RESEARCH ARTICLE

A Comparative Study of Beijing Hutong Micro Garden: Assessing Resident Preferences

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Abstract

With Beijing's urbanization shifting toward stock renewal, the Micro Gardens in Hutong communities face prominent challenges, including declining landscape features and deteriorating functional quality. To address these issues, this study developed a user centered update framework for these Micro Gardens. Using mixed methods that combine quantitative surveys with qualitative observations, the spatial characteristics and residents' needs of three typical Micro Gardens located in Zhuanta Hutong, Shijia Hutong, and Baita Hutong were analyzed. The results indicated that: (1) residents exhibited distinct functional zoning behaviors in Micro Gardens, with accessibility significantly impacting these patterns; (2) residents' facility demands followed a hierarchical development process, evolving from basic needs to comfort needs, and ultimately to social interaction needs; (3) landscapes combining local plants with cultural elements proved most effective in cultivating local identity. Comparative analysis revealed that Zhuanta Hutong received the highest evaluation due to its superior green layout and accessibility, while Baita Hutong demonstrated the most urgent renovation needs. The study's primary contribution lies in developing a novel "functional facility landscape" design framework based on resident behavior. This framework provides practical and scientific foundation for micro-renewal of historical districts. Additionally, we propose a "cultural empowerment, gradual renewal" model to guide policy formulation and design practices, supporting sustainable protection of urban historic spaces.

Keywords: *Beijing Hutong; Micro Garden; residents' preferences; Service facilities; Landscape types; Micro renewal*

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Introduction

The Beijing Hutong neighborhood represents a traditional form of Chinese residential architecture, featuring numerous well-known quadrangle courtyards and historical sites. With the progression of urban development, the courtyards in traditional Siheyuan and the open spaces around newly built houses have gradually evolved into Hutongs known as Micro Garden. Micro Garden is a unique form of green landscape in Beijing's Hutong neighborhoods, characterized by small, aesthetically pleasing green spaces. These miniature gardens are created by Hutong residents who utilize idle, discarded, or recycled materials and items from their daily lives to cultivate vegetation, which can be viewed or accessed through windows, doors, courtyards, or idle and scattered spaces (Cao, 2020). China has adopted the policy of "urban renewal and sustainable development" to protect

historic neighborhoods. The government requires that old cities can no longer be demolished but should instead be preserved through relocation and restorative construction. It also strengthens urban design and style control, while promoting the development of high-quality and humanized public spaces (Hou, 2019).

As a carrier of daily life, the Hutong Micro Garden is closely tied to residents' practical interests through the renewal and refined management of small and micro spaces. It is also a key focus of current neighborhood renewal practices in Beijing.

As urbanization continues to advance, Beijing's Hutong neighborhoods have entered an era of stock renewal. Numerous Hutong Micro Garden spaces that have lost their original landscape features require improvement (Yu et al., 2021). Simultaneously, Hutong residents express dissatisfaction with the current state of Micro Garden, citing issues such as insufficient service facilities, lack of resident activity spaces, and monotonous landscape vegetation.

The purpose of this study is to conduct empirical investigations to comprehensively analyze the spatial demand characteristics of "Micro Garden" among residents in Beijing's Hutongs. This research addresses the following questions:

RQ1: What are the residents' behavioral preferences and evaluation criteria regarding Micro Garden functional zoning, road network accessibility, and participation experience in daily use?

RQ2: How to identify residents' functional needs and configuration preferences for leisure facilities, and reveal the correlation mechanism between facility usage requirements and spatial features?

RQ3:What are the differences in residents' perceptions of green configuration and cultural landscapes, and establish a quantitative relationship between aesthetic evaluation and frequency of use?

Based on the research questions, this study embarks on the following research objectives:

RO1:To analyze residents' behavioral preferences and evaluation criteria for Micro Garden functional zoning, road network accessibility, and participation experience in daily use.

