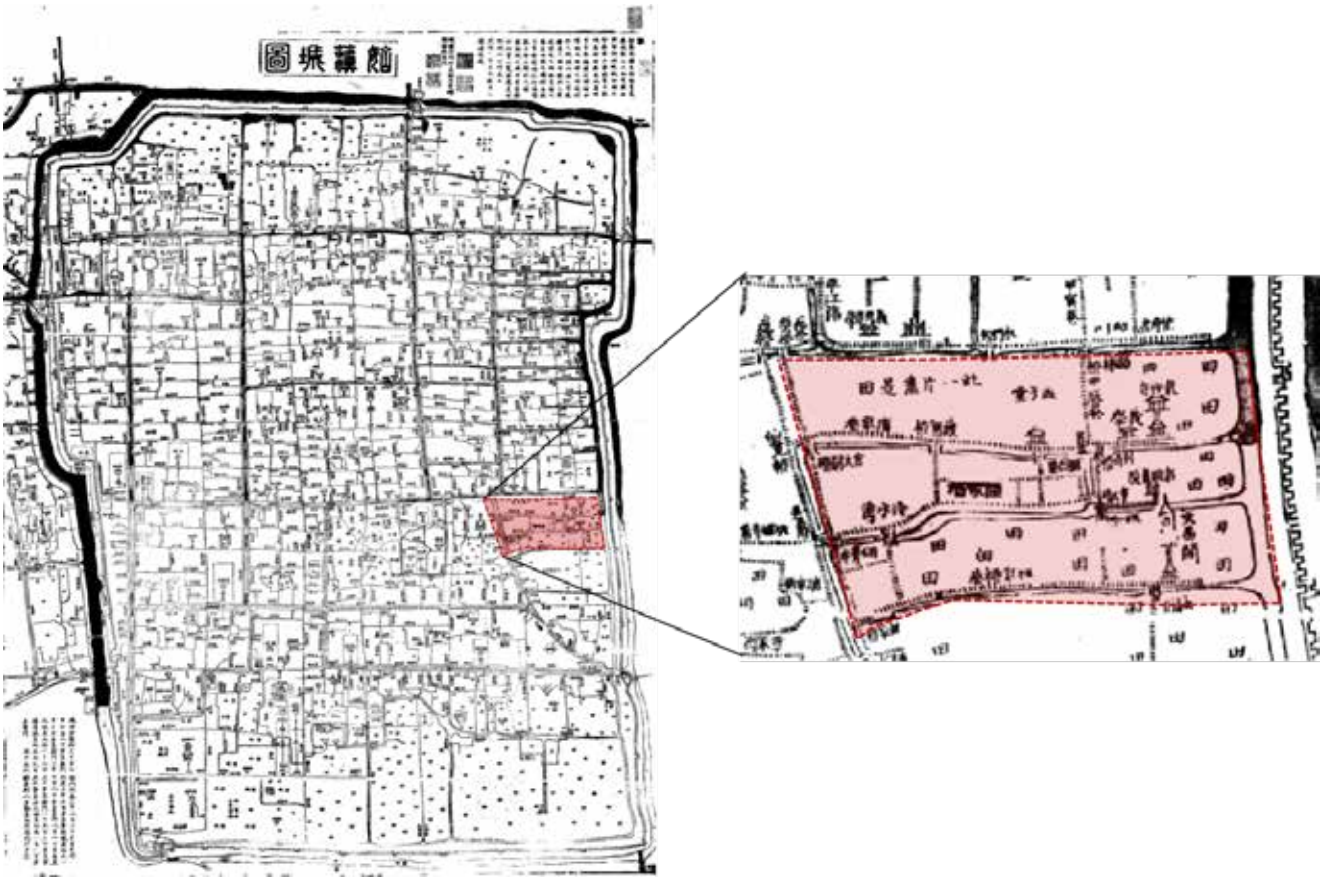


Figure 4: Study Area of this Research
Source: Suzhou Municipal Archives (2024).

Figure 5 displays the connectivity axial map derived from the map of Gusu. During this period, the area was primarily the site of Dongchan Temple, which was originally constructed in 239 CE. Although it was repeatedly destroyed and rebuilt during periods of conflict, its significant religious and social influence has enabled it to persist for over a thousand years. Owing to the proximity of the Xiangmen area to the city wall, limited commercial opportunities existed at the time, and the land use was predominantly agricultural. The extensive farmland also resulted in a very simple street network with minimal development. The red streets with the highest connectivity in the middle of the figure represent the main thoroughfares of the period, connecting with most of the streets in the Xiangmen area. The street structure surrounding this area is complex, with densely connected horizontal and vertical streets. However, this does not indicate a highly developed or well-planned network; in contrast, many of these streets emerged as natural paths formed by purposeful gatherings of people rather than through systematic planning. This lack of planning suggests a high degree of randomness in the network structure at that time.

