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A Micro-Scale Spatial Study of Pedestrian Experience in Historical Districts from a Multi-Sensory Perspective: A Case Study of Pingjiang Road, Suzhou

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Abstract. This paper explores the experience of pedestrians in historical areas through a multi-sensory and multi-scale analytical system, and a specific case study of Pingjiang Road in Suzhou, China, is conducted. Field research (sensory mapping, n=50 interviews) indicates that the quality of the environment is deteriorating: 63% of the signs have high-saturation colours, noise levels (70-85 dB(A)) exceed the WHO standard by 30%, and 72% of the respondents have experienced odour discomfort. Root causes include a macro-to-micro transmission failure (riparian greenery: 42% $\rightarrow$ 18%), institutional fragmentation (seven agencies), and commercial sensory overload. Layers of reinforcement address the four aspects of sight, sound, touch and smell, thereby creating a multi-sensory system in harmony with history. It has promoted the development of theory on walkability and place-making in historical urban areas, as well as offered some empirical support for guiding the development and construction of the cultural-tourism streetscape.

Keywords: Historical districts, pedestrian experience, multi-sensory perception, micro-scale space, Pingjiang Road, spatial quality

1. Literature review

1.1. Evolution of historical district conservation

International conservation systems have moved from building-focused protection to integrated "living heritage" models. This new model of "static preservation to dynamic renovation" has provided a theoretical basis for investigating pedestrian experiences in the context of healthy heritage [1].

Since the beginning of the 21st century, research in the West has moved from static protection to dynamic renovation and sustainable development. Currently, the general consensus is to introduce new functions while maintaining the historical environment, enhancing the district's economic vitality and sustainability through functional replacement and business mix adjustment; it is firmly opposed to large-scale demolition and construction, and small-scale, refined, and incremental renovation and transformation that respects the original urban fabric are promoted instead. These

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policies are to show that they are aware of the laws on the protection and development of historical areas.

In 1986, China's State Council put forward the idea of "Historic and Cultural Conservation Areas" and moved from point-based protection to area-based protection. Ruan Yisan's [2] first studied three key features: the material carrier (traditional fabric), living culture (resident customs and intangible cultural heritage), and a human-scale spatial scope (30-minute walkable core, around 1-2 km^2). Although the new policies encourage organic renewal rather than large-scale redevelopment, difficulties in their implementation persist, such as how to combine conservation with commercial vitality, how to deal with "destructive protection", over-tourism and gentrification [3].

In recent years, China's laws, regulations and standards for the protection of historical districts have been gradually strengthened and expanded, and research at home has begun to approach the advanced level internationally. The research focus has moved from the first phase of rescue conservation to the renewal problems of historical districts, and the model of large-scale "demolish-renovate-preserve" is being replaced by an organic renewal model that is "small-scale, incremental, and micro-cyclic". Academia has begun to investigate the problems of "destructive conservation", "over-tourism development" and "gentrification" in greater depth and explore more scientific and reasonable conservation and renewal paths. Recently, some local research on Pingjiang Road has also proposed regeneration strategies based on the sense of place [4].

1.2. Applied research related to historical districts

1.2.1. Combined research on pedestrian systems and historical districts

Chinese scholars have set technical standards for historical district pedestrian systems: continuity (path interruptions <100m), cultural identification (interpretation facilities every 200m), and comfort (effective width ≥ 2.5m) [5-7]. Wang Jianguo [8] put forward a "micro-renewal" framework to enhance pedestrian-priority node connection, and Zhang Song [3] proposed "graded pedestrianisation" strategies with quantitative suitability indicators (width, slope, interface continuity). Urban Design: Propose a "micro-renewal" model for historical areas and focus on node connection and pedestrianisation. He put forward three basic ideas for the design of pedestrian paths in historical areas: the pedestrian path should be in line with historical axes to maintain the traditional spatial sequence; ground paving should use traditional materials to reflect local characteristics; and motor vehicle entry into the core conservation area should be strictly prohibited.

