buildings

MDPI

Article

Diagnosing Spatial Activation in Historic Public Spaces: An Exploratory Perception–Behavior–Space Study in Guibeicheng, China

Zirui Zhan [1], Shiyu Lu [2], Dan Wu [1,*] and Suhui Zhang [1,*]

[1] Shanghai Academy of Fine Arts, Shanghai University, Shanghai 200444, China; zhanzirui@shu.edu.cn
[2] School of Urban and Regional Planning, University of Alberta, Edmonton, AB T6G 2E3, Canada; slu11@ualberta.ca
* Correspondence: 23820429@shu.edu.cn (D.W.); zhangsuhui03@shu.edu.cn (S.Z.)

Abstract

The regeneration of public spaces in historic urban areas increasingly relies on small-scale and incremental interventions. However, how spatial configuration, observed use, and perceived meaning converge or diverge across specific historic public spaces remains insufficiently understood. This exploratory single-case study uses a Perception–Behavior–Space (PBS) evidence-organizing and diagnostic structure to examine three selected public spaces in Guibeicheng, Wuxi. Evidence was drawn from 24 semi-structured interviews, cognitive maps, short-term multi-period behavioral observations at the three sites, and segment-based space syntax analysis at R = *n* and at metric radii of 400 m and 800 m. The cross-evidence comparison identified three case-specific patterns: a movement–staying mismatch at Sanyang Square Subway Station, a combined configuration–use and memory–use mismatch at Xue Fucheng's Former Residence, and perception–behavior convergence despite lower configurational values at Chong'an Temple pedestrian street. None of the six configurational measures reproduced the observed pedestrian-flow ordering, indicating that configurational potential was not consistently aligned with mean pedestrian-flow intensity across the three sites. These patterns informed a case-derived interpretive model organized around everyday-use triggering, activity amplification, narrative anchoring, actor coordination, and governance enablement. The PBS evidence structure supports transparent cross-evidence diagnosis and the development of case-informed planning implications for historic public-space regeneration.

Keywords: Perception–Behavior–Space; cross-evidence diagnosis; historic public spaces; behavioral mapping; spatial translation; adaptive governance

Check for updates

Academic Editors: Haifeng Liao and Antonio Caggiano

Received: 16 July 2026
Revised: 18 August 2026
Accepted: 26 August 2026
Published: 28 August 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.

1. Introduction

As urban development shifts from expansion-oriented growth to stock-based regeneration, historic urban districts are increasingly renewed through small-scale and incremental interventions in public space [1]. These interventions are expected not only to improve physical environments, but also to support everyday use, cultural continuity, social inclusion, and adaptive governance [2,3]. International policy agendas, including the United Nations' Sustainable Development Goals (SDG11: Sustainable Cities and Communities), similarly emphasize context-sensitive renewal that avoids large-scale demolition and strengthens urban life through gradual and inclusive processes [4,5]. In this context, the renewal of

historic public spaces has become a multidimensional issue in which spatial configuration, daily behavior, place meaning, and governance arrangements are closely intertwined [6,7].

Public spaces in historic urban areas are shaped by long-term historical accumulation and often contain diverse spatial forms, multiple stakeholders, and overlapping user demands [8–10]. Although small-scale renewal is widely adopted, physical improvement does not necessarily generate active public-space use, and isolated interventions may remain disconnected from wider spatial networks [11–13].

A key difficulty lies in mismatches among spatial potential, actual use, and perceived meaning. Accessible spaces may function mainly as passages, while culturally significant places may remain weakly embedded in daily routines [8,14]. Because regeneration also involves multiple actors and phased interventions, an evidence structure is needed to compare spatial potential, observed behavior, and perceived meaning and identify where these dimensions converge or diverge.

Urban catalyst theory provides an interpretive lens for understanding how localized interventions may generate broader spatial and social effects when connected with surrounding conditions [15–17]. Recent studies further indicate that public-space vitality depends on behavioral, cultural, and institutional conditions as well as built form [8,18,19]. In this study, urban catalyst theory frames activation as a relational process, while PBS provides the evidence structure for diagnosing relationships among spatial potential, observed behavior, and perceived meaning.

Three related research gaps remain. First, spatial accessibility, perceived experience, and public-life behavior are still often examined as separate evidence domains. This separation limits understanding of where spatial potential, observed use, and perceived meaning converge or diverge in historic public spaces. Second, existing studies have increasingly recognized that public-space regeneration depends on more than spatial form, including everyday use, cultural meaning, social participation, and management conditions. However, the comparative logic used to relate these evidence streams at the place level is often insufficiently explicit. This limits the transparency of diagnoses concerning convergence and mismatch. Third, diagnosis-oriented findings are not always translated into planning implications that connect spatial nodes, pedestrian routes, activity settings, cultural narratives, and governance arrangements. These gaps indicate the need for a transparent evidence structure that can compare heterogeneous evidence, identify case-specific relationships, and support planning interpretation without conflating configurational potential, observed behavior, and perceived meaning.

To address these gaps, this exploratory single-case study applies a Perception–Behavior–Space (PBS) evidence-organizing and diagnostic structure to three selected public spaces in Guibeicheng, Wuxi, China. PBS is defined here as an evidence-organizing and diagnostic structure rather than as a standalone theory or predictive model. It aligns semi-structured interviews and cognitive maps, short-term multi-period behavioral observations, and segment-based space syntax analysis to compare perceived meaning, observed use, and configurational potential at the place level. The comparison identifies site-specific convergences and mismatches, informs a case-derived interpretive model of public-space activation, and supports the development of case-informed node–route–network planning implications.

The study makes three contributions within the scope of this exploratory case:

(1) It provides a transparent structure for organizing and comparing established perception, behavior, and spatial evidence at the place level;
(2) It identifies site-specific mismatches and convergences and uses them to inform a case-derived interpretive model organized around everyday-use triggering, activity amplification, narrative anchoring, actor coordination, and governance enablement;

(3) It links place-level diagnoses with case-informed planning implications across micro-node, route, and network scales.

Accordingly, the study addresses three research questions:

(1) How do perception, observed behavior, and spatial configuration converge or diverge across the three selected public spaces?
(2) How can these case-specific mismatches and convergences inform an interpretive model of public-space activation?
(3) How can the resulting diagnoses inform node–route–network planning implications for historic public-space regeneration?

2. Literature Review

2.1. Urban Catalyst Theory

Urban catalyst theory provides a useful conceptual background for understanding how small-scale interventions may influence wider urban regeneration processes. Originally articulated by Attoe and Logan, the theory uses the catalyst metaphor to describe strategic actions that trigger broader spatial and social effects without relying on large-scale reconstruction [16,20]. It is therefore closely related to incremental and process-oriented approaches to urban regeneration [21]. For this study, its value lies not in identifying fixed catalyst types, but in framing local public-space activation as a process that may expand, weaken, or become connected over time.

In urban design and regeneration studies, catalytic processes are often described through a sequence of triggering, amplification, and diffusion (Figure 1). Initial interventions may activate specific nodes, while subsequent activities, repeated use, or social attention can intensify their influence. Diffusion then refers to the extension of these effects from individual places to routes, interfaces, and wider urban systems. In historic public spaces, however, such extension is rarely sustained by spatial connection alone. Everyday practices, place meanings, organizational support, and governance arrangements also shape whether local activation can persist and be reproduced [8,22,23].

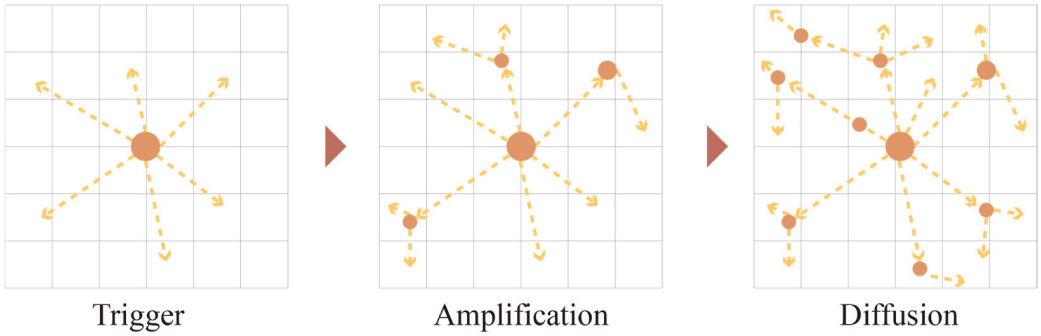


Figure 1. Trigger–amplification–diffusion logic in urban catalyst theory. Orange circles denote activated nodes, dashed arrows indicate the outward extension of catalytic effects, and arrows between panels indicate the conceptual progression from triggering to amplification and diffusion. Source: authors' diagram.

Recent research has therefore expanded catalyst-related discussions beyond physical form [23,24]. Temporary urbanism, community participation, cultural narratives, and governance arrangements have all been discussed as conditions that shape public-space activation and continuity [17]. This broader understanding is important for historic urban areas, where spatial resources, social practices, cultural memory, and management rules are closely intertwined [25,26]. Nevertheless, these dimensions are still often examined

in separate strands, making it difficult to explain how spatial potential, actual use, and perceived meaning support or constrain one another in specific places.

Accordingly, urban catalyst theory is used in this study as an interpretive lens rather than as a stand-alone evaluation model. It helps frame why local activation matters and why its continuity depends on relations among spaces, activities, meanings, actors, and governance conditions [21,27]. The following section introduces the Perception–Behavior–Space perspective as the evidence structure through which these relations can be diagnosed.

2.2. Perception–Behavior–Space

Public spaces are not only physical settings or circulation corridors. They are also places where movement, staying, social encounter, everyday routines, and collective identity are produced and negotiated [28,29]. In historic urban areas, public-space regeneration must therefore address spatial configuration, daily use, cultural meaning, and governance conditions at the same time [7,9]. A single type of evidence is insufficient for explaining these relations, because spatial form, observed behavior, and perceived meaning may point to different interpretations of the same place.

The Perception–Behavior–Space (PBS) perspective is used in this study to organize these different forms of evidence. Perception refers to users' experiences, memories, evaluations, and recognition of public spaces. Behavior records how people move, pause, stay, and interact in specific settings. Space describes the physical and configurational conditions that shape accessibility, route-through potential, interfaces, and structural centrality. Taken together, the three dimensions allow the study to compare what people recognize, what they do, and what the spatial network affords.

Recent studies of historic public spaces have increasingly combined spatial, behavioral, experiential, and heritage-related evidence using tools such as space syntax, user-experience assessment, and multi-source spatial analysis [30–39]. However, these approaches differ in analytical scale and in how heterogeneous evidence is aligned. Fewer studies explicitly align site-linked perception, directly observed behavior, and segment-level spatial configuration at the same public spaces while retaining contradictions among the results.

In this study, PBS is therefore used as a diagnostic evidence structure rather than as a separate theory or predictive model. It aligns perception, behavior, and spatial evidence at the selected public-space level and identifies where the evidence converges or diverges. Urban catalyst theory is used separately as the interpretive lens through which the resulting diagnoses are related to possible planning implications.