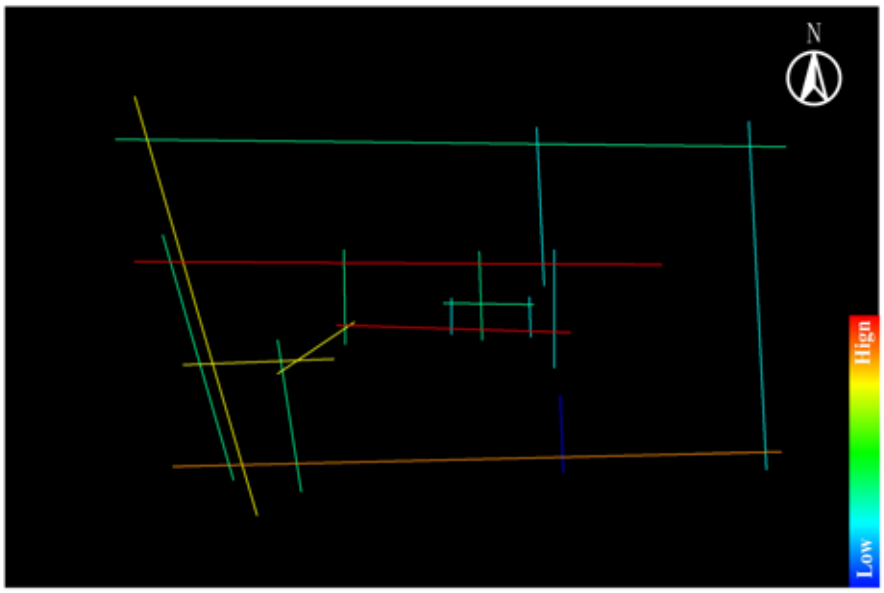
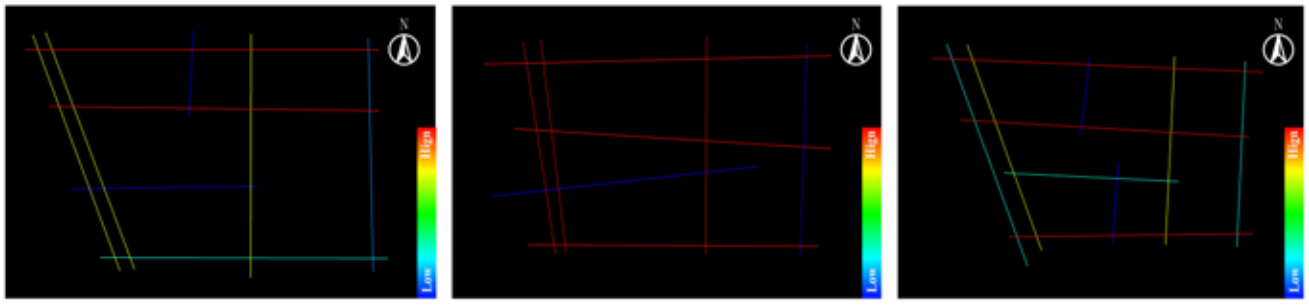


Figure 5: Connectivity Axial Map of 1745

Source: Depthmapx (2024).

The following diagram presents the Connectivity Axial Map, overlaid with the 1881 geographical map of Suzhou, the 1893 city grid map, and the 1906 patrol zone map. It is evident that a more structured grid network emerged in this area over time, with smaller, irregular streets gradually replaced by wider, longer streets capable of supporting increased traffic. Due to the wartime conditions affecting China during this period, urban construction was almost stagnant during this period, limiting the detailed and in-depth development of the Xiangmen area. However, the basic framework of a modern network was established, although connectivity along the main streets showed minimal improvement.