Professor Zhang Song, in Introduction to the Conservation of Historic Cities, proposed a "graded pedestrianisation" plan: full pedestrianisation management in core conservation areas and pedestrian-vehicle separation mode in buffer zones. He also introduced the "Pedestrian Suitability Evaluation Index System for Historical Districts", and listed various quantitative indices such as road width, ground slope, and interface continuity to offer a scientific means for evaluating the quality of pedestrian areas in historical districts.

In addition, research has also examined how the small-scale built environment directly affects tourists' walking and stopping behaviour [9], thus adding to the body of knowledge on pedestrian experience in historic areas.

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1.2.2. Research on historical districts from a transportation system perspective

Most recent transport research in historical districts focuses on large-scale system planning rather than pedestrian-focused or slow-traffic studies [10, 11], and there are still significant deficiencies in micro-level, sensory-oriented assessments.

1.3. Research gaps and conceptual framework

1.3.1. The researcher's definition of historical districts

A historical core in an urban area with a walking distance of 30 minutes (about 1-2 km^2), a high density of old buildings, unique regional characteristics, preserved traditional street patterns, and continuous new life.

The four main features of a historical district in this sense are: a human-scaled spatial scale; the clustered arrangement of architectural heritage; regional characteristics in culture; and the completeness of the traditional pattern.

1.3.2. Deficiencies in the aforementioned research

Three current research problems are as follows:

(1) Theory-Practice Disconnect: While international frameworks are well-established, their integration with Chinese contexts remains superficial, lacking deep examination of local district uniqueness.

(2) Macro-Micro Scale Gap: Existing studies focus on either macro policy or micro design, but lack systematic linkage revealing how macro elements transmit to experiential outcomes.

(3) Sensory Evaluation Deficit: Pedestrian research emphasizes physical metrics (width, continuity) over user-centered, multi-sensory experience quality.

Therefore, research on micro-scale spatial quality evaluation based on pedestrian experience has had good theoretical and practical results.

2. Introduction

2.1. Background

Historical districts are the physical manifestations of a city's cultural heritage that have spatial characteristics and, thus, affect the sense of identity among residents and the experience of visitors. Pedestrian Areas face the problem of excessive commercialisation that damages the spatial scale and traditional character, and tourism-oriented areas limit multi-sensory exploration by reducing walking to consumption corridors.

Shop Density increased by 62%, and tourist satisfaction dropped by 31%. When Space is reduced to a conduit for consumption, it is no longer an experience but merely movement.

2.2. Research object

This study takes the core section of Pingjiang Road (Baita East Road to Ganjiang Road, about 1,090m) in Suzhou's "parallel water-land" pattern with varying degrees of commercialisation as the research object. Select representative micro-units as typical section samples for detailed study.

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2.3. Research methods

Methodology: Qualitative case study based on a multi-scalar (macro-meso-micro) framework. Data sources: Literature review (macro/meso level), field observation and sensory mapping (8 weeks, March-May 2024), semi-structured interviews (n=50: 32 tourists, 18 residents), soundscape measurement (B&K 2250), olfactory surveys (22 points). Theme Analysis for Scale Interactions in Pedestrian Experience. Future research will use the new algorithm assessment method of visual comfort evaluation based on semantic segmentation [12] to increase the objectivity of the data.

3. Multi-scale analysis

Pingjiang Road will be studied at the three levels of macro (natural conditions), meso (policy system) and micro (sensory experience).

3.1. Macro level: natural foundation and current situation

Pingjiang Road has a sub-tropical monsoon climate and is relatively flat; it is suitable for walking. Commercialisation has systematically broken down the above advantages.

Climate-Hydrology Degradation: Commercial expansion reduced the proportion of riparian green cover from 42% (2010) to 18% (2023) [13] and weakened evaporative cooling. Summer ground temperature in the unshaded area exceeded 45 °C (July 2024, 14:00-16:00). Waterfront space is now 67% commercial development, and open viewing areas have fallen from 17 (2015) to just 5 (2024). Research by local scholars has shown that disorderly commercial development has led to an adverse change in the spatial structure of historical areas [14].