2.3. From Cross-Evidence Diagnosis to Interpretive and Planning Propositions

Building on urban catalyst theory and the PBS analytical perspective, this study shifts attention from identifying catalytic elements to diagnosing relationships among perceived meaning, observed use, and spatial potential. Existing studies have shown that public-space activation may be associated with spatial nodes, temporary activities, cultural narratives, community participation, and governance arrangements. However, the presence of these factors does not by itself explain whether they reinforce one another, remain disconnected, or constrain local activation in specific public-space settings.

Cross-evidence diagnosis treats spatial configuration as an enabling condition rather than a direct indicator of public-space vitality. High accessibility does not necessarily produce repeated use or cultural recognition, while perceived meaning and observed behavior may also diverge. A diagnostic approach therefore needs to retain these evidence streams separately and examine where they converge or conflict.

Diagnosis becomes useful for planning when these relationships can be translated into place-specific spatial and operational implications. Accordingly, this study uses PBS

to compare perception, behavior, and spatial configuration at the same sites, identify site-level convergences and mismatches, and use these diagnoses to inform a case-derived interpretive model and planning implications.

Accordingly, this study uses PBS to compare spatial configuration, observed public-space use, and situated perception at the same sites. The comparison identifies place-level convergences and mismatches. These diagnoses then inform the case-derived interpretive model and case-informed planning implications. The three evidence streams remain distinct rather than being treated as interchangeable measures.

3. Materials and Methods

3.1. Study Area

The Guibeicheng historic urban area is located in central Wuxi, Jiangsu Province, China. Its boundary is defined by the ancient canal and the ring canal and covers approximately 3.64 km^2 (Figure 2). Guibeicheng is a planning-defined historic urban area rather than an independent statistical administrative unit; consequently, a current population figure corresponding exactly to the canal-bounded study area is not available in official population statistics. Its residential population is supplemented by daily inflows of workers, shoppers, commuters, tourists, and other visitors.

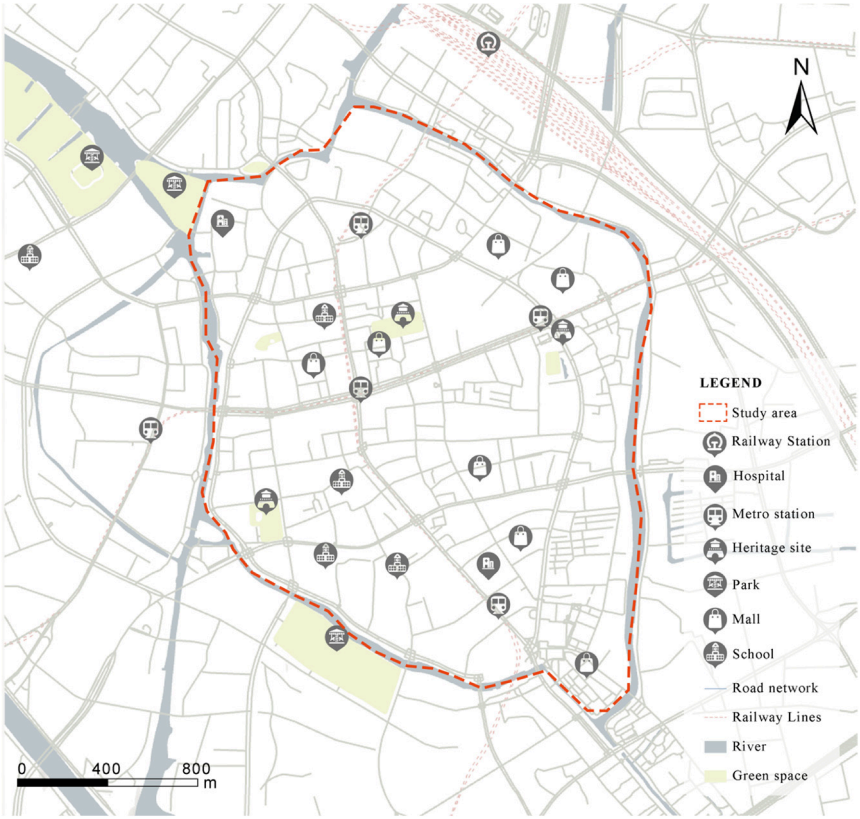


Figure 2. Study area and major public-space resources in Guibeicheng, Wuxi, China. Source: authors' mapping based on OpenStreetMap data and field survey.

Land use within the study area is characterized by a fine-grained mixture of residential neighborhoods, commercial and office frontages, transport interfaces, public-service facilities, historic buildings, cultural landmarks, and small community open spaces. Major commercial and metro-related interfaces are concentrated around Sanyang Square and Chong'an Temple, while historic residences, traditional lanes, residential areas, and community spaces are distributed throughout the internal street network. The resulting mixture

produces marked differences between daytime commercial and visitor activity and the everyday use of residential and neighborhood spaces.

Guibeicheng forms the core of Wuxi's officially designated historic urban area. Its conservation plan identifies the canal-bounded historic form, traditional streets and lanes, and multiple heritage resources for differentiated conservation [40]. Recent regeneration projects have combined heritage conservation, streetscape improvement, commercial activation, transport organization, and residential-environment enhancement [41]. The area therefore provides a suitable setting for examining relationships among spatial configuration, public-space use, perceived meaning, and operational conditions.

Recent regeneration has included streetscape, public-space, and infrastructure improvements in the Jiankang Road–Houxixi area, together with wider renewal initiatives involving Shenglimen Square, Renmin Road, the former CPPCC site, and Nanshiqiao Lane [41]. These interventions combine heritage conservation, public-space improvement, commercial activation, transport organization, and residential-environment enhancement. Guibeicheng therefore provides an appropriate setting for examining how spatial configuration, observed public-space use, perceived meaning, and operational conditions interact within an actively changing historic urban area.

3.2. Evidence Construction

Evidence was constructed through three streams: perception, behavior, and spatial configuration.

3.2.1. Perception: Semi-Structured Interviews and Cognitive Mapping

Perception evidence was constructed from 24 semi-structured interviews conducted between 8 April and 8 June 2026. Following established guidance for semi-structured interview design [42], the interviews examined participants' perceptions of spatial quality, everyday use, event participation, place identity, organizational support, and governance arrangements in Guibeicheng's public spaces. Participants included residents, shopkeepers, visitors, and local governance and planning actors familiar with the study area. Interviews were conducted online or in person according to participant availability, and oral informed consent was obtained from all participants before each interview.

Participants were recruited through a combination of online recruitment, acquaintance referral, and on-site invitation. Inclusion was based on direct experience with or familiarity with Guibeicheng as a resident, shopkeeper, visitor, or local governance and planning actor. The sample comprised 13 residents, three shopkeepers, five visitors, and three local governance and planning actors. The latter group included community workers and a public-sector planning professional familiar with the study area; specific institutional affiliations and professional titles are not reported to protect participant anonymity. Fifteen interviews were conducted online and nine in person, with each interview lasting approximately 30–50 min. Participant composition and interview characteristics are summarized in Table A3.

Recruitment continued until the later interviews largely reiterated the existing descriptive themes and produced no substantively new thematic categories. This was treated as practical thematic sufficiency for the exploratory case analysis rather than as evidence of statistical representativeness.

All participants were assigned anonymized role-based codes, with serial numbers used to distinguish individuals within each group. Names and contact details were removed from the interview transcripts and cognitive-map files, which were linked only to the anonymized participant codes. Participant-specific cognitive maps were not reproduced in the manuscript or deposited publicly.

Eighteen of the 24 participants completed cognitive mapping using either paper or electronic versions of the same base map. They were asked to mark commonly used routes, important or frequently used nodes, memory-related places, and places that they seldom visited. Paper annotations were digitized, electronic annotations were standardized, and the records were organized by anonymized participant code and shared place identifier. The annotations were coded according to these spatial categories and linked with the corresponding interview excerpts. No fixed frequency threshold was applied because the cognitive maps were used as qualitative, site-linked spatial references rather than as estimates of the prevalence of particular perceptions. Formal comparisons among participant groups were not conducted because the groups were small and unequal in size. Places explicitly identified as seldom visited were interpreted as indicating limited everyday spatial engagement; unmarked locations were not classified as weakly perceived because non-marking could also reflect omission or unfamiliarity.

Interview materials were transcribed, anonymized, and imported into NVivo 15 for coding. The analysis followed thematic analysis and constant comparison [43,44]. An initial codebook was developed from the interview guide and the study's analytical focus. The first author conducted the primary coding, while another researcher reviewed the codebook and checked coded excerpts against the transcripts. The second researcher did not independently code the full dataset; accordingly, no intercoder reliability coefficient was calculated. The secondary review served as a qualitative coding audit, and coding differences were discussed and resolved through consensus. The finalized codes were organized into five descriptive themes: everyday use, event participation, place memory, organizational support, and governance perception. Spatial references contained in the coded excerpts were retained for comparison with behavioral mapping and space syntax results. At this stage, the themes were treated as perception-based evidence categories rather than as interpretive dimensions. These themes and their spatial references were subsequently compared with the behavioral and spatial evidence in the cross-evidence analysis described in Sections 3.3 and 3.4.

3.2.2. Behavioral: Multi-Temporal Place-Centered Behavioral Mapping

Behavioral evidence was generated through systematic field observation using multi-temporal place-centered behavioral mapping [45]. Before the formal behavioral observations and cross-evidence diagnosis, 17 candidate public-space units within Guibeicheng were compiled from the preliminary field survey and site references recorded in the interviews and cognitive maps. The candidates were organized into three categories according to their predominant public-space function: mobility-oriented interfaces, everyday commercial public spaces, and heritage and cultural-memory sites (Table A4).

Within each category, candidates were evaluated using five pre-analysis considerations: (1) the relative frequency with which the site was referenced by participants; (2) public accessibility during the observation period; (3) the presence of a clearly identifiable physical or functional observation boundary; (4) the feasibility of establishing a stable pedestrian counting line and fixed observation position; and (5) an observable extent broadly comparable with those of the other selected sites. One site was retained from each category to achieve maximum variation in predominant public-space function.

Three functionally distinct and operationally observable cases were retained for formal observation. Exit 1 of Sanyang Square Subway Station represented a mobility-oriented transport and commercial interface. The entrance area of Xue Fucheng's Former Residence represented a heritage-related public-space interface. A selected segment of Chong'an Temple pedestrian street represented an everyday commercial pedestrian space. The selection procedure was completed before the formal behavioral observations, extraction

of the site-level space syntax values, and cross-evidence diagnosis. Accordingly, the selection did not use the subsequently measured pedestrian-flow values, stationary-use patterns, space syntax rankings, or resulting diagnostic categories. Participant-reference frequency was used as a preliminary indicator of site salience rather than as a cross-evidence diagnostic result.

The observation area at each site was defined as a functionally continuous public-space unit centred on the selected interface: the pedestrian circulation area associated with Exit 1 at Sanyang Square Subway Station, the entrance forecourt of Xue Fucheng's Former Residence, and the selected segment of Chong'an Temple pedestrian street. Boundaries followed identifiable physical or functional edges, where applicable, including building frontages, entrance thresholds, street curbs, intersections, and changes in access or public-space use. Because the three sites differed in spatial form, a uniform metric buffer was not imposed. Broadly comparable observable extents were used as a secondary consideration to prevent one observation area from covering a substantially larger public-space unit than the others. The observation boundary and pedestrian counting line were established during the preliminary site survey and remained unchanged across all sessions.