RO2:To identify residents' functional needs and configuration preferences for leisure facilities and reveal the correlation mechanism between facility usage requirements and spatial features.

RO3:To explore the differences in residents' perceptions of green configuration and cultural landscapes and establish a quantitative relationship between aesthetic evaluation and frequency of use.

Literature review

The historical evolution of Hutong Micro Garden

As one of the eight ancient capitals, Beijing possesses profound historical and cultural heritage. Its interlocking Hutongs represent the most intuitive reflection of traditional life (Hu, 2018). Since their emergence in the Yuan Dynasty, Beijing's Hutongs have been characterized by residential squares and chessboard-like streets. Siheyuan courtyards were uniformly arranged within them, forming the basic spatial pattern (Naz et al., 2024). The Ming Dynasty witnessed an increase in courtyard houses with population growth. This development broke area limitations and promoted the further evolution of Hutong layouts. By the Qing Dynasty, the city's "convex" shape with its north-south axis was firmly established. Private garden construction within these courtyards reached its peak during this period .

The modern city inherited this basic pattern, though the traditional Hutong texture has been somewhat damaged by modern construction (Wartmann & Purves, 2018). With rapid urban population increase, traditional courtyard spaces could no longer meet residential demands. To maximize housing area, extensive additions were built within Hutongs and courtyards. This transformation converted single-family quadrangles into large courtyards shared by dozens of households. Such changes significantly destroyed the original integrated green landscape space. However, this diverse and shared living model also generated numerous scattered, spontaneous green spaces throughout courtyards and public alleyways. These spaces formed a unique landscape pattern in Beijing's old city (Liu, Liang, & Chen, 2019). Consequently, with growing demand for quality of life during urban renewal, attention has shifted toward improving the deteriorating living environment, protecting historical neighborhoods, and exploring the development of green landscape environments in these Hutongs.

The Types of Beijing Hutong Micro Garden

Research examining Micro Garden types and elements, resident activities and behavioral influences demonstrates a clear preference for spaces featuring comprehensive service facilities and diverse vegetation (Table 1). The existing landscape distribution encompasses three primary types: (1) climbing plants on trellises, (2) combinations of functional facilities and plants, and (3) decorative flowerpots and pools.

The trellis climbing vine type represents the most extensively utilized approach. This method employs structural supports for vines, including roses, wisteria, and grapes. This extends planting into vertical and overhead spaces, providing shade, cooling, and beautifying unsightly walls (Dou, 2010). This type creates a humanized scale and a warm, relaxing spatial perception. The integrated function type overlays essential daily requirements onto green spaces. These necessities encompass fitness, storage, drying, and social chatting, which integrate seamlessly with the green space's ornamental and ecological features (Song, Gao, & Ma, 2024). This multifunctional approach significantly enhances space utilization, promotes spontaneous social activity. Moreover, it reflects the unique cultural atmosphere of Beijing's Hutongs. Finally, the flowerpot and pool type utilizes pots and building materials to create green landscapes in stacked or linear forms. This flexible, movable, and easily maintained type frequently appears in narrow, fragmented spaces along channel sides or alleys. These installations maximize limited spatial resources through systematic arrangement and visual continuity (Hou & Shu, 2020).

Table 1: Types of Beijing Hutong Micro Garden

	Type of Beijing Hutong Micro Garden			
Flower rack climbing vine type				
Functional facilities as the main type				
Combination landscape type of flower pool and flower pot				

(Source: According to Hou,2020)

Methodology

This study employed a combination of mixed methods, integrating quantitative questionnaire research with qualitative research based on regional observations. Three Hutong community Micro Garden in Beijing were selected as research sites: Baita Hutong Community, Shijia Hutong, and Zhuanta Hutong (Table 2). Quantitative methods and field observations were utilized to conduct comparative evaluations of facility functions, resident participation, regional culture, and spatial experience across these three Hutong Micro Gardens. Data collection involved photo analysis and on-site investigation (Figure 1). The research methods included case studies, map analysis, and comparative studies. A questionnaire survey was administered to 60 residents aged 25-65 living near each community Micro Garden, yielding a total sample of 180 residents across the three Gardens . The study assessed accessibility, service facility maintenance, safety, inclusiveness, community participation, aesthetic appeal, and spatial diversity of the Micro Garden to understand residents' preferences, opinions, and behaviors regarding Hutong "Micro Garden."