Transmission Gap: Natural advantages fail to provide micro-level comfort due to commercial encroachment.

3.2. Meso level: the transmission path of policy mechanisms and spatial management

The Suzhou National Historical and Cultural City Protection Regulations (2017) require the preservation of authenticity and have set building form constraints (height $\le$12m and traditional materials, as specified in Article 13). The application is blocked by institutional constraints.

Policy Conflict: Strict Preservation Requirements vs. Commercial Needs. Shop sign regulations limit size and material, but merchants use loopholes (high-saturation colours, LED strips). Modern facilities (exhaust pipes, AC units) lack concealment guidelines and are thus "visual scars".

Governance Fragmentation: Management involves 7+ departments with overlapping mandates. 2023 complaint data (n=282): 37% unresolved due to buck-passing; average resolution time: 18 days.

Transmission Attenuation: Policies suffer from signal decay during implementation and appear fragmented.

3.3. Micro Level: Analysis of Pedestrian Sensory Experience Based on Field Research

Field research shows that pedestrian experience is a combination of various senses and has a high spatial contradiction.

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3.3.1. Visual experience

Visual Experience has high sequence and contradiction. The specific structure of Pingjiang Road is an all-continuous "parallel water and land" design that creates a variable-corridor view at each step. A light-coloured colour system of white walls, black tiles and chestnut-brown doors and windows is used, along with a meandering river and old stone bridges, to create a sense of history in the area. Research has also shown that due to the enthusiasm of commercial work, many new visual elements have been introduced, such as bright-coloured shop signs, flashing LED displays, and a dense network of overhead wires and outdoor air-conditioning units. These components create a strong local visual disruption and do not align with the traditional character images of the main area. Research on the building facades of Suzhou's traditional commercial areas has shown that a harmonious visual experience can be achieved to preserve historical character [15].

3.3.2. Auditory experience

Auditory experience is another kind of life in the district, and it can be divided into three levels: first, the natural soundscape includes the sound of flowing water, rowing oars, wind and birdsong, etc., which gives people a sense of peace; second, the faint sounds of Suzhou Pingtan (storytelling and song) that drift from teahouses and residences constitute a cultural symbolic soundscape to enhance the cultural identity and sense of place for tourists; third, the main commercial and social soundscape consists of tourist chatter, vendors shouting their wares, and modern pop music. All three layers of the soundscape are interconnected and overlap at many points on the street. This multi-level analysis meets the requirements set by the theory of soundscape studies [16]. Especially in the commercially developed areas of the main street, the sound of commerce and society has become too prominent; the sounds of nature and culture are barely audible, so the mood of people visiting this part of the city has changed from tranquil and remote to noisy and busy.

3.3.3. Tactile & olfactory

Tactile and olfactory sensations are generally weaker and less direct. The slight unevenness and texture of the blue-stone pavement underfoot give the soles of people's feet a certain "historical tactile sense", and unconsciously lead to a slower pace for pedestrians. Scents in different areas of the city are all different: there is the smell of water and mud near the river; the sweet aroma of freshly baked bread drifts from a pastry shop; and the subtle, clear scent of tea shops spreads through the air. Specialised research on the "taste" of historical areas has also indicated that the sense of smell is one of the primary factors influencing the sense of place and the walking experience [17].

3.3.4. Integrated summary

Sensory experience is spatially heterogeneous, and at some nodes (bridges), the sensory components briefly align to form a peak experience. However, in the city centre, there are many people and things, so they are noisy and crowded with too many smells. Walking degrades from immersive "place experience" to utilitarian "spatial transit".

3.4. Root cause analysis

Pingjiang Road's deterioration is the result of systemic failures at all three levels:

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Macro-Micro Transmission Gap: Natural Advantages Fail to Support Micro-Experiences. Greenery loss (42% $\rightarrow$ 18%) weakens microclimate regulation; waterfront occupation (67%) removes hydrophilic interaction; and flat topography lacks designed sequences and thus appears monotonous.