Field observations were conducted on Friday, 12 June 2026 (weekday), and Saturday, 13 June 2026 (weekend). Morning, afternoon, and evening observation sessions were scheduled within 09:00–11:00, 14:00–16:00, and 18:00–20:00, respectively, when site opening hours permitted. According to daily records issued by the Wuxi Meteorological Observatory, 12 June was cloudy, with a citywide daily temperature range of 18.5–33.2 °C, whereas 13 June was cloudy to overcast with scattered showers, with temperatures of approximately 24.9–29.4 °C. Observations were conducted under ordinary non-holiday conditions and avoided periods of heavy rain or other abnormal weather. Each observation session lasted 20 min. In total, 16 valid site–period sessions were completed: four at Xue Fucheng's Former Residence and six each at Sanyang Square Subway Station and Chong'an Temple pedestrian street. No evening observation was conducted at Xue Fucheng's Former Residence because the site was closed during that period.

Pedestrian and non-motorized movement crossing the predefined counting line was counted during each valid observation period and normalized to persons per 10 min. Stationary activity scans were conducted at the 5th, 10th, 15th, and 20th minutes. Each scan recorded the number and location of stationary users, primary activity type, and group size. Two researchers conducted the observations simultaneously using the same predefined counting and activity-coding protocol, while a fixed-position iPhone 17 Pro (Apple Inc., Cupertino, CA, USA) recorded each session. Following each session, the two field records were cross-checked and subsequently verified against the video recording. Any discrepancies in pedestrian counts or activity classifications were resolved by replaying the relevant video interval before the final record was established. This constituted a three-source procedural consistency check rather than a formal statistical assessment of inter-rater reliability.

Stationary activities were coded as resting (R), waiting (W), social interaction (S), consumption (C), children or caregiving activity (P), and viewing or cultural activity (V). The resulting data were used for descriptive comparisons across the selected public spaces, time periods, and weekday–weekend conditions. Given the limited observation period, the analysis was not used to establish long-term behavioral patterns or causal relationships.

3.2.3. Space: Space Syntax Analysis

A segment-based space syntax model was constructed using OpenStreetMap data accessed on 6 January 2026. The model covered the 3.64 km^2 historic urban area enclosed by the ancient canal and the ring river. Publicly accessible streets, historic lanes, waterfront

paths, and pedestrian passages were retained, whereas private internal roads, parking aisles, and non-walkable elevated or expressway segments were excluded. Duplicate segments, network disconnections, and topological errors were checked and corrected before analysis. The final cleaned segment graph comprised 2373 segment nodes, all of which were connected within the R = *n* analysis.

The cleaned segment model was analyzed in DepthmapX v0.9.1 using angular segment analysis with the Tulip approximation and 1024 angular bins (T1024) [46]. Integration and choice were calculated simultaneously at R = *n* and at metric radii of 400 m and 800 m, without additional segment weighting. Angular change defined the least-cost paths, whereas metric distance defined the 400 m and 800 m radius constraints. Global integration was used to describe district-wide accessibility and structural centrality, whereas global choice represented route-through potential. The 400 m and 800 m measures were used to examine immediate and broader pedestrian-scale configuration, respectively, approximating 5- and 10-min walking distances.

The resulting maps were used to characterize the overall street-network structure and to document the site-specific integration and choice values associated with the selected public spaces. These indicators were interpreted as configurational potentials rather than direct measures of pedestrian flow or public-space vitality. The reported measures were the original T1024 integration and choice outputs from DepthmapX rather than normalized angular integration (NAIN) and normalized angular choice (NACH). Values were therefore interpreted comparatively within each measure and radius rather than compared directly in absolute magnitude across radii.

The network boundary followed the continuous canal system surrounding Guibeicheng, providing a morphologically and geographically defined extent for the analysis. The R = *n* measures were interpreted relative to this canal-bounded network. Comparison with the R = 400 m and R = 800 m results was used to assess whether the principal configurational patterns persisted across district and pedestrian scales. The canal-bounded extent reduced arbitrary boundary placement but did not eliminate possible edge effects. The network extent was held constant across all analyses; comparison among R = *n*, R = 400 m, and R = 800 m therefore examined sensitivity to analytical scale rather than sensitivity to alternative definitions of network extent.

To obtain site-level configurational measures, integration and choice values were extracted from the ground-level street segment most directly corresponding to each observation area. For Xue Fucheng's Former Residence and Chong'an Temple pedestrian street, the values were obtained from the surface segment associated with the predefined pedestrian counting line. The behavioral observation at Sanyang Square Subway Station was conducted at the below-ground interface of Exit 1, which was not represented in the ground-level street-network model. The corresponding syntax values were therefore extracted from the nearest ground-level segment connected to Exit 1 and represent the surface-access configuration of the station exit.

3.3. Cross-Evidence Comparison

Cross-evidence comparison was conducted for the three sites selected through the procedure described in Section 3.2.2. The common spatial unit for cross-evidence alignment was the predefined observation place rather than a uniform metric buffer. For each of the three sites, this unit comprised (i) the behavioral observation boundary and counting line; (ii) the ground-level street segment directly associated with that boundary, as described in Section 3.2.3; and (iii) interview excerpts and cognitive-map marks explicitly referring to the named site, its entrance or interface, or an immediately connected pedestrian route. Cognitive-map marks and coded spatial references were grouped by these place identifiers

rather than reassigned to individual street segments. References concerning Guibeicheng generally, without a direct connection to one of the three observation places, informed the district-level perception results but were not used to assign a site-level convergence or mismatch. The three evidence streams were therefore compared at a shared place level while retaining their different original spatial resolutions.

For the site-level comparison between spatial configuration and observed movement, the mean pedestrian-flow rate at each site was calculated as the arithmetic mean of the normalized flow rates across all valid observation sessions and expressed as persons per 10 min. The site-level integration and choice values were compared with the observed flow rates using their between-site ordering within each measure and radius. Weekday, weekend, and time-period observations were treated as repeated observations within the same sites rather than as independent spatial cases. Given the three spatially independent observation sites, this comparison was used as an exploratory site-level calibration rather than for correlation or regression modelling.

3.4. Analytical Procedure: From Cross-Evidence Diagnosis to Case-Derived Interpretation

To examine place-level relationships among perceived meaning, observed use, and spatial configuration, this study applied the Perception–Behavior–Space (PBS) analytical procedure shown in Figure 3. Perception evidence comprised coded interview themes, cognitive-map annotations, and their spatial references. Behavioral evidence comprised short-term observations of pedestrian flow, stationary occupancy, and activity types. Spatial evidence comprised integration and choice at R = *n* and at metric radii of 400 m and 800 m.

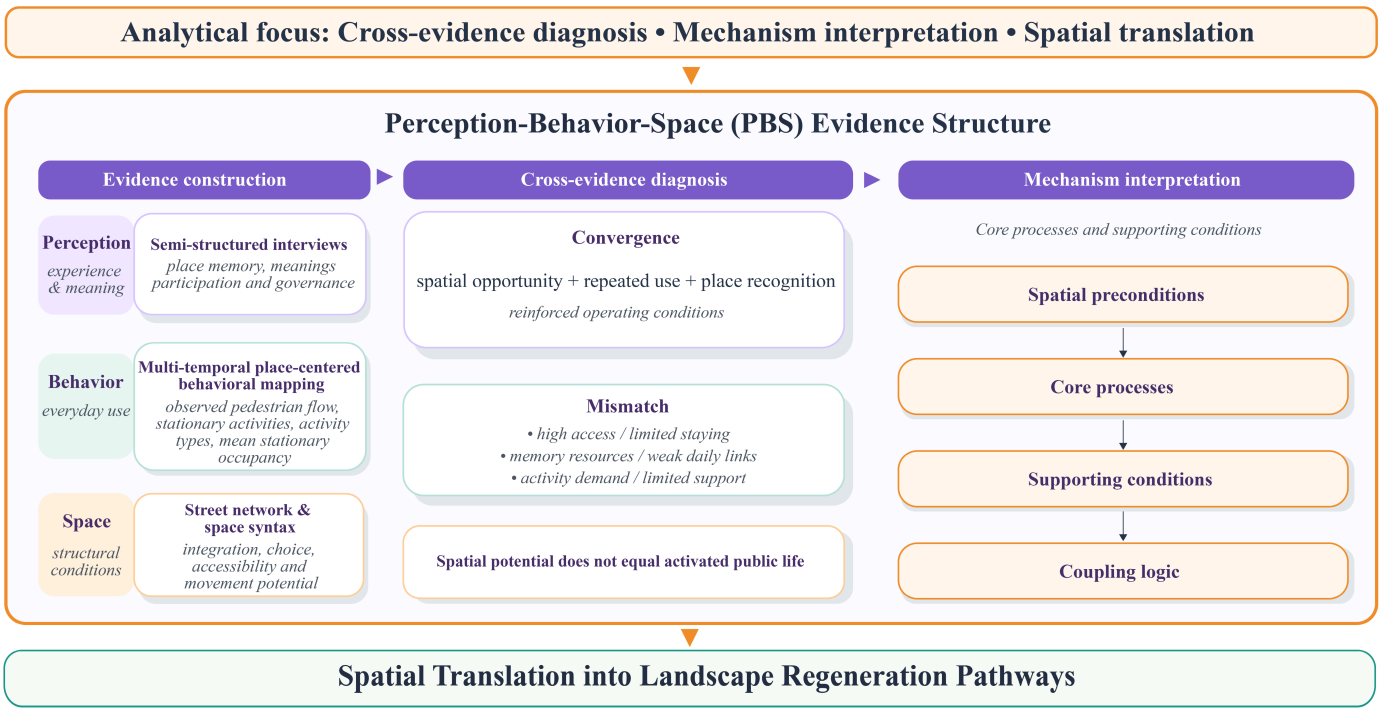


Figure 3. Analytical sequence of PBS evidence construction, site-level cross-evidence diagnosis, case-derived interpretation, and planning translation. Source: authors' diagram.

The three evidence streams were first analyzed separately and then aligned by selected public space. The site-level comparison examined whether the evidence streams showed corresponding or divergent patterns. Contradictory evidence was retained as part of the diagnosis rather than combined into a composite score. This approach follows the complementary logic of mixed-method analysis [47].

To make the diagnostic decision process traceable, three rules were applied. First, behavioral and configurational comparisons used the reported values or between-site ranks within the same indicator; values from different syntax measures or radii were not compared directly. Perception descriptors were based on coded themes and cognitive-map references explicitly linked to each site rather than on numerical scores. Second, convergence was recorded when two or more independently constructed evidence streams indicated a corresponding site-level condition. The contributing dimensions were named explicitly, and three-way PBS convergence was not assigned unless all three evidence streams aligned. Third, mismatch was recorded when two behavioral indicators or two evidence streams indicated contrasting site-level conditions—for example, relatively high pedestrian movement with limited stationary occupancy, site-linked place memory with limited observed use, or a higher within-measure configurational rank with a lower observed-flow rank. No composite PBS score was calculated. The place-level evidence matrix presented in Section 4.4 operationalizes these rules by reporting the site-linked perception evidence, behavioral indicators, within-measure configurational ranks, decision rule applied, resulting diagnosis, and case-informed implication for each observation place.