The selection of Zhuanta Hutong, Shijia Hutong, and Baita Hutong as research objects for this "Micro Garden" study was based on three primary considerations:

Firstly, typicality and comparability: Zhuanta Hutong (high-score sample), Shijia Hutong (medium-balanced sample), and Baita Hutong (low-score problem sample) represent the developmental stages of "perfect, traditional, and requiring optimization" Micro Garden, respectively. This selection creates a comprehensive research framework spanning from successful practice analysis to problem-solving exploration. Secondly, spatial and cultural diversity representations: these "Micro

Gardens" in Hutongs are distributed across different historical districts of Beijing, encompassing diverse community ecosystems such as indigenous settlements, tourists, and merchants. This ensures the research findings' applicability to various types of Hutongs. Thirdly, by quantitatively comparing high, medium, and low score samples, correlations such as the positive relationship between greenery level and experience can be identified. This approach reveals connections between residents' needs and spatial quality, providing data support for the renewal of Micro Garden .

Figure 1: Location of the Study Area within Beijing China

(Source: Author, 2024)

Table 2: Basic Situation of Beijing Baita Hutong, Shijia Hutong ,Zhuanta Hutong Micro Garden

Micro Gardens	Details	Attribute	Description	Photograph
Garden 1 Baita Hutong (Beijing, China)	Size: 384 m2 Location: Xisi Gongmen, Xicheng District, Beijing Type: Climbing Plant Strip Type	Hardscape Shading	“chatting”, and “walking” “Sitting,” “Rest,”	 
Garden 2 Shija Hutong (Beijing, China)	Size: 540 m2 Location: No. 24 Shija Hutong, Dongcheng District, Beijing Type: Flower Pool and Flower Pot Plant Landscape	Softscape Hardscape Shading	“Many different types of plants,” “Climbing plants”	 
Garden 3 Zhuanta Hutong (Beijing, China)	Size: 468 m2 Location: No. 43 Xisi South Street, Xicheng District, Beijing Type: Fuctional facilities type	Softscape Hardscape Shading device Activities	“Many moveable chairs,” and “moveable light tables” “Sitting,” “Rest,” “Chatting,” and “Walking”	 

(Source: Author, 2024)