(a) (b) (c)

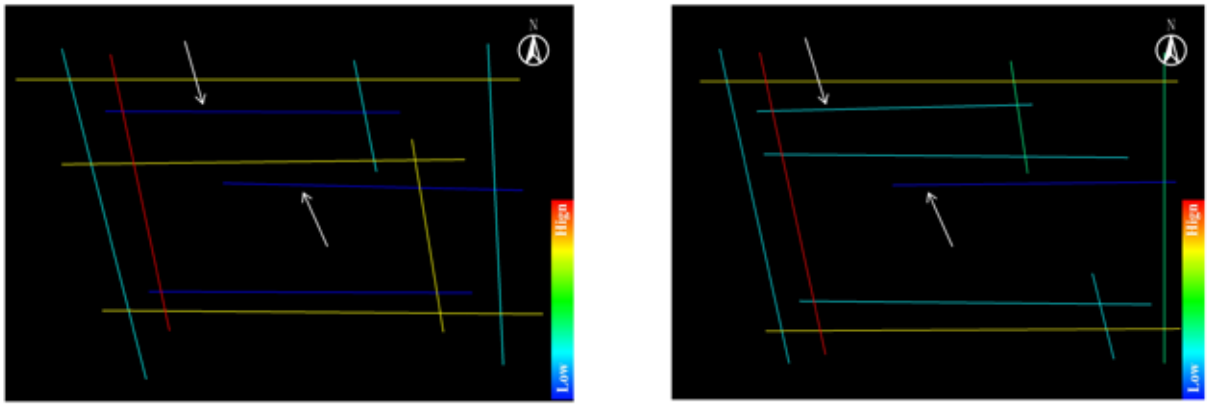
Figure 6: Connectivity Axial Map. (a) 1881, (b) 1893, (c) 1906

Source: Depthmapx (2024).

The following map is the Connectivity Axial Map for the corresponding historical period, derived from the detailed 1914 Suzhou City Map and the 1940 Suzhou Tourist Map, processed through spatial analysis software. The map shows that, based on the existing road network, two horizontal roads (indicated by white arrows) appeared near this area. These additions further complicated the road network structure and significantly enhanced regional connectivity. The primary reason for the construction of these two roads was the establishment of Soochow University, a new government-funded institution on the district's western side. To facilitate students' commute to and from school, these lateral roads were rapidly constructed.

This example underscores the intrinsic relationship between street network structures and the socio-spatial dynamics of urban environments-a perspective that aligns closely with Hillier's theory of spatial configuration. Hillier (1996) emphasized that while local spatial arrangements, such as those within buildings or neighbourhoods, are often governed by metric distances, the broader evolution of urban form is shaped by the underlying geometric and topological properties of the street network. These spatial logics influence how movement, visibility, and access patterns develop across a city, thereby affecting its functional and social hierarchies.

Moreover, Hillier and Iida (2005) conceptualized the city as a multi-scalar spatial network composed of interdependent centres and subcentres. These centres evolve not in isolation but through continuous interaction with one another, creating a layered urban morphology that reflects both historical development and contemporary social use. In the context of historic urban areas such as Xiangmen, these theoretical insights help explain how the persistence or transformation of certain street segments corresponds to heritage value, collective memory, and functional resilience over time. The findings of this study are thus consistent with previous scholarship, demonstrating how spatial configuration can serve as both a record of historical evolution and a framework for heritage-sensitive planning.

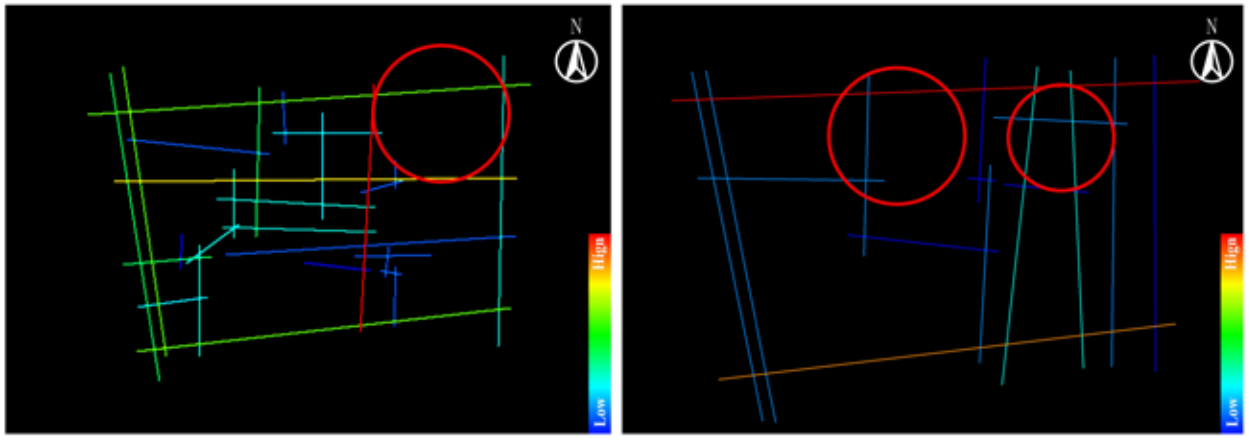


(a) (b)

Figure 7: Connectivity Axial Map. (a) 1914, (b) 1940

Source: DepthmapX (2024).