The analytical procedure involved four steps. First, evidence construction generated the perception, behavior, and spatial evidence independently. Second, cross-evidence comparison aligned the three evidence streams at the place level. Third, the comparison identified site-specific convergences and mismatches and summarized them as place-level diagnoses. Fourth, these diagnoses were considered in relation to urban catalyst theory to develop a case-derived interpretive model and corresponding planning implications. Figure 3 summarizes this analytical sequence.

3.5. Planning Translation Procedure

Planning translation linked the place-level diagnoses and case-derived interpretations to possible design, management, and governance responses [48]. Responses were organized across material and operational dimensions and across three spatial scales: micro-node, route, and network.

At the micro-node scale, implications addressed interfaces and activity settings; at the route scale, pedestrian movement, cultural narratives, and activity connections; and at the network scale, place-keeping, actor coordination, and governance arrangements.

4. Results

4.1. Perception Evidence

The perception evidence shows that users' understandings of Guibeicheng's public spaces were shaped not only by physical form, but also by everyday routines, event experiences, place memory, organizational participation, and governance conditions. Interview-coded evidence and cognitive-map annotations connected these perceptions with specific streets, entrances, commercial frontages, historical spaces, and management situations. These coded themes were used to characterize perceived use, place meaning, organizational conditions, and governance experiences at spatially referenced locations, providing the perception evidence for subsequent cross-evidence comparison. The coding-derived perception themes and their roles in cross-evidence comparison are summarized in Table 1.

The coding-derived themes summarized different dimensions of participants' accounts. Everyday use and event participation characterized perceived patterns of routine and time-specific public-space use. Place memory captured heritage recognition, attachment, and remembered locations. Organizational support and governance perception described reported actor participation and management conditions. The spatial references associated

with these themes were retained for comparison with the behavioral observations and configurational measures reported in Sections 4.2–4.4.

These themes and their spatial references formed the perception evidence used in the subsequent cross-evidence comparison.

Table 1. Coding-derived perception themes and their roles in cross-evidence comparison.

Coding-Derived Perception Theme	Representative Coded Evidence	Role in Cross-Evidence Comparison
Everyday use	Repeated daily visits; walking-based access; route choice; short-term resting; consumption; strolling; family-oriented leisure; social encounters.	Characterizes perceived patterns of routine movement, staying, and social use for comparison with observed pedestrian flow and stationary activities.
Event participation	Temporary markets; seasonal activities; festival decorations; commercial renewal; shop updating; brand intervention; declining attractiveness caused by homogeneous activities.	Characterizes perceived changes in activity intensity, visibility, and diversity associated with temporary and commercial events for comparison with observed activity patterns.
Place memory	Childhood and schooling memories; repeat visits driven by memory; local identity; emotional attachment; former residences; place-name continuity; historical imagery; heritage recognition.	Identifies spatially referenced heritage recognition, attachment, and remembered places for comparison with everyday routes and observed use.
Organizational support	Parent–child volunteer activities; merchant participation; acquaintance networks; co-organized activities; participation experience; public responsibility; strengthened belonging.	Identifies reported participation, collaboration, programming, and maintenance support associated with specific public spaces.
Governance perception	Electric-bike management; sanitation and safety improvement; ticketing constraints; vending restrictions; night lighting; policy support; government-led public activities.	Identifies perceived permissions, constraints, and management conditions affecting temporary, informal, and everyday public-space use.

The coding-derived themes served as perception-evidence categories. Their spatial references were subsequently compared with behavioral observations and space syntax evidence in Sections 4.2–4.4.

4.2. Behavioral Evidence

Behavioral mapping provided the second evidence stream. It was conducted at the three selected public spaces: Exit 1 of Sanyang Square Subway Station, the entrance area of Xue Fucheng's Former Residence, and a selected segment of Chong'an Temple pedestrian street. The observed results show clear differences between movement intensity and stationary public-space use across the three places (Figure 4; Appendix A Tables A1 and A2).

Pedestrian flow differed substantially across the three sites (Figure 4; Table A1). Chong'an Temple pedestrian street recorded the highest flow across all observed periods, followed by Sanyang Square Exit 1, while Xue Fucheng's Former Residence consistently showed the lowest flow. Evening observations were unavailable for Xue Fucheng's Former Residence because the site was closed.

Stationary occupancy showed a different pattern (Figure 4; Table A2). Chong'an Temple recorded the highest stationary use, whereas Sanyang Square showed relatively limited staying despite substantial pedestrian flow. Xue Fucheng's Former Residence showed the lowest stationary occupancy.

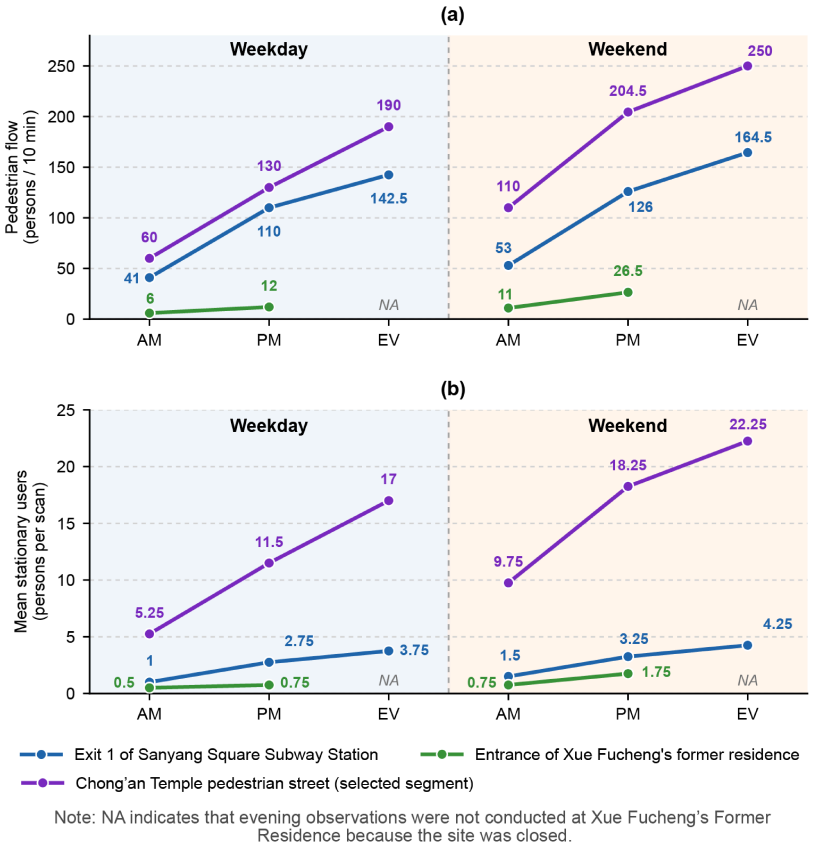


Figure 4. Multi-temporal behavioral profiles of three observed public spaces in Guibeicheng. (**a**) Pedestrian flow. (**b**) Mean stationary occupancy. Source: authors' analysis.

The spatial distribution of stationary activities further clarifies these differences (Figure 5). At Exit 1 of Sanyang Square Subway Station, stationary users were concentrated near the edges of the passage and around small facilities, while the central space remained dominated by through movement. Activities mainly included waiting, short consumption-related stops, child caregiving, and viewing. At Chong'an Temple pedestrian street, stationary activities were more spatially dispersed and more diverse, including consumption, social interaction, resting, and waiting along shopfronts and widened pedestrian areas. At the entrance area of Xue Fucheng's Former Residence, stationary activity was limited and mainly associated with viewing and short waiting near the entrance and street-facing interface.

Overall, the behavioral evidence indicates that high pedestrian flow did not necessarily correspond to high stationary use. Exit 1 of Sanyang Square Subway Station functioned mainly as a movement-oriented space, whereas Chong'an Temple pedestrian street combined high flow with more frequent and diverse stationary activities. Xue Fucheng's Former Residence showed lower movement volume and limited stationary occupancy, but its observed activities were closely related to entrance use and cultural viewing. These behavioral differences provide the basis for the cross-evidence diagnosis in Section 4.4.

4.3. Spatial Evidence

Integration varied by analytical radius, with Sanyang Square and surrounding central streets retaining relatively high values, while local patterns became more differentiated at R = 400 m and R = 800 m. Choice remained more corridor-oriented across all radii, with higher values concentrated along a limited set of major routes (Figure 6).

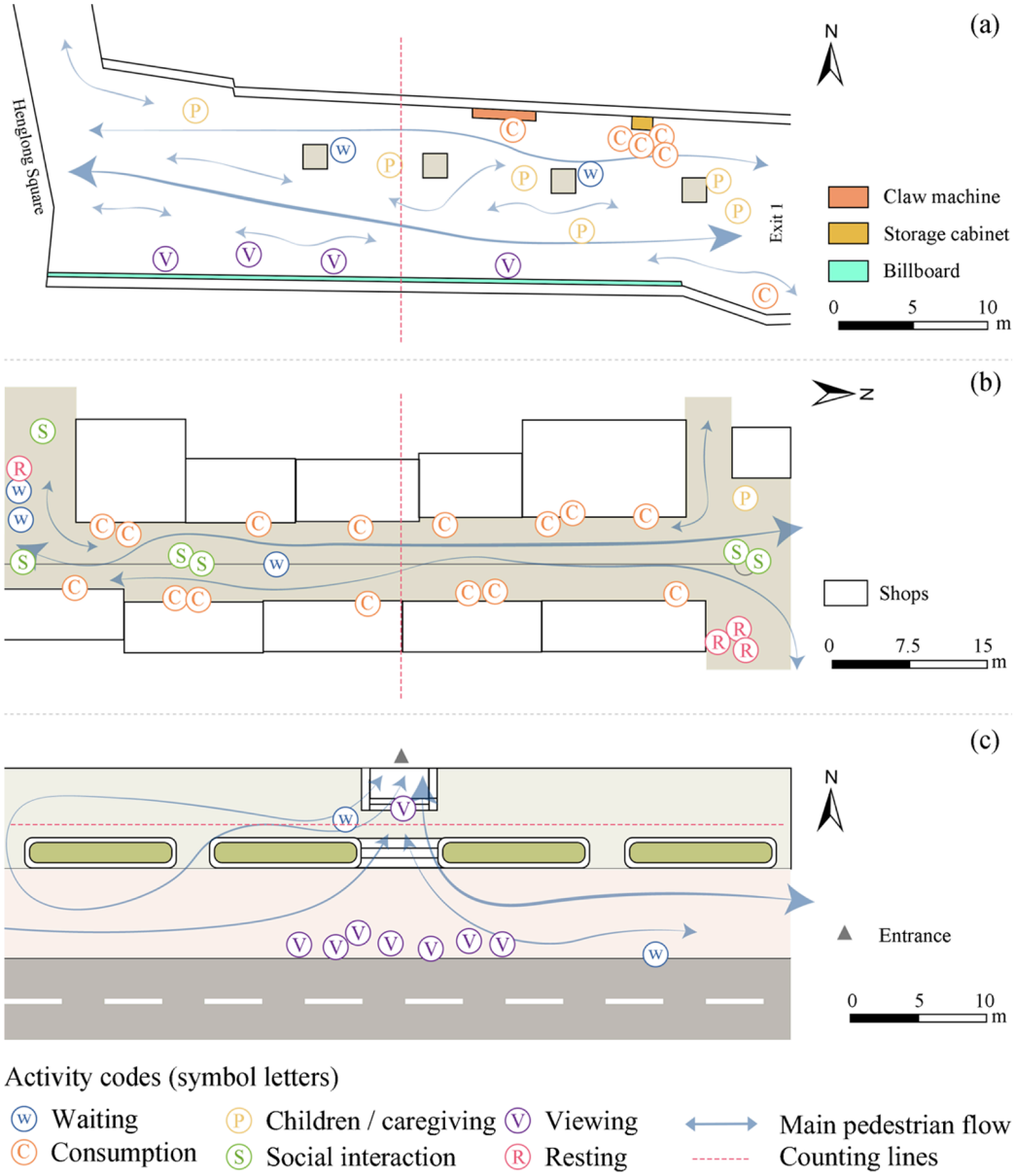


Figure 5. Spatial distribution of observed stationary activities and pedestrian flows at the three selected public spaces. (**a**) Exit 1 of Sanyang Square Subway Station; (**b**) Chong'an Temple pedestrian street; (**c**) entrance area of Xue Fucheng's Former Residence. Source: authors' field observation and mapping.