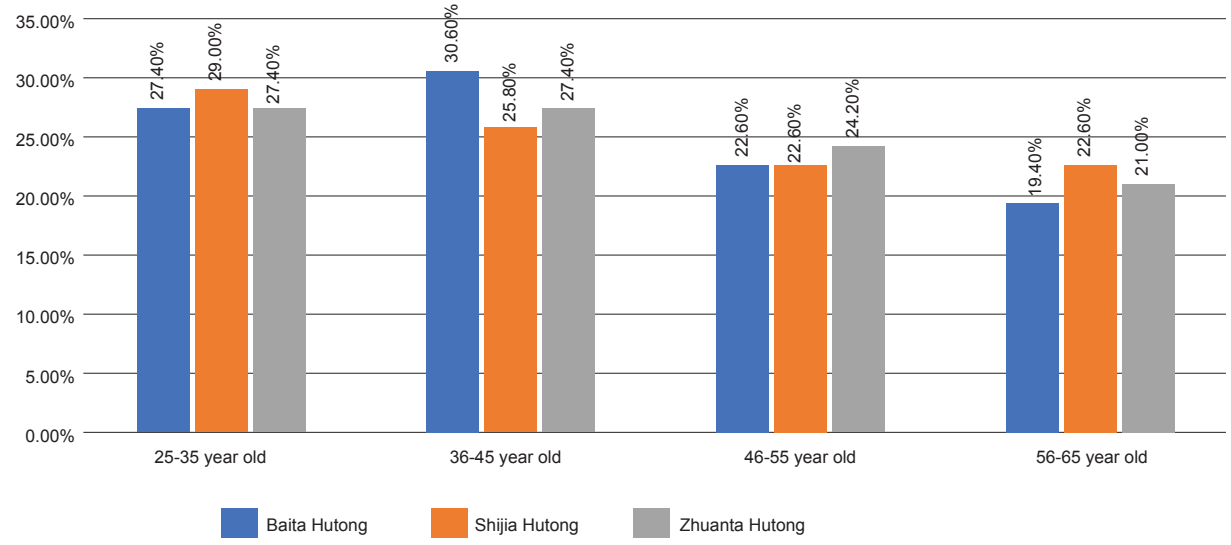


Figure 2: Old for Respondent
(Source: Author, 2024)

Based on Figure 2, the age distribution of respondents demonstrated relatively balanced representation across the three Hutongs (Baita Hutong, Shijia Hutong, and Zhuanta Hutong). Within the 25-35 year age group, proportional distribution remained consistent across locations, with Baita Hutong and Zhuanta Hutong each comprising 27.40% of respondents, while Shijia Hutong accounted for 29.00%. The 36-45 year age group exhibited the highest concentration in Baita Hutong at 30.60%, followed by Zhuanta Hutong at 27.40% and Shijia Hutong at 25.80%. Third, for the 46-55 year age group, Baita Hutong and Shijia Hutong each represented 22.60%, and Zhuanta Hutong was at 24.20%. For the 56-65 year age group, 19.40% were in Baita Hutong, 22.60% in Shijia Hutong, and 21.00% in Zhuanta Hutong. This balanced age distribution across the three Hutongs ensured comprehensive demographic representation, thereby enhancing the reliability and generalizability of the research findings.

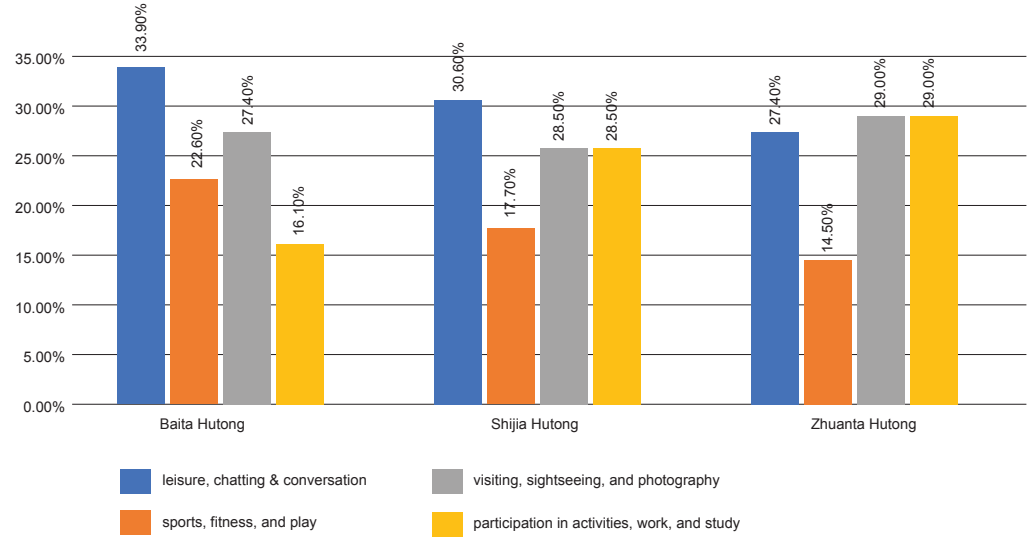


Figure 3: The Reason for Visiting
(Source: Author, 2024)

Based on Figure 3, the distribution of respondents' participation in various activities across three Hutongs (Baita Hutong, Shijia Hutong, and Zhuanta Hutong) was analyzed.