The following map presents the connectivity axial map for the historical period derived from the 1960 Tourism Map of Suzhou and the 2024 satellite map. The year 1960 marked the early period following the founding of the People's Republic of China, during which extensive urban construction after the war significantly complicated the road network structure in the region, introducing numerous new roads that connected various areas. Notably, the western road in the studied area became one of the most interconnected routes within the entire Xiangmen area. However, owing to the special status of Dongchan Temple, large-scale road construction did not extend into this area. Compared with the road network of previous decades, the structure in this region remained relatively unchanged during this period. By 2024, the road network structure in the Xiangmen region appears more rationalized, with a few major thoroughfares accommodating the majority of the regional traffic flow. Additionally, the government consolidated several fragmented parcels of land to create larger areas designated for specific functions. For example, a substantial portion of land in the western part of the study area has been planned as a residential area, whereas the southern section is designated for educational purposes, specifically as the teaching area for Soochow University. Compared with the 1960 axial diagram, the overall complexity of the road network in the region has diminished, resulting in a more orderly and rational layout of the related roads.



(a) (b)

Figure 8: Connectivity Axial Map. (a) 1960, (b) 2024

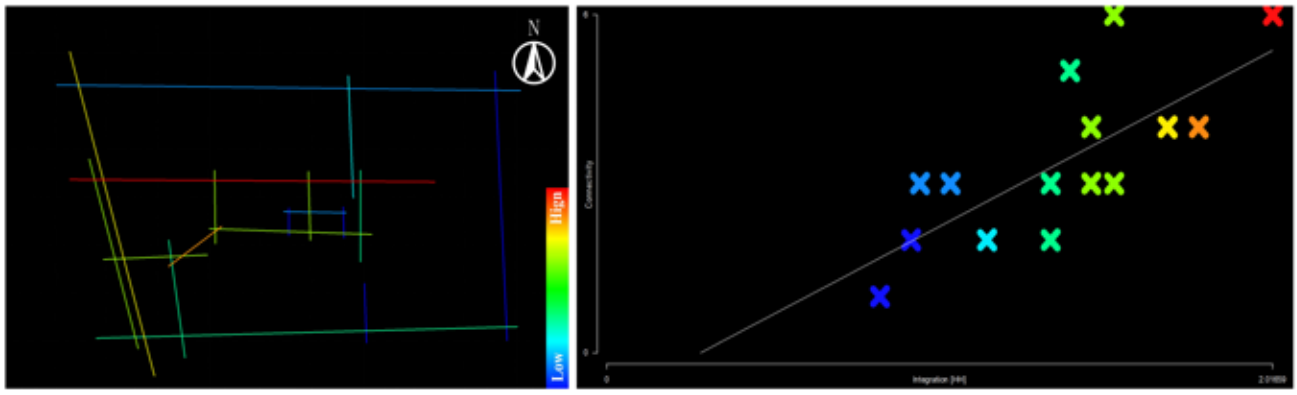
Source: Depthmapx (2024).

Research on the changes in the street network structure in the Xiangmen region since 1775 has revealed significant trends and the underlying socioeconomic and political factors. Specifically, the studied area has historically maintained relatively important social functions and influences, resulting in a road network structure that is not overly complex, and is characterized by single-function buildings. However, the region is situated near a relatively developed road network and is closely connected to the main traffic trunk road of Xiangmen, as well as to adjacent areas. This network structure not only enhances its social function and value but also ensures high connectivity with surrounding regions.

Regional Core Movement in the Xiangmen Area

The following Figure 9(a) presents the integration axial map of the 1745 Gusu city map. The Figure 9(b) is a two-dimensional scatter plot showing the relationship between Connectivity (Y-axis) and Integration (X-axis), with a regression line included. Each point represents a street segment within the study area, which is plotted according to its integration and connectivity values. The colour gradient from blue to red indicates variations in these values, with blue representing lower connectivity and integration and red representing higher values.

As indicated in Figure 9(a), this area was not a core part of the Xiangmen region, and the surrounding streets exhibited low integration values. The regression line suggests a positive correlation between connectivity and integration values, indicating that streets with higher Integration tend to have higher connectivity. However, there are deviations from this trend, as some points fall below or above the line, highlighting that not all streets align perfectly with the average relationship. This variance could be attributed to differences in the street network's structure, potentially influenced by the reliance on water transportation in Suzhou during this period, which may have led to lower connectivity in certain areas despite high integration values. This nonproportional relationship aligns with the historical context of Suzhou's transport network, where water routes played a significant role alongside the overland road network in this specific period.