These results indicate that global and local measures capture different configurational scales and should not be treated as interchangeable. Their relationship with observed movement was therefore examined directly in the cross-evidence comparison.

4.4. Cross-Evidence Diagnosis

This section compares the PBS evidence for the three selected public spaces. Three site-specific patterns were identified. Sanyang Square showed a movement–staying mismatch. Xue Fucheng's Former Residence showed a combined configuration–use and memory–use mismatch. Chong'an Temple showed perception–behavior convergence despite its lower configurational values.

Table 2 compares the site-level integration and choice values with the mean pedestrian-flow rates recorded during the behavioral observations. The observed flow order was

C > S > X, with mean rates of 157.42, 106.17, and 13.88 persons per 10 min, respectively. This ordering was not reproduced by any of the six syntax measures.

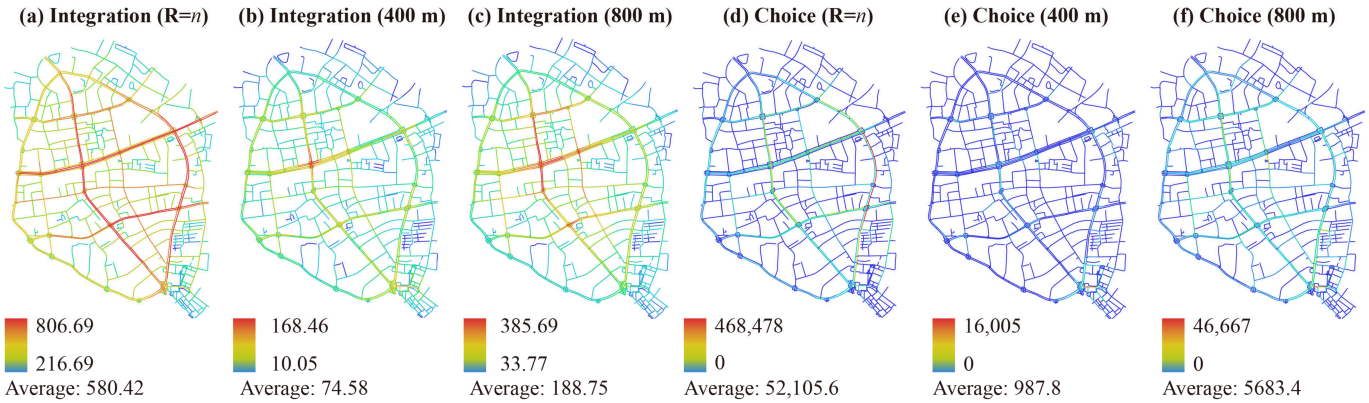


Figure 6. T1024 angular segment analysis of the Guibeicheng street network: (**a**) integration at R = *n*; (**b**) integration at R = 400 m; (**c**) integration at R = 800 m; (**d**) choice at R = *n*; (**e**) choice at R = 400 m; and (**f**) choice at R = 800 m. Angular change was used to define least-cost paths, whereas the 400 m and 800 m analytical radii were constrained by metric distance. No additional segment weighting or NAIN/NACH normalization was applied. Warmer colours indicate higher values within each individual measure and radius; colour values should not be compared directly across panels. Source: authors' analysis based on OpenStreetMap road-centreline data using DepthmapX v0.9.1.

Table 2. Site-level comparison of space syntax measures and observed pedestrian flows.

Site	Int. R = *n*	Int. R400	Int. R800	Choice R = *n*	Choice R400	Choice R800	Mean Flow/ 10 min
Xue Fucheng's Former Residence (X)	675.072327	106.037682	223.094772	77,905	2366	12,009	13.88
Sanyang Square Exit 1 (S)	682.256470	123.823807	325.127533	32,530	1084	6773	106.17
Chong'an Temple pedestrian street (C)	495.195313	71.956261	170.293686	5280	1699	3171	157.42

Note: X, S, and C denote the three behavioral-observation sites. The S values represent the nearest ground-level segment connected to Exit 1 because the observation area was located below ground. Mean flow is the arithmetic mean of the normalized pedestrian-flow rates across all valid observation sessions. Because the syntax outputs were not normalized across measures or radii, comparisons are made among sites within each column rather than between columns.

Integration produced the same site ordering at all three radii (S > X > C). Sanyang Square had the highest integration value at R = *n*, R = 400 m, and R = 800 m but the second-highest observed flow, whereas Chong'an Temple had the lowest integration values but the highest observed flow. Choice identified Xue Fucheng's Former Residence as the highest-ranked site at all three radii, despite this site having the lowest observed flow. Choice at R = *n* and R = 800 m produced an ordering of X > S > C, while Choice at R = 400 m produced X > C > S.

The site-level comparison therefore did not show complete directional correspondence between the configurational measures and the observed pedestrian-flow intensity. The syntax results and behavioral observations were retained as distinct but comparable evidence

streams in the subsequent PBS diagnosis, rather than treating integration or choice as direct proxies for pedestrian movement.

Given the limited number of spatially independent sites, this comparison should be interpreted as an exploratory calibration rather than as a statistical test of association. Validation across a larger set of independent observation sites will be required to determine the statistical relationship between syntactic measures and pedestrian movement.

Table 3 summarizes the evidence and resulting cross-evidence diagnosis for each site.

Table 3. Place-level PBS evidence matrix and cross-evidence diagnoses.

Diagnostic Item	Exit 1 of Sanyang Square Subway Station	Outer Public Space of Xue Fucheng's Former Residence	Chong'an Temple Pedestrian Street
Site context	Transport-oriented station interface	Heritage-related entrance space	Everyday commercial pedestrian street
P evidence	Site-linked references emphasized transit transfer and connections with the metro and adjacent commercial space.	Site-linked references emphasized place memory and heritage recognition	Site-linked references emphasized everyday use and public recognition
B-flow	Second-highest mean flow (106.17 persons/10 min)	Lowest mean flow (13.88 persons/10 min)	Highest mean flow (157.42 persons/10 min)
B-staying	Comparatively low (session means: 1.00–4.25 users per scan)	Lowest (session means: 0.50–1.75 users per scan)	Highest (session means: 5.25–22.25 users per scan)
B-activity pattern	Waiting, short stops, edge-based activities	Viewing and short waiting near the entrance	Consumption, social interaction, resting, waiting
S evidence	Integration: highest at all radii; choice: second at R = *n* and R = 800 m and lowest at R = 400 m.	Integration: second at all radii; choice: highest at all radii.	Integration: lowest at all radii; choice: lowest at R = *n* and R = 800 m and second at R = 400 m.
Diagnostic basis and diagnosis	Second-highest pedestrian flow + limited stationary use and predominantly short-stop activities → movement–staying mismatch	Highest choice + lowest pedestrian flow; strong place memory + limited observed use → configuration–use and memory–use mismatch	High everyday relevance + highest flow, staying, and activity diversity, but lower configurational values → perception–behavior convergence rather than three-way PBS convergence
Case-informed implication	Flow needs to be converted into staying through micro-spatial support	Narrative resources need to be embedded into everyday routes and stayable interfaces	Everyday use, active interfaces, and activity diversity reinforce activation

Note: P, B, and S evidence was constructed independently and compared at the predefined observation-place level. Behavioral and configurational judgments used reported values or within-indicator site ranks, while perception judgments used finalized site-linked codes and cognitive-map references. Convergence required corresponding evidence from at least two streams, whereas mismatch required contrasting behavioral indicators or evidence streams. Three-way PBS convergence required alignment of P, B, and S evidence. No composite score was calculated. Underlying evidence is reported in Tables 1 and 2, Figure 4, and Tables A1 and A2.

Figure 7 visualizes the same diagnostic relationships by placing perceived use and memory evidence against structural accessibility and route-through potential. In this comparison, spatial structure, observed use, and perceived meaning are read as parallel evidence streams. Their overlap marks spaces where structural potential was more readily translated into public-space activity. Their separation marks spaces where movement, staying, or cultural meaning remained weakly connected.

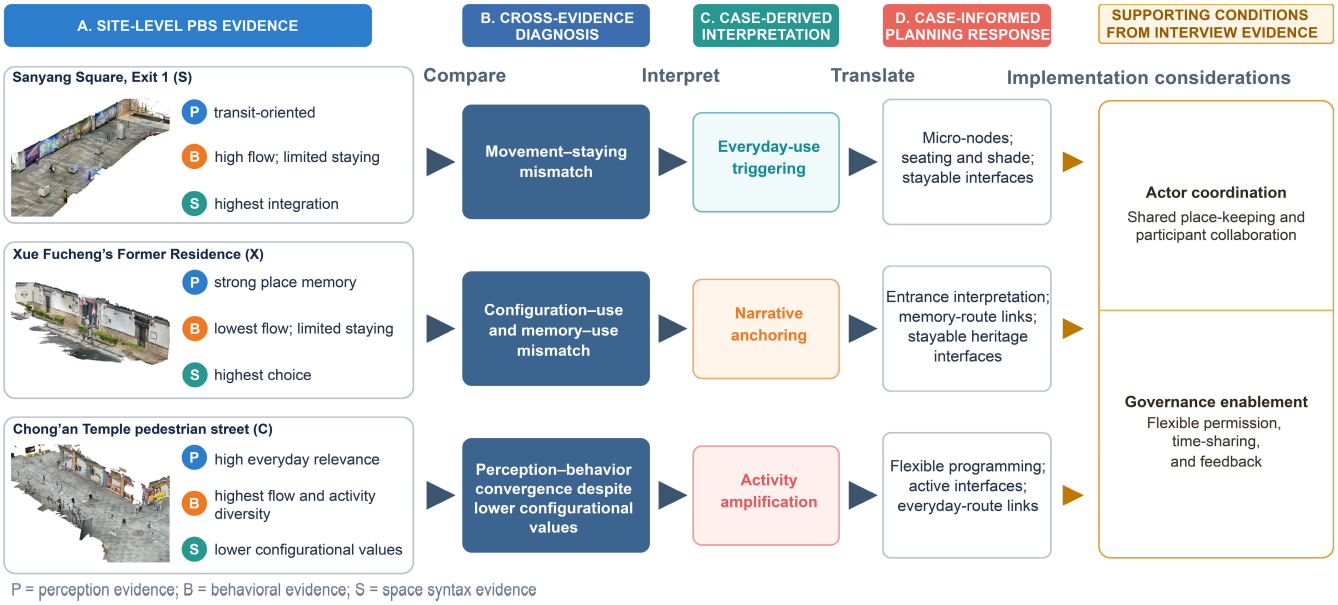


Figure 7. Integrated PBS conceptual model linking site-level evidence, cross-evidence diagnoses, case-derived interpretive dimensions, and case-informed planning responses in Guibeicheng. Site codes in parentheses are S = Exit 1 of Sanyang Square Subway Station, X = Xue Fucheng's Former Residence, and C = Chong'an Temple pedestrian street. Evidence-circle codes are P = perception evidence, B = behavioral evidence, and S = space syntax evidence. Site-context panels: field-derived 3D scan-model views; 3D models and diagram: authors.