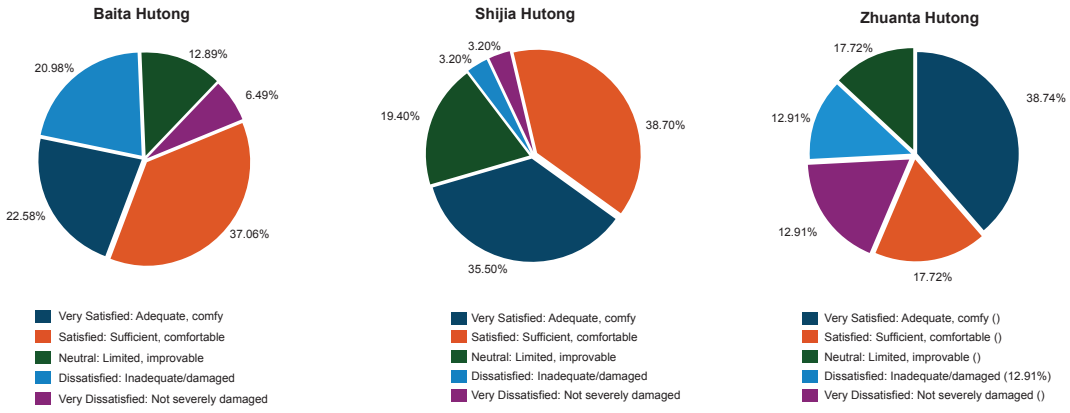
First, leisure, chatting, and conversation achieved the highest proportion in Baita Hutong at 33.90%, followed by Shijia Hutong at 30.60%, and Zhuanta Hutong at 27.40%. Second, sports, fitness, and play activities were most prevalent in Baita Hutong at 22.60%, compared to 17.70% in Shijia Hutong and 14.50% in Zhuanta Hutong. Third, visiting, sightseeing, and photography were most frequently observed in Zhuanta Hutong at 29.00%, followed by Baita Hutong at 27.40%, and Shijia Hutong at 25.80%. Last, showed equal proportions in Zhuanta Hutong and Shijia Hutong at 29.00% each, while Baita Hutong recorded the lowest at 16.10%.

In short, Baita Hutong demonstrated the highest participation in leisure activities, while Zhuanta Hutong attracted the largest proportion of residents involved in structured activities such as work or study. In contrast, Shijia Hutong exhibited a more balanced distribution across the different activities.

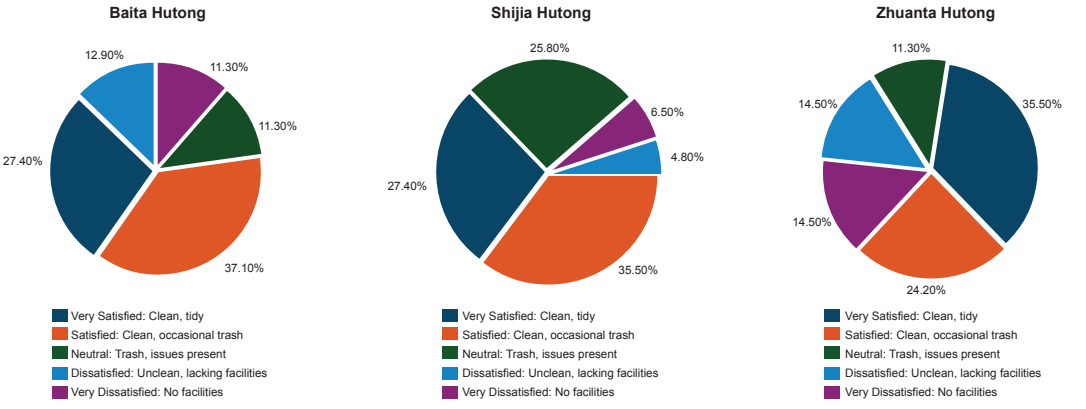
Overall comparison of Micro Garden

Table 3: Various Aspects of Beijing Baita Hutong, Shijia Hutong ,Zhuanta Hutong Micro Garden