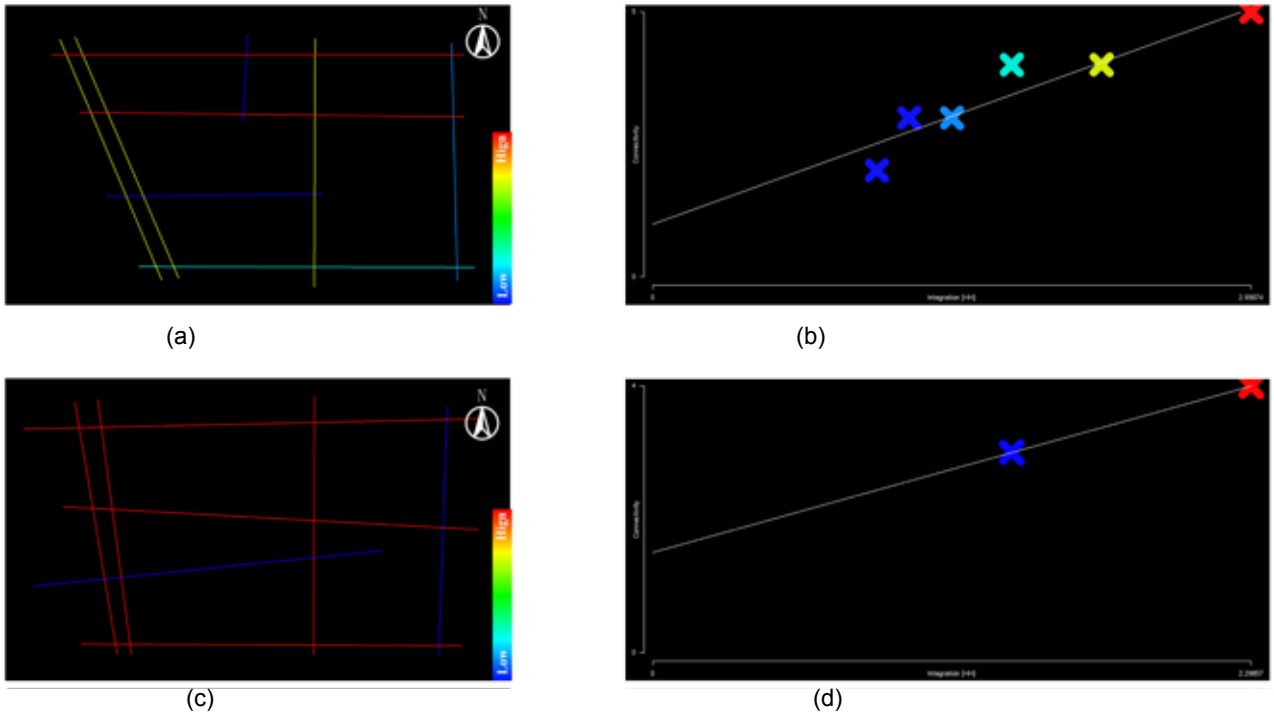


(a) (b)

Figure 9: Analysis Results: (a) Spatial Distribution of Integration Values in 1745, (b) Scatter Plot of Connectivity and Integration Values in 1745
Source: Depthmapx (2024).

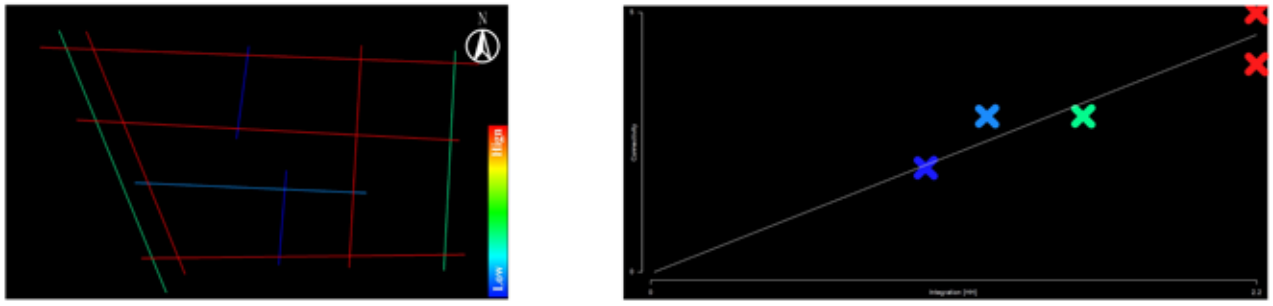
The following figure presents the integration analysis of the Xiangmen area during the late Qing Dynasty, which was derived from the 1881 Map of Suzhou, the 1893 Suzhou City Map, and the 1906 Suzhou Patrol Map. During this period, the core of Xiangmen shifted closer to this area, largely due to the presence of Dongchan Temple. The Peng family, a prominent clan involved in the imperial examination system, made multiple investments in the temple's construction, transforming it into a gathering place for Suzhou's distinguished scholars. This influx of influential figures fostered intellectual exchange and lectures, stimulating local economic growth. Consequently, businesses in the vicinity began to thrive, and several nearby main roads exhibited higher integration values.