At Exit 1 of Sanyang Square Subway Station, the main diagnostic relationship was a movement–staying mismatch. The space supported substantial pedestrian flow and route transition between the metro exit and adjacent commercial space. However, stationary users were relatively few, and most observed activities were short, edge-based, or related to waiting and temporary stops. This indicates that high integration and substantial pedestrian movement were not accompanied by substantial stationary use during the observed sessions.

At the entrance area of Xue Fucheng's Former Residence, the evidence pointed to a memory–use mismatch. The site also showed the highest choice values at all three radii but the lowest observed pedestrian flow, indicating an additional divergence between configurational through-movement potential and observed use. Interviews and cognitive-map evidence showed strong heritage recognition and place memory. In the behavioral observations, however, both pedestrian flow and stationary use remained limited. The site worked as a meaningful cultural reference, but this meaning was only weakly connected with everyday routes, longer staying, and broader public-space use.

At Chong'an Temple pedestrian street, perceived everyday relevance and observed behavior were closely aligned: the site recorded the highest pedestrian flow, the greatest stationary occupancy, and the most diverse activity pattern. However, the corresponding segment had the lowest integration values at all three radii and relatively low choice values. The diagnosis therefore indicates perception–behavior convergence despite lower configurational values, rather than convergence across all three PBS dimensions.

Taken together, the cross-evidence diagnosis identified distinct relationships among spatial configuration, observed behavior, and perceived meaning across the three sites. The retained convergences and divergences provide the case-level evidence for the interpretive model developed in Section 4.5 and the planning implications that follow.

4.5. Case-Derived Interpretive Model: From Cross-Evidence Diagnosis to Planning Translation

Based on the cross-evidence diagnoses, this section develops a case-derived interpretive model comprising three interpretive dimensions—everyday-use triggering, activity amplification, and narrative anchoring—and two supporting conditions: actor coordination and governance enablement. The three interpretive dimensions were informed by the site-level convergences and mismatches, whereas the supporting conditions were primarily informed by interview evidence concerning participation, operation, and management. The model is used to organize case-based interpretation and planning translation rather than to represent a validated causal sequence (Figure 7).

4.5.1. Everyday-Use Triggering

Everyday-use triggering refers to the relationship between repeated low-threshold practices and opportunities for stopping, interaction, and routine return. Walking, waiting, resting, small-scale consumption, and informal encounters can help public spaces acquire recognizable everyday roles [24,28].

The contrast between Sanyang Square and Chong'an Temple informed this dimension. Both accommodated substantial pedestrian movement during the observed periods, but Chong'an Temple supported more stationary and diverse activities. This contrast suggests that movement alone does not constitute everyday public-space activation; interfaces that support stopping and interaction may be important in translating movement into more diverse forms of use.

4.5.2. Activity Amplification

Activity amplification refers to the relationship between existing everyday use and increased activity intensity, diversity, and visibility. Temporary activities, event programming, and commercial renewal may broaden participation when they are connected with daily routes and suitable activity settings [21,49].

Chong'an Temple informed this interpretation because pedestrian movement, consumption, resting, and social interaction co-occurred during the observed periods. The case suggests that programming may contribute more effectively to public-space use when it builds on recurring local demand and everyday movement rather than operating as an isolated event.

4.5.3. Narrative Anchoring

Narrative anchoring refers to the relationship between place memory, historical narratives, and everyday spatial experience. Collective memory can contribute to identity and attachment, but cultural recognition does not necessarily translate into everyday public-space use [19,50].

Xue Fucheng's Former Residence informed this dimension. Despite strong heritage recognition and high choice values, the site showed the lowest observed pedestrian flow and limited stationary use. This combined memory–use and configuration–use mismatch suggests that cultural resources may become more closely embedded in everyday public life when they are connected with routine routes, interpretable entrance spaces, and opportunities for staying.

4.5.4. Supporting Conditions: Actor Coordination and Governance Enablement

Actor coordination and governance enablement are treated as supporting conditions rather than direct activation processes. They reflect the organizational and regulatory conditions relevant to implementing and maintaining public-space activities.

Interview evidence referred to commercial operation, merchant participation, occasional activity organization, community involvement, and place-keeping. Actor coordination therefore concerns how relevant participants and responsibilities may be connected around recurring public-space activities and maintenance.

Governance enablement concerns the conditions under which temporary, informal, and everyday uses can occur. Participants referred to practices such as outdoor sitting, small-scale vending, temporary activities, and informal gathering. These accounts suggest a need for management arrangements that balance flexibility with safety, maintenance, and public order.

4.5.5. Planning Translation

The case-derived interpretations were translated into possible planning responses across node, route, and network scales. These include supporting stopping and informal interaction in movement-oriented spaces, linking flexible programming with everyday routes, embedding cultural memory within accessible and stayable public-space sequences, strengthening shared place-keeping, and enabling temporary or informal uses through adaptive management. Table 4 links each diagnostic basis with its interpretive dimension, planning objective, and possible response. These directions are presented as case-informed planning implications rather than validated intervention effects.

Table 4. Case-informed planning translation matrix for Guibeicheng.

Interpretive Dimension or Supporting Condition	Diagnostic Basis	Planning Objective	Possible Planning Response
Everyday-use triggering	Movement–staying mismatch at Sanyang Square: high integration and substantial pedestrian movement were accompanied by limited stationary use.	Support staying and informal interaction in movement-oriented spaces.	Micro-node improvement; seating and shade provision; stayable interfaces; pedestrian-route connections.
Activity amplification	Activity diversity was greatest at Chong'an Temple, where movement, consumption, resting, and social interaction occurred together.	Connect temporary and commercial programming with everyday routes and recurring local uses.	Flexible event spaces; periodic programming; market and event interfaces; activity settings linked with daily routes.
Narrative anchoring	Combined configuration–use and memory–use mismatch at Xue Fucheng's Former Residence: strong heritage recognition and high choice values coincided with the lowest observed pedestrian flow and limited stationary use.	Connect heritage recognition with everyday spatial experience.	Narrative landscape sequences; heritage interpretation; memory-route connections; entrance-space and stayable-interface improvement.
Actor coordination	Interview evidence indicated uneven participation in commercial operation, activity organization, maintenance, and community involvement across the selected public spaces.	Connect relevant actors through shared place-keeping arrangements.	Community platforms; merchant–resident collaboration; shared maintenance; coordination of recurring activities.
Governance enablement	Interview evidence identified demand for flexible street-life practices, including outdoor sitting, small-scale vending, temporary activities, and informal gathering.	Accommodate flexible public-space uses while maintaining safety, maintenance, and public order.	Flexible permissions; time-sharing management; low-threshold arrangements for temporary and everyday uses.

Their effectiveness, sequencing, and longer-term effects require subsequent design development, stakeholder deliberation, implementation, and evaluation.

5. Discussion

5.1. What Cross-Evidence Comparison Adds

The comparison shows that configurational potential and observed public-space use were not consistently aligned across the three sites. In particular, the site with the highest observed pedestrian flow did not have the highest integration or choice values, while strong configurational potential at other sites did not necessarily correspond to greater staying or everyday use. This finding reinforces the distinction between spatial configuration as a potential and public-space use as an observed outcome. This non-alignment also cautions against treating a single configurational or land-use indicator as a direct proxy for public-space vitality [31,32,51].

The value of PBS therefore lies less in combining multiple methods than in retaining disagreement among them. A syntax-only assessment could have overestimated the behavioral significance of highly configured segments, while perception evidence alone could have overstated the everyday role of culturally recognized places. Comparing the three evidence streams makes these divergences explicit and provides a more transparent basis for place-level diagnosis.

5.2. Interpreting Activation Beyond Spatial Configuration

Urban catalyst theory helps interpret these mismatches relationally rather than treating catalytic potential as a property of isolated spatial elements. The Guibeicheng cases suggest that movement opportunities, everyday practices, cultural meanings, and organizational conditions may reinforce or constrain one another in different combinations [16].

The three interpretive dimensions capture different relationships revealed by the diagnoses: everyday-use triggering links movement with stopping and routine interaction; activity amplification links recurring use with greater activity diversity and visibility; and narrative anchoring links cultural recognition with everyday spatial experience. Actor coordination and governance enablement are treated separately as implementation conditions rather than as equivalent mechanisms.

This interpretation should not be read as a temporal or causal sequence. The present cross-sectional evidence does not establish that triggering leads to amplification or that narrative anchoring produces longer-term stabilization. Instead, the model identifies relationships and propositions that can guide subsequent longitudinal testing.

5.3. Planning and Governance Implications

The diagnoses suggest planning responses at three related scales. At the node scale, movement-oriented interfaces such as Sanyang Square may benefit from conditions that support stopping and informal interaction. At the route scale, the Xue Fucheng case points to stronger connections among heritage interpretation, everyday pedestrian movement, and stayable interfaces. At the network scale, activity programming, place-keeping, and governance arrangements can be coordinated across multiple public spaces. These node- and route-scale implications are consistent with studies showing that street interfaces, environmental comfort, and pedestrian-supportive elements influence stopping behavior and pedestrian vitality [52,53].

Chong'an Temple provides a contrasting reference in which movement, staying, consumption, and social interaction occurred together despite relatively low configurational values. This suggests that active interfaces, recurring local demand, and flexible activity settings may partly compensate for configurational disadvantages at the site level. However,

planning for active commercial and visitor-oriented spaces should also preserve inclusive opportunities for residents and other non-consumptive users [54,55].