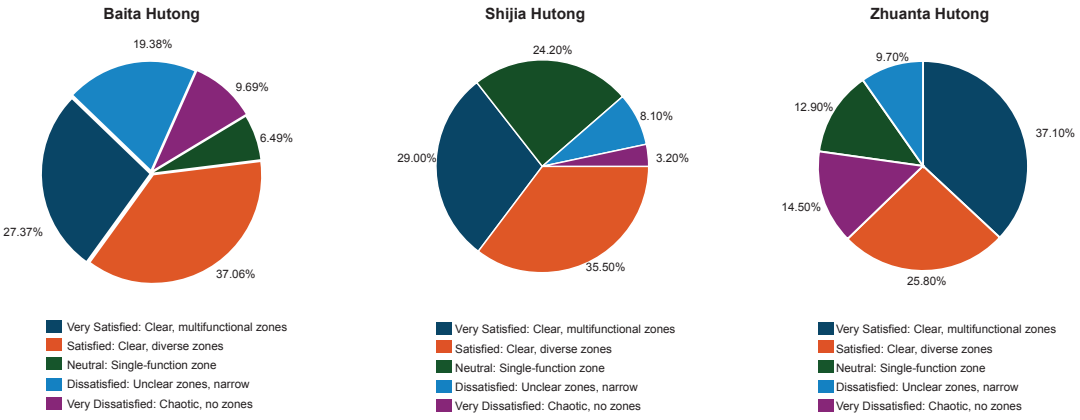
Bar Graphs showed various aspects in Baita Hutong, Shijia Hutong, Zhuanta Hutong, Micro Garden



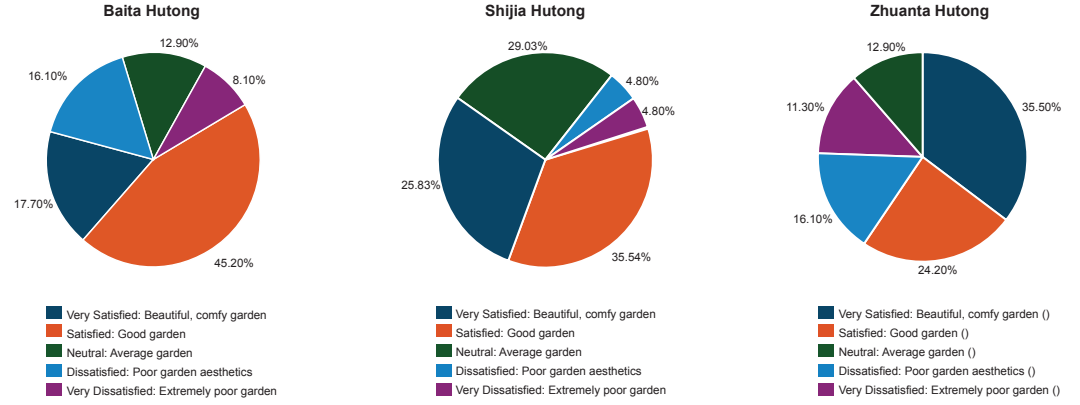
Overall sense of experience



Cleanliness and hygiene of Garden grounds, paths and facilities



Evaluation of the zoning of public space in the Garden



Evaluation of the aesthetics of the Garden environment

(Source: Author, 2024)