Additionally, the two-dimensional coordinate plot shows a trend toward proportionality between integration and connectivity across various streets during this period. This shift can be attributed to the introduction of modern road systems, which gradually replaced water-based transportation. As a result, a more spacious and rational road network structure began to form in the Xiangmen district.



(a) (b)

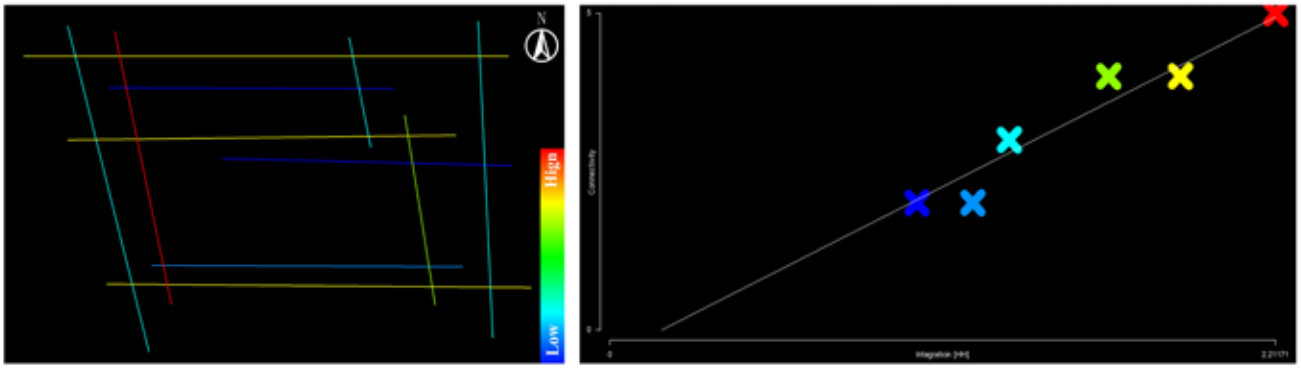
(c) (d)



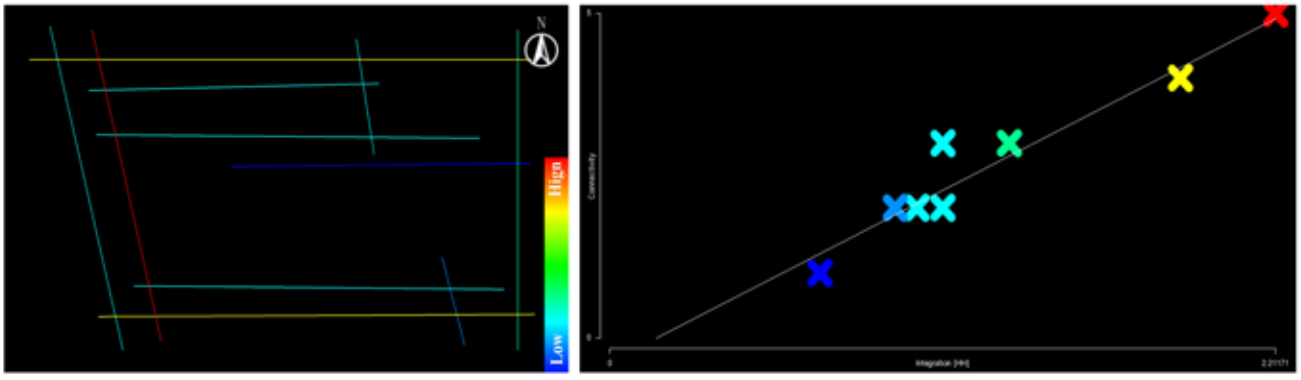
(e) (f)

Figure 10: Analysis Results: (a) Spatial Distribution of Integration Values in 1881, (b) Scatter Plot of Connectivity and Integration Values in 1881, (c) Spatial Distribution of Integration Values in 1893, (d) Scatter Plot of Connectivity and Integration Values in 1893, (e) Spatial Distribution of Integration Values in 1906, (f) Scatter Plot of Connectivity and Integration Values in 1906
Source: DepthmapX (2024).