Interview evidence further indicates that planning responses depend on organizational and regulatory conditions. Temporary markets, outdoor sitting, informal activities, and community participation require arrangements that balance flexibility with safety, maintenance, and responsibility [56,57]. Actor coordination and adaptive governance are therefore treated as implementation considerations rather than empirically demonstrated outcomes of the proposed interventions. For heritage management in resource-constrained intermediate cities, cost-effective geospatial monitoring can complement local knowledge, actor coordination, and participatory governance by helping prioritize attention across dispersed heritage assets [58].

5.4. Transferability and Limitations

The transferable contribution of this study lies primarily in the PBS comparison logic rather than in the specific diagnostic patterns or planning responses identified in Guibeicheng. The evidence structure can be adapted to other historic urban areas by aligning place-based perception evidence, observed behavior, and spatial configuration at comparable public-space units. However, the resulting diagnoses are expected to vary with local morphology, heritage practices, commercial functions, user groups, and governance arrangements. The case-derived interpretive dimensions and planning implications should therefore be treated as context-sensitive propositions rather than universally applicable mechanisms or intervention rules.

Several limitations should also be acknowledged. First, the study is based on a single historic urban area and 24 interview participants, limiting the breadth of comparison across social and spatial contexts. Second, behavioral observations were conducted at three selected sites on one weekday and one weekend day. The findings therefore describe short-term observed patterns rather than seasonal, longitudinal, or before-and-after change. Third, repeated stationary scans measured occupancy rather than individual dwell duration or movement trajectories. Fourth, the space syntax analysis was based on a canal-bounded network, and the comparison among R = n, R = 400 m, and R = 800 m examined analytical scale rather than alternative network extents.

The small number of spatially independent observation sites also limits quantitative calibration. With only three sites, reliable correlation or regression modelling between configurational measures and observed pedestrian movement was not appropriate. Future research should therefore test the PBS comparison logic across larger numbers of independent sites, additional historic urban areas, repeated observation periods, and alternative network specifications. Longitudinal and before-and-after studies would also be needed to evaluate whether the case-derived interpretive relationships and proposed planning responses are sustained over time.

6. Conclusions

This exploratory study identified three distinct cross-evidence patterns in Guibeicheng: a movement–staying mismatch at Sanyang Square, a combined configuration–use and memory–use mismatch at Xue Fucheng's Former Residence, and perception–behavior convergence despite lower configurational values at Chong'an Temple. None of the six configurational measures reproduced the observed pedestrian-flow ordering across the three sites. These findings highlight the importance of distinguishing configurational potential from observed use and perceived meaning when diagnosing historic public spaces.

The principal contribution of the PBS evidence structure lies in making convergences and contradictions among perception, behavior, and spatial configuration explicit without collapsing them into a single score. The resulting diagnoses informed a case-derived interpretive model comprising everyday-use triggering, activity amplification, and narrative anchoring, with actor coordination and governance enablement treated as supporting conditions. These interpretations were subsequently linked with case-informed planning responses across node, route, and network scales. The contribution of the study is therefore primarily diagnostic and interpretive rather than predictive or causal.

The findings should be interpreted in light of several limitations. The study is based on a single historic urban area, a limited interview sample, and short-term behavioral observations at three spatially independent sites. The observations do not capture seasonal or longitudinal variation, and the small number of sites does not permit reliable statistical modelling of relationships between spatial configuration and pedestrian movement. Future research should test the PBS comparison logic across larger samples, additional historic urban areas, and repeated or longitudinal observation periods, and should evaluate the proposed interpretive relationships and planning responses through implementation or before-and-after studies.

Author Contributions: Conceptualization, Z.Z. and S.L.; methodology, Z.Z. and S.L.; investigation, Z.Z.; data curation, Z.Z.; formal analysis, Z.Z.; visualization, Z.Z.; writing—original draft preparation, Z.Z., S.L. and D.W.; writing—review and editing, Z.Z., S.L., D.W. and S.Z.; supervision, S.Z.; project administration, Z.Z. and S.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were not required for this study under the Measures for Ethical Review of Life Science and Medical Research Involving Human Participants [59], because this non-interventional urban-design study did not involve life-science or medical research procedures, human biological samples, health information, or sensitive personal information. The study involved semi-structured interviews and cognitive mapping concerning participants' perceptions and experiences of public spaces. All interview and cognitive-map materials were anonymized during transcription and analysis, and participant-specific cognitive maps were not reproduced or publicly released.

Informed Consent Statement: Participation was voluntary, and oral informed consent was obtained from all participants before data collection.

Data Availability Statement: The original contributions presented in this study are included in the article and Appendix A. De-identified supporting materials are available from the corresponding author upon reasonable request. Interview transcripts and cognitive-map materials are not publicly available because they contain potentially identifiable participant information and are subject to confidentiality commitments.

Acknowledgments: The authors would like to thank all interview participants for generously sharing their experiences, memories, and perspectives on Guibeicheng's public spaces. During the preparation of this manuscript, the authors used GPT-5.6 Sol for language polishing. The authors reviewed and edited all outputs and take full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Multi-temporal pedestrian-flow counts and normalized flow rates at selected public spaces in Guibeicheng.

Site	Day Type	Time Period	Time Duration	Total Flow	Normalized Flow /10 min
X	weekday	AM	20 min	12	6
X	weekday	PM	20 min	24	12
X	weekend	AM	20 min	22	11
X	weekend	PM	20 min	53	26.5
S	weekday	AM	20 min	82	41
S	weekday	PM	20 min	220	110
S	weekday	EV	20 min	285	142.5
S	weekend	AM	20 min	106	53
S	weekend	PM	20 min	252	126
S	weekend	EV	20 min	329	164.5
C	weekday	AM	20 min	120	60
C	weekday	PM	20 min	260	130
C	weekday	EV	20 min	380	190
C	weekend	AM	20 min	220	110
C	weekend	PM	20 min	409	204.5
C	weekend	EV	20 min	500	250

Table A2. Mean numbers of stationary users per scan across day types and time periods at selected public spaces in Guibeicheng.

Site	Weekday AM	Weekday PM	Weekday EV	Weekend AM	Weekend PM	Weekend EV
X	0.50	0.75	NA	0.75	1.75	NA
S	1.00	2.75	3.75	1.50	3.25	4.25
C	5.25	11.50	17.00	9.75	18.25	22.25

Note for Tables A1 and A2: X = entrance area of Xue Fucheng's Former Residence; S = Exit 1 of Sanyang Square Subway Station; C = Chong'an Temple pedestrian street, selected segment. AM = morning; PM = afternoon; EV = evening.

Table A3. Composition and interview characteristics of the participant sample.

Sample Dimension	Category or Description	*n*
Participant role	Residents	13
	Shopkeepers	3
	Visitors	5
	Local governance and planning actors, comprising community workers and a public-sector planning professional	3
Gender	Female	15
	Male	9
Residence or sustained familiarity with Guibeicheng	≥5 years	14
	<5 years	10
Interview mode	Online	15
	In person	9
Cognitive mapping	Completed	18
	Not completed	6
Interview duration	Approximately 30–50 min	24
Recruitment strategy	Online recruitment, acquaintance referral, and on-site invitation	

Note: Counts reported under the different sample dimensions refer to the same 24 participants and should not be summed across dimensions. Age was not systematically recorded. Specific institutional affiliations and professional titles are withheld to protect participant anonymity.

Table A4. Pre-analysis candidate categories and site-selection outcomes.

Site Type	Candidate Public-Space Unit	Selection Outcome
Mobility-oriented interfaces	Sanyang Square Subway Station, Exit 1	Retained as the more frequently referenced mobility-oriented candidate and because it provided a clearly identifiable observation boundary and stable pedestrian counting line.
	Shenglimen Metro Station entrance area	Not retained because it was less frequently referenced than the selected site within the same candidate category and did not provide an additional functional contrast.
	Nanchan Temple Metro Station entrance area	
Everyday commercial public spaces	Underground pedestrian street	Not retained because it was less frequently referenced than the selected site within the same candidate category and did not provide an additional functional contrast.
	T12 Shopping Center frontage	
	Suning Plaza frontage	
	Yaohan frontage	
	Chong'an Temple pedestrian street	Retained as the more frequently referenced everyday commercial pedestrian space and because it provided a clearly identifiable observation segment and pedestrian counting line.
Heritage and cultural-memory sites	Xue Fucheng's Former Residence entrance area	Retained as the more frequently referenced heritage-related candidate and because it provided a clearly defined entrance-area observation unit.
	Qian Zhongshu's Former Residence surroundings	Not retained because it was less frequently referenced than the selected site within the same candidate category and did not provide an additional functional contrast.
	Former Residence of A Bing surroundings	
	Former Residence of Qin Yujun surroundings	
	Former Residence of Qin Guilin surroundings	
	Former Residence of Qin Bangxian surroundings	
	Former Residence of Zhang Wentian surroundings	
	Former Residence of Qian Songyan surroundings	
	Gu Yuxiu Memorial Hall surroundings	

Note: Candidate public-space units were grouped according to their predominant function before the formal behavioral observations and cross-evidence diagnosis. Within each category, participant-referenced salience was considered together with public accessibility, the clarity of the observation boundary, and the feasibility of establishing a stable pedestrian counting line and fixed observation position. One site was retained from each category to provide maximum variation in predominant public-space function. Selection was not based on the subsequently measured pedestrian-flow values, space syntax rankings, or cross-evidence diagnoses.

References

1. Zhang, H.; Cong, C.; Chakraborty, A. Exploring the Institutional Dilemma and Governance Transformation in China's Urban Regeneration: Based on the Case of Shanghai Old Town. *Cities* **2022**, *131*, 103915. [CrossRef]
2. Zhang, D.; Ma, S.; Fan, J.; Xie, D.; Jiang, H.; Wang, G. Assessing Spatial Equity in Urban Park Accessibility: An Improve Two-Step Catchment Area Method from the Perspective of 15-Mintue City Concept. *Sustain. Cities Soc.* **2023**, *98*, 104824. [CrossRef]
3. Tang, F.; Zeng, P.; Wang, L.; Zhang, L.; Xu, W. Urban Perception Evaluation and Street Refinement Governance Supported by Street View Visual Elements Analysis. *Remote Sens.* **2024**, *16*, 3661. [CrossRef]
4. United Nations. *New Urban Agenda*; Habitat III Secretariat: New York, NY, USA, 2017.
5. United Nations Statistics Division. *Global Indicator Framework for the Sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development*; United Nations: New York, NY, USA, 2023.