Overall sense of experience. Regarding overall experience, three different groups of residents from the three Hutongs demonstrated significant differences in terms of overall Hutong satisfaction. In Baita Hutong, 22.56% were very satisfied while 37.06% reported satisfaction with their experience. However, 20.98% indicated dissatisfaction and 6.49% expressed high satisfaction. Shijia Hutong showed very satisfaction, with 35.5 % reporting very satisfaction and 38.7 % indicating satisfaction, alongside significantly lower dissatisfaction rates of 3.2 % for both dissatisfied and very dissatisfied categories. Conversely, Zhuanta Hutong achieved the highest percentage of very satisfied at 38.74% and satisfied at 17.72 %. Nevertheless, it also recorded a considerable proportion of strong dissatisfaction at 17.72 %. Overall, Shijia Hutong demonstrated the highest percentage of satisfaction and lowest percentage of dissatisfaction, while Zhuanta Hutong exhibited more dissatisfaction despite higher satisfaction. Baita Hutong maintained general satisfaction (Table 3).

Cleanliness and hygiene of Garden grounds, paths and facilities. Based on Fig. 6, in terms of Zhuanta Hutong, it performed optimally regarding cleanliness and hygiene standards, with 35.5% of respondents rating conditions as very satisfactory and 24.2% as satisfactory. However, 14.5 % and 14.5 % of respondents rated it as unsatisfactory or highly unsatisfactory, respectively. For Shijia Hutong, 27.4 % of respondents were very satisfied and 35.5 % were satisfied, while 25.8 % were 'neutral' about the presence of rubbish and stains. In the Baita Hutong, 27.4 % were very satisfied and 37.1 % were satisfied, while 12.9 % and 11.3 % were

dissatisfied or very dissatisfied, respectively. Overall, Zhuanta Hutong had a slight advantage in terms of hygiene satisfaction, followed by Shijia Hutong, while Baita Hutong had a relatively balanced performance (Table 3).

Evaluation of the zoning of public space in the Garden. Based on Table 3, in terms of the evaluation of the zoning of public space in the Hutong, Zhuanta Hutong had the highest percentage of 'very satisfied' with 37.10 %, followed by Shijia Hutong (29.00 %) and Baita Hutong (27.37 %). However, for the 'satisfied' option, Baita Hutong and Shijia Hutong were closer, with 37.06% and 35.50%, respectively, while Zhuanta Hutong had a slightly lower percentage of 25.80%. In the 'Neutral' option, the percentage of Shijia Hutong reached 24.20%, which is significantly higher than that of Baita Hutong (6.49%) and Zhuanta Hutong (12.90%). Besides, the proportions of both 'dissatisfied' and 'very dissatisfied' are higher in Baita Hutong (29.07) than in Shijia Hutong (11.30) and Zhuanta Hutong (24.20). Generally, Zhuanta Hutong was the most satisfied with its zoning and Baita Hutong was much more concerned with its zoning.

Evaluation of the aesthetics of the Garden environment. Based on Table 3, in terms of evaluation of the aesthetics of the Hutong environment, Zhuanta Hutong, with 35.50% 'very satisfied', is significantly higher than Shijia Hutong at 25.83% and Baita Hutong at 17.70%. For the 'satisfied', Baita Hutong had the highest percentage of 45.20%, while Shijia Hutong and Zhuanta Hutong had 35.54% and 24.20% respectively. In the 'Neutral' option, Shijia Hutong had 29.03%, much higher than Baita Hutong and Zhuanta Hutong. Regarding the options (dissatisfied' and 'very dissatisfied'), Baita Hutong and Zhuanta Hutong had higher proportions, totaling 24.20% and 27.40% respectively, while Shijia Hutong's proportion remained at only 9.60%. Overall, Zhuanta Hutong received the highest aesthetic ratings, while Baita Hutong and Shijia Hutong require aesthetic enhancements.

From a comprehensive evaluation, Shijia Hutong had the highest overall satisfaction and lowest dissatisfaction among residents, making it the best evaluated alley. Although Zhuanta Hutong demonstrated advantages across three dimensions: prominent "high satisfied" ratio, its overall satisfaction is slightly lower than Shijia Hutong; Baita Hutong had the lowest overall satisfaction and needs systematic improvement. In the evaluation, Zhuanta