Meso-Institutional Blockage: Policy Intentions Attenuate in Practice. Conservation-Development Conflicts Create Dilemmas. Fragmented Multi-departmental Cooperation (7+ agencies) Results in Inefficiency (37% of unresolved cases).

Micro-Sensory Overload: Commercial dominance (63% discordant signage, noise +30% above WHO standards [18], 72% olfactory discomfort) overwhelms natural/cultural elements and reduces the experience of walking from immersion to mere transit.

Synergistic Interaction: Macro advantages cannot be conveyed; meso mechanisms cannot be regulated; micro experiences cannot be realized – thus, "chaos within order".

4. Design of layered enhancement strategies

Based on the above problem analysis, three layers of strategies will be used: large-scale nature restoration, mid-level governance integration, and small-scale sensory design.

4.1. Macro-level strategies

The large-scale plan is to improve the natural foundation and planning system systematically, enable the full development of macro-level advantages in micro-scale areas, and prevent damage due to commercial construction. Singapore's Bishan-Ang Mo Kio Park is a typical case of climate regulation. A network of native-plant forests along the river has reduced the summer high-temperature island in that area by about 2-3 ° C due to shade and evapotranspiration. In addition, various architectural elements can be added to improve the summer walking environment and solve the problem of winter wind obstruction by arranging buildings differently, as shown in Freiburg's Vauban district in Germany with building overhangs and retractable shading devices. Yongning Park in Taizhou, Zhejiang, is a representative case of a hydrological restoration project with ecological transformation. Reduce the height of the hard revetment, add gentle slopes on either side of the river, and set up stepping-stones to restore the river's ecological environment. Build an intelligent flood-season warning system to ensure the safety and accessibility of the waterfront area through the above measures. In terms of terrain use, a small-scale modification of micro-topography has been made in the Suzhou Creek waterfront area of Shanghai to create undulating viewing platforms and sunken gardens, thereby breaking the monotony of a flat-terrain linear experience and adding spatial sequences and viewing hierarchies.

4.2. Meso-level strategies

Governance problems of historical districts are widespread across the country. Singapore's historical district management uses a "single lead agency, multi-party collaboration" model, and the Urban Redevelopment Authority (URA) is responsible for cultural relic protection, urban planning and tourism in cooperation with other parties; this is worthy of study. Pingjiang Road should establish a strong Pingjiang Road Management Committee instead of a loose coordination platform. Based on the model of the Lijiang Ancient Town Administration, the Management Committee should have independent administrative law enforcement powers and the scope of this authority should cover cultural relic protection, planning implementation, and market supervision. It should have a separate

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fund for this purpose, accounting for no less than 15 per cent of the total tourism income annually, and a professional management team that includes planners, cultural heritage specialists, community workers, etc. To promote the development of nature reserves in tandem with conservation, reform the system of regulations on nature reserves. The experience of protecting the historical area in Hangzhou shows that one can maintain the original character and culture of a place while making some changes for modern life, as long as the core historical essence is not harmed. Specifically, concrete construction rules for shop signs, facades and facilities to be built with traditional materials and elegant colour schemes should be elaborated upon, and within the scope of these rules, creative selections should be encouraged that avoid visual clashes. At the same time, we should also strengthen the "Three-Society Linkage" mechanism to encourage communities, merchants and residents to take part in decision-making; for example, hold regular council meetings to discuss how to adjust the layout of commercial areas and public space use in light of policies and meet the varied needs of the people. The Law Enforcement and Supervision Department will build an online patrol system in the pedestrian area to monitor illegal occupation and noise pollution in real time, and at the same time use a digital platform to assess the effectiveness of the policy. The purpose of the above measures is to improve policy dissemination and governance efficiency at the micro level through institutional support.

4.3. Micro-level strategies

Micro-level strategies directly address the pain points in the pedestrians' sense of environment to make basic improvements in the walking environment through fine design and management measures. Based on the idea of "multi-sensory synergy", the above measures will integrate spatial arrangement and behaviour guidance to create an orderly and immersive place experience.