6. Dempsey, N.; Burton, M. Defining Place-Keeping: The Long-Term Management of Public Spaces. *Urban For. Urban Green.* **2012**, *11*, 11–20. [CrossRef]
7. Zhu, J. Public Space and Its Publicness in People-Oriented Urban Regeneration: A Case Study of Shanghai. *J. Urban Aff.* **2025**, *47*, 2319–2338. [CrossRef]
8. Zamanifard, H.; Alizadeh, T.; Bosman, C. Towards a Framework of Public Space Governance. *Cities* **2018**, *78*, 155–165. [CrossRef]
9. Pourbahador, P.; Brinkhuijsen, M. Municipal Strategies for Protecting the Sense of Place through Public Space Management in Historic Cities: A Case Study of Amsterdam. *Cities* **2023**, *136*, 104242. [CrossRef]
10. Qian, Z.; Li, H. Urban Morphology and Local Citizens in China's Historic Neighborhoods: A Case Study of the Stele Forest Neighborhood in Xi'an. *Cities* **2017**, *71*, 97–109. [CrossRef]
11. Cai, F.; Zhang, S.; Zhang, T.; Jiang, X.; Zhang, W.; Yang, J. *Practical Models of Organic Urban Renewal*; China Architecture & Building Press: Beijing, China, 2023.
12. Jung, H.; Lee, S.; Kim, H.S.; Lee, J.S. Does Improving the Physical Street Environment Create Satisfactory and Active Streets? Evidence from Seoul's Design Street Project. *Transp. Res. Part Transp. Environ.* **2017**, *50*, 269–279. [CrossRef]
13. Xu, N.; Zhang, X.; Wang, P. Public Vitality-Driven Optimization of Urban Public Space Networks—A Case Study from Nanjing, China. *Smart Cities* **2025**, *8*, 18. [CrossRef]
14. Meerow, S.; Newell, J.P.; Stults, M. Defining Urban Resilience: A Review. *Landsc. Urban Plan.* **2016**, *147*, 38–49. [CrossRef]
15. Jacobs, J. *The Death and Life of Great American Cities*; Vintage: New York, NY, USA, 1992.
16. Attoe, W.; Logan, D. *American Urban Architecture: Catalysts in the Design of Cities*; University of California Press: Berkeley, CA, USA, 1989.
17. Lydon, M.; Garcia, A. *Tactical Urbanism: Short-Term Action for Long-Term Change*; Island Press: Washington, DC, USA, 2015.
18. Zhang, J.; Shen, Y. Model Modeling the Spatiotemporal Vitality of a Historic Urban Area: The CatBoost-SHAP Analysis of Built Environment Effects in Kaifeng. *Buildings* **2025**, *15*, 4499. [CrossRef]
19. Lak, A.; Hakimian, P. Collective Memory and Urban Regeneration in Urban Spaces: Reproducing Memories in Baharestan Square, City of Tehran, Iran. *City Cult. Soc.* **2019**, *18*, 100290. [CrossRef]
20. Kristo, S.; Dhiamandi, J. Urban Catalyst as the Tool for Public Space Transformation. In Proceedings of the 1st International Scientific Conference On Professional Sciences, Durrës, Albania, 25–26 November 2016.
21. Stevens, Q.; Leorke, D.; Dovey, K.; Awepuga, F.; Morley, M. From 'Pop-up' to Permanent: Temporary Urbanism as an Emerging Mode of Strategic Open-Space Planning. *Cities* **2024**, *154*, 105376. [CrossRef]
22. Chen, W.; Liu, Q. A Catalytic Landscape. *J. Archit.* **2016**, *12*, 88–93. [CrossRef]
23. Madanipour, A. Temporary Use of Space: Urban Processes between Flexibility, Opportunity and Precarity. *Urban Stud.* **2018**, *55*, 1093–1110. [CrossRef]
24. Mehta, V. Evaluating Public Space. *J. Urban Des.* **2014**, *19*, 53–88. [CrossRef]
25. Pstross, M.; Talmage, C.A.; Knopf, R.C. A Story about Storytelling: Enhancement of Community Participation through Catalytic Storytelling. In *Rural Wealth Creation as a Sustainable Economic Development Strategy*; Routledge: London, UK, 2016.
26. Ferilli, G.; Sacco, P.L.; Tavano Blessi, G.; Forbici, S. Power to the People: When Culture Works as a Social Catalyst in Urban Regeneration Processes (and When It Does Not). *Eur. Plan. Stud.* **2017**, *25*, 241–258. [CrossRef]
27. Bertolini, L. From "Streets for Traffic" to "Streets for People": Can Street Experiments Transform Urban Mobility? *Transp. Rev.* **2020**, *40*, 734–753. [CrossRef]
28. Gehl, J. *Cities for People*; Island Press: Washington, DC, USA, 2013.
29. Carr, S. *Public Space*; Cambridge University Press: Cambridge, UK, 1992.
30. Wu, J.; Lu, Y.; Gao, H.; Wang, M. Cultivating Historical Heritage Area Vitality Using Urban Morphology Approach Based on Big Data and Machine Learning. *Comput. Environ. Urban Syst.* **2022**, *91*, 101716. [CrossRef]
31. Wu, Z.; Mao, M.; Yang, J.; Peng, C.; Zha, H. Street Vitality Evaluation of the Mengzi East Street Historical District Based on Space Syntax and POI Big Data. *Buildings* **2025**, *15*, 2896. [CrossRef]
32. Huang, J.; Hu, X.; Wang, J.; Lu, A. How Diversity and Accessibility Affect Street Vitality in Historic Districts? *Land* **2023**, *12*, 219. [CrossRef]
33. Ding, J.; Luo, L.; Shen, X.; Xu, Y. Influence of Built Environment and User Experience on the Waterfront Vitality of Historical Urban Areas: A Case Study of the Qinhuai River in Nanjing, China. *Front. Archit. Res.* **2023**, *12*, 821–836. [CrossRef]
34. Garau, C.; Annunziata, A.; Yamu, C. The Multi-Method Tool 'PAST' for Evaluating Cultural Routes in Historical Cities: Evidence from Cagliari, Italy. *Sustainability* **2020**, *12*, 5513. [CrossRef]
35. Dogan, O.; Lee, S. Jane Jacobs's Urban Vitality Focusing on Three-Facet Criteria and Its Confluence with Urban Physical Complexity. *Cities* **2024**, *155*, 105446. [CrossRef]
36. Kruth, J.; Rugare, S. *Urban Histories in Practice: Morphologies and Memory*; Cambridge Scholars Publishing: Newcastle upon Tyne, UK, 2022.

37. Zhang, Q.; Cheng, T.; Xu, P.; Jiang, X. Balancing Heritage Conservation and Urban Vitality through a Multi-Tiered Governance Strategy: A Case Study of Nanjing's Yihe Road Historic District, China. *Land* **2025**, *14*, 1894. [CrossRef]
38. Ginzarly, M.; El Khoury, R.; Srour, F.J. Public Space and Everyday Heritage: An Inquiry into Children's and Adults' Perception. *City Cult. Soc.* **2024**, *38*, 100594. [CrossRef]
39. Yang, L.; Van Dam, K.H.; Majumdar, A.; Anvari, B.; Ochieng, W.Y.; Zhang, L. Integrated Design of Transport Infrastructure and Public Spaces Considering Human Behavior: A Review of State-of-the-Art Methods and Tools. *Front. Archit. Res.* **2019**, *8*, 429–453. [CrossRef]
40. Wuxi Natural Resources and Planning Bureau. *Wuxi Historical and Cultural City Conservation Plan (2025–2035)*; Wuxi Natural Resources and Planning Bureau: Wuxi, China, 2025.
41. Wuxi Municipal People's Government. *Construction of 30 Urban-Renewal Pilot Areas Accelerated Across Wuxi*; Wuxi Municipal People's Government: Wuxi, China, 2025.
42. Kallio, H.; Pietilä, A.-M.; Johnson, M.; Kangasniemi, M. Systematic Methodological Review: Developing a Framework for a Qualitative Semi-Structured Interview Guide. *J. Adv. Nurs.* **2016**, *72*, 2954–2965. [CrossRef] [PubMed]
43. Braun, V.; Clarke, V. Using Thematic Analysis in Psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [CrossRef]
44. Boeije, H. A Purposeful Approach to the Constant Comparative Method in the Analysis of Qualitative Interviews. *Qual. Quant.* **2002**, *36*, 391–409. [CrossRef]
45. Gehl, J.; Svarre, B. *How to Study Public Life*; Island Press: Washington, DC, USA, 2013.
46. Hillier, B.; Hanson, J. *The Social Logic of Space*; Cambridge University Press: Cambridge, UK, 1984.
47. Greene, J.C.; Caracelli, V.J.; Graham, W.F. Toward a Conceptual Framework for Mixed-Method Evaluation Designs. *Educ. Eval. Policy Anal.* **1989**, *11*, 255–274. [CrossRef]
48. Börjeson, L.; Höjer, M.; Dreborg, K.-H.; Ekvall, T.; Finnveden, G. Scenario Types and Techniques: Towards a User's Guide. *Futures* **2006**, *38*, 723–739. [CrossRef]
49. Nelischer, C.; Ramirez, A.F.; Wendel, G. Turn of Events: Community Events as a Practice for Inquiry in Public Space Research. *Plan. Theory Pract.* **2025**, *26*, 483–502. [CrossRef]
50. Diao, J.; Lu, S. The Culture-Oriented Urban Regeneration: Place Narrative in the Case of the Inner City of Haiyan (Zhejiang, China). *Sustainability* **2022**, *14*, 7992. [CrossRef]
51. Xia, C.; Yeh, A.G.-O.; Zhang, A. Analyzing Spatial Relationships between Urban Land Use Intensity and Urban Vitality at Street Block Level: A Case Study of Five Chinese Megacities. *Landsc. Urban Plan.* **2020**, *193*, 103669. [CrossRef]
52. Mu, X.; Mu, L.; Zhang, J. The Impact of Street Elements on Pedestrian Stopping Behavior in Commercial Pedestrian Streets from the Perspective of Commercial Vitality. *Sustainability* **2024**, *16*, 7727. [CrossRef]
53. Zhou, W.; Zhang, J.; Li, X.; Guo, F.; Zhu, P. Influence of Environmental Factors on Pedestrian Summer Vitality in Urban Pedestrian Streets in Cold Regions Guided by Thermal Comfort: A Case Study of Sanlitun—Beijing, China. *Sustainability* **2024**, *16*, 10419. [CrossRef]
54. Dempsey, N.; Bramley, G.; Power, S.; Brown, C. The Social Dimension of Sustainable Development: Defining Urban Social Sustainability. *Sustain. Dev.* **2011**, *19*, 289–300. [CrossRef]
55. Gotham, K.F. Tourism Gentrification: The Case of New Orleans' Vieux Carre (French Quarter). *Urban Stud.* **2005**, *42*, 1099–1121. [CrossRef]
56. Said, M.; Tempels, B. Challenges in Managing Public Space: Insights from Public Space Management Practice. *J. Environ. Plan. Manag.* **2025**, *68*, 519–538. [CrossRef]
57. Folke, C.; Hahn, T.; Olsson, P.; Norberg, J. Adaptive Governance of Social-Ecological Systems. *Annu. Rev. Environ. Resour.* **2005**, *30*, 441–473. [CrossRef]
58. Rodríguez-Antuñano, I.; Sousa, J.J.; Bakoň, M.; Ruiz-Armenteros, A.M.; Martínez-Sánchez, J.; Riveiro, B. Empowering Intermediate Cities: Cost-Effective Heritage Preservation through Satellite Remote Sensing and Deep Learning. *Int. J. Remote Sens.* **2024**, *45*, 4046–4074. [CrossRef]
59. National Health Commission of the People's Republic of China; Ministry of Education of the People's Republic of China; Ministry of Science and Technology of the People's Republic of China; National Administration of Traditional Chinese Medicine. *Measures for Ethical Review of Life Science and Medical Research Involving Human Participants*; National Health Commission of the People's Republic of China: Beijing, China, 2023.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.