The following figure illustrates the integration analysis of the Xiangmen area, based on the Detailed Map of Suzhou from 1914 and the Tourist Map of Suzhou from 1940. During this period, Dongchan Temple experienced gradual abandonment, resulting in a decline in its original social function and influence. To the west, the government funded the establishment of a new public school, Suzhou Public School, which prompted a further shift in the regional centre westwards. Additionally, throughout this time, the ratio of integration and connectivity among various streets remained approximately proportional, with few extreme values observed.



(a) (b)



(c) (d)

Figure 11: Analysis Results: (a) Spatial Distribution of Integration Values in 1914, (b) Scatter Plot of Connectivity and Integration Values in 1914, (c) Spatial Distribution of Integration Values in 1940, (d) Scatter Plot of Connectivity and Integration Values in 1940
Source: DepthmapX (2024).

The following figure presents the integration analysis of the Xiangmen area, which is based on the Suzhou Tourism Map from 1960 and a satellite map from 2024. In 1960, extensive urban construction during the early years of the People's Republic of China resulted in the rapid development of numerous new roads, which were often implemented without proper planning to meet citizens' needs. This led to significant fluctuations in the ratio of integration to connectivity on the two-dimensional graph. Furthermore, as Soochow University's influence in the area expanded, previously distinct regions with high integration began to merge into a cohesive residential area, resulting in a more uniform level of integration throughout the district. Ganjiang East Road emerged as a new core area within the Xiangmen district, serving as a vital traffic artery in the ancient city of Suzhou. It spans the Xiangmen area and serves as the primary route for north - south movement.