The second is that Pingjiang Road is visually noisy. Draw inspiration from the character management in Kyoto's Gion district to build a rigorous yet flexible visual management system. First, to standardise the commercial section, develop and strictly enforce design norms for shop signs that require the use of elegant colours such as black, white and grey, and natural materials. High-saturation colours and flashing LEDs are not allowed. Carry out phased renovations of the old discordant signs and offer tax incentives for merchants who adopt traditional styles. Skyline and Facade Enhancement: Utility Line Burial Projects will be carried out in stages. Pingjiang Road in the Suzhou Ancient City Protection Plan (2018-2035) will be selected as one of the first areas for utility line renovation, and work will be expedited. At the same time, employ a uniform concealment design for the outdoor air conditioning unit or use plants for visual screening. To prevent the commercial area from encroaching on the pedestrian way, merchandise stalls should be set back from it, and "street furniture" can be used to form a cultural atmosphere. At the nodes of construction, a small courtyard, a green belt, or a water-feature sculpture can be added to create a visual buffer zone that separates the noise from the commercial area and restores the visual rhythm of "parallel water and land". Thus, these measures can reduce visual clutter and guide pedestrian sightlines with thoughtful, sequenced design to enhance their sense of historical immersion.

To achieve the goal of reconstruction in auditory experience, one must balance all types of sounds in nature, culture and society. First, divide Pingjiang Road into functional areas for soundscapes, set up high-quiet-level zones, cultural experience areas and active-commercial areas, and apply differentiated management strategies. Quiet Zones in the Core Area will limit commercial noise and implement technology to improve the natural sound environment. Regularly organise traditional performances of Suzhou Pingtan and Kunqu opera in the cultural experience zone and set up soundscape guidance signs to help pedestrians find the cultural sound source. Reduce the volume

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and content of the background music in the commercial active area, and replace the current pop music with soft folk music. At the same time, set up soundscape monitoring sensors to collect noise data in real time and address problems of excessive noise promptly through a management platform. Design "soundscape walks" that take visitors from loud to quiet areas, have them feel the changes in the soundscape, and add more rhythm and cultural identity to the tour.

Pavement materials are relatively coarse and rough. Rodaway [19] argues that in Sensuous Geographies, various materials have caused different feelings and emotional reactions in people's bodies. To optimise the pavement design, the historical tactile qualities of blue stone pavement should be maintained, and leveling treatment needs to be carried out to reduce unevenness and improve safety. Use anti-slip materials in high-traffic areas for people and install tactile paving lines to guide them. Laomendong District in Nanjing employed the strategy of "traditional materials and modern technology in renovation" to enhance living conditions while preserving historical atmosphere. Rest areas for people will have wooden benches, stone stools or other stepped seats placed regularly along the river and in the alleys for rest. Use natural materials and traditional crafts in the construction of these facilities to create a more tactile environment. According to the research, a space of one rest area per 100 metres is suitable. Add more interactive tactile elements to the environment; for instance, install touchable relief walls, water feature touch pools, or areas with samples of traditional materials for people to feel history through touch. Reduce the number of people to prevent a large crowd, and therefore it is more convenient to sense the changes in texture.

Henshaw's [20] research shows that smell is the sense with the strongest memory-evoking power; thus, a new "smell signature" for the historical area can be created. To control the sources of pollution, supervise catering enterprises more strictly, require the installation of high-efficiency fume purification equipment, and prohibit open-air barbecuing or frying operations. Periodically cover and organise the area around the trash can to prevent a smell. Increase the emission rate of natural fragrance by strengthening the cultivation of greening and planting some fragrant flowers, such as osmanthus and gardenia, in the walkway area. Improve the cleanliness of the river to promote the emission of water vapour and set up ventilation corridors in the waterfront area for airflow guidance. At the nodes, diffusion technology for natural plant essential oils can be used to release light tea- or floral scents and form a pleasant olfactory sequence. Narrow alleys have been selected for this purpose, and either an enlarged ventilation opening will be set up, or the buildings will be arranged to form a "wind channel" to reduce odour accumulation and sensory distress. Microclimate simulation research shows that a well with good ventilation can reduce the time for an odour in the well to dissipate by 40-50%. Design "olfactory map" pathways to reduce the strength of the odour at certain nodes and avoid over-diffusion of overly sweet artificial fragrances. Natural diffusion can be used to spread the light fragrance of tea and flowers gradually, and then one can enjoy the gentle scent. Narrow alleys should be used for ventilation to increase the size of the openings and arrange the buildings in a way that forms an effective wind channel; otherwise, there will be an accumulation of odour and sensory aversion.

At the nodes, "sensory gardens" should be established to integrate sight, sound, touch and smell, and offer readers rich sensory experiences. For example, at the waterfront platform, integrate water features (visual and auditory), aromatic plants (olfactory), and wooden seating (tactile) to create a multi-sensory, combined resting area. At the same time, manage the flow of pedestrians efficiently to reduce sensory overstimulation by directing some visitors to secondary passages during busy periods. The above measures hope to turn walking from "movement" into a rich "experience" for the public and improve their sense of identity and enjoyment.

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5. Conclusion and discussion

5.1. Core findings

Through a multi-scale systematic analysis of the pedestrian experience in Suzhou's Pingjiang Road historical area, this study identifies the fundamental structure and formation mechanism of the spatial quality problems there. Pingjiang Road should have a good natural foundation at a large scale to support a high-quality pedestrian area. However, this potential has not been fully realised in practice and has not offered people a good micro-experience. Encroachment in the waterfront area has reduced the regulation of the microclimate, and a lack of connection with water has also failed to meet the original purposes. At the mesoscale, although policy mechanisms have achieved some results in the preservation of character and traffic regulation, significant institutional obstacles have arisen due to conflicting goals of "conservation and development", unclear responsibilities, and fragmented governance resulting from multi-headed management. Therefore, the policy objectives have been reduced or altered in practice and thus have created a situation of "disorderly order" at the micro level. At the micro level, the core of a person's experience is formed by the combination and conflict of various sources of sensory information. Research has shown that Pingjiang Road is severely lacking in a sense of sight, sound, and smell. These problems cause sensory overload for pedestrians and a decline in walking behaviour; as a result, they have lost their "immersive experience" and now serve only a "functional purpose". In short, the problems in the pedestrian experience of Pingjiang Road are not due to a single reason but rather the combined effect of transmission failures across macro-, meso-, and micro-scale elements, institutional bottlenecks, and multiple sensory pain points.

5.2. Theoretical contribution

(1) Multi-Scale Integration Framework: Unlike previous single-scale research, this framework systematically links macro context, meso governance, and micro experience, revealing transmission mechanisms [21].

(2) Sensory-Behavioral Framework: Integrating environmental psychology [22, 23], sensory anthropology [24], and urban design [21], the triangle deepens understanding of "sense of place" and "walkability," emphasizing experiential subjectivity over purely physical metrics.

(3) Practical Model: Evidence-based strategies offer a replicable model for commercialized heritage districts, assisting sustainable renewal.

This responds to Carmona's [25] "urban design beyond form" and UN-Habitat's [26] "people-centred renewal".

5.3. Practical limitations

Although this study has presented some innovations in the theoretical system and research methods, there are still some deficiencies due to time and resource limitations, as well as shortcomings in the researchers' abilities. First, although the research scope included Pingjiang Road's main street and some secondary alleys, the "typical section sampling" strategy did not cover all spatial types and temporal variations, thus reducing the all-encompassing nature of the conclusions. Specifically, the study focused on the main street of Pingjiang Road and three secondary alleys as the key research sites, gave little attention to the residential alleys and seasonal variations, and the data collection was limited to spring and summer. Therefore, the residents' actual life experiences and the pedestrian