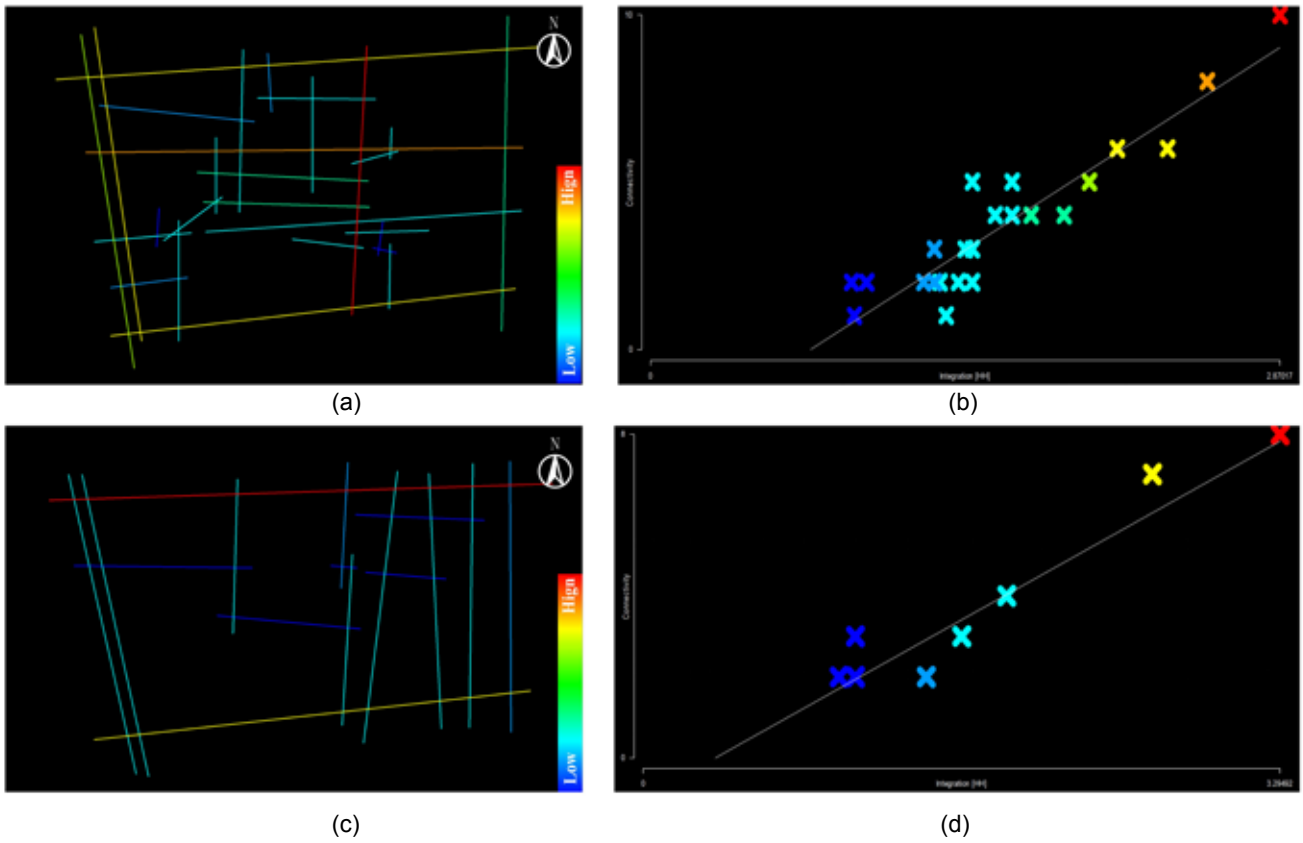


Figure 12: Analysis Results: (a) Spatial Distribution of Integration Values in 1960, (b) Scatter Plot of Connectivity and Integration Values in 1960, (c) Spatial Distribution of Integration Values in 2024, (d) Scatter Plot of Connectivity and Integration Values in 2024

Source: Depthmapx (2024).

This analysis traces the evolution of the regional core in the Xiangmen area from 1775 to 2024. The findings suggest that shifts in the regional core are primarily driven by functional transformations. Areas with greater social significance and influence tend to develop more complex street networks and attract higher population densities. However, the potential for an area to emerge as a regional core is also strongly conditioned by its geographical location-an essential factor that must not be overlooked.

Although the studied area has consistently maintained a high degree of social influence-stemming from the religious importance of Wanshou Temple and the educational role of Suzhou University-its proximity to the Suzhou city moat and its peripheral position within the Xiangmen district have constrained its ability to function as the central core throughout much of its history. This underscores

the interplay between spatial form, functional use, and geographic constraints in shaping the urban hierarchy of historical districts.

Discussion

This study contributes to the research that applies space syntax as a tool for understanding historical urban transformation, particularly in the context of Chinese heritage districts. The phased analysis of the Xiangmen area demonstrates how spatial configuration variables, especially connectivity and integration, can reveal underlying patterns of urban change across multiple historical stages. Compared with previous studies that primarily focus on single-time-point spatial analysis or contemporary urban functions, this research offers a longitudinal perspective that emphasizes both temporal continuity and spatial reconfiguration.

The novelty of this study lies in its integration of diachronic morphological analysis with quantitative spatial syntax measures, allowing for a more nuanced understanding of how street networks evolve in response to political, economic, and cultural dynamics. While earlier space syntax studies in China have often focused on accessibility, commercial vitality, or movement patterns in modern settings, this research critically bridges the historical and contemporary dimensions by tracing morphological shifts from 1745 to 2024.

Moreover, the findings reveal that changes in the spatial core of the Xiangmen area are not random but shaped by broader socioeconomic forces. These observations support Hillier's (1996) proposition that spatial configuration both reflects and influences social logic. The results also echo Van Nes and Yamu's (2021) findings on the relationship between urban vitality and street network continuity but extend their implications to the context of heritage preservation.

Nonetheless, certain limitations warrant acknowledgment. For example, while the study incorporates eight historical maps, their cartographic accuracy and consistency vary, which may influence the precision of axial modelling. In addition, the interpretation of functional shifts is constrained by the availability and granularity of historical land use data. Future research could benefit from integrating high-resolution historical GIS layers and extending the scope to include resident or stakeholder perceptions through participatory mapping or ethnographic interviews.

Conclusion

This study underscores the complex relationship between spatial configuration and functional transformation in the Xiangmen area, illustrating how historical trajectories and socioeconomic dynamics have continuously influenced its urban morphology. By analysing spatial changes across historical phases, the research clarifies the intertwined roles of urban morphology, historical development, and socioeconomic dynamics in shaping this heritage district. The findings demonstrate how spatial analysis tools, such as space syntax, can effectively reveal long-term urban evolution patterns in historic contexts.

In sum, this research enhances the methodological toolkit for studying historic urban areas by demonstrating how space syntax can be employed not only to measure spatial accessibility but also to interpret long-term urban evolution. The insights derived from this study can guide cultural heritage protection, especially in reconciling conservation with urban transformation. Furthermore, the analytical framework is replicable and adaptable to other historic cities in China and beyond, thereby contributing to heritage management strategies and sustainable urban design practices.

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