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environment in winter may not be fully known. Secondly, there are some research deficiencies. Although rich qualitative data have been collected through 50-person-and-eight-week-field-research interviews, the overall sample size is still relatively small; therefore, it may not be representative of the experience differences among all groups of users. In terms of measuring the five senses, soundscape and odour field observations were carried out at various places at different times of the day. Although the above measurements have identified the most serious problems, they have not fully revealed the changes in these issues at different times of the day and year. There are now some deficiencies in the collected environmental data. In addition, the micro-space optimisation strategies based on the five-sense analysis are mainly derived from theoretical deduction and case interview induction, and have not yet been subjected to post-implementation evaluation. Their actual feasibility, cost-effectiveness and adaptability in the complex property rights and business environment of Pingjiang Road will need to be verified in the future urban renewal project. Strategies for infrastructure renovation and adjustments to management mechanisms generally require cross-departmental cooperation and continuous maintenance, so they are difficult to implement. Due to research permission and other resource constraints, most of the analysis of meso-level institutional factors affecting the sensory environment of Pingjiang Road has been limited to public policy documents, on-site observations, and indirect accounts from some residents and merchants. There were no organised interviews with the main policy implementers, such as planners and staff from the Department of Culture, Tourism and Urban Management Office. As a result, the understanding of potential "blockages" or "failures" in policy implementation is largely based on literature inference and outcome deduction, thus lacking in depth. Finally, there are also some deficiencies in this study: first, the sample of interviewees was relatively homogenous, and little attention was paid to the walking experiences of long-term residents; second, due to the lack of horizontal comparisons with other types of historical districts, the generalizability of the results is limited; and third, the relationship among economic factors and spatial quality has not been sufficiently investigated and will need to be addressed in future research. Reason: Modify the structure of sentences, enrich the vocabulary, correct grammatical and punctuation mistakes, and improve the clarity and logic of the text. Methodological Deficiencies and the Scope of Research have been Clarified. Revise also to maintain the consistency of terms and use a more formal style suitable for academic writing.

5.4. Future directions

Based on the results and deficiencies of this study, future research can be extended in the following ways: First, from the perspective of research methods, sensor technology and behaviour tracking can be combined to conduct quantitative and dynamic studies of pedestrian sensory perception and movement behaviour, thus increasing data objectivity and spatiotemporal coverage. GPS trajectory tracking can be used to collect records of pedestrian movement patterns; at the same time, a network of environmental sensors will continuously monitor conditions in Area 24 hours a day (such as temperature, humidity, noise, air quality, etc.), and by combining eye-tracking with physiological indices (heart rate, galvanic skin response, etc.), real-time changes in people's bodies can also be obtained. Second, regarding the research scope, it is proposed that historical districts in different climatic zones (e.g., Pingyao Ancient City in the north and Lijiang Ancient City in the southwest) be selected for comparison, and various functional types (e.g., purely residential, purely commercial, mixed-use) and different management models (e.g., government-led, community self-governance, enterprise-operated) should also be included in the study. The above will help to identify the common features and shortcomings of pedestrian experiences at different times and places, and

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promote the development of all-weather-suitable renovation plans. Thirdly, we need to examine how to apply digital government-building tools in the system of governance. Build a "sensory database" and a cooperative management platform to provide prompt information on the progress of policy implementation and address space issues promptly. A "Historical District Experience Database" can be built to store various types of sensory data, and at the same time, a visual collaborative management platform can be developed to enable managers, merchants and residents to view real-time spatial quality indicators and report problems or participate in decision-making via this platform. Fourth, at the practical level, promote integrated "strategy-design-evaluation" pilot projects. Select representative sections of Pingjiang Road for the on-site experiment with micro-strategies, and then evaluate the results through pre- and post-implementation comparison to establish a replicable and optimized renewal path. Based on the above directions of exploration, it is hoped that the synergy between theory and practice can further enhance the pedestrian environment of historical districts from "spatial organisation" to "sensory governance" and achieve the joint development of cultural heritage and a high-quality urban life for all. Reason: The text has been amended to improve its clarity and logic; therefore, some words have been adjusted and minor errors in grammar and punctuation have been corrected. Clarify the meaning of technical terms to enhance accuracy, and rearrange the whole section to present research directions and their significance more reasonably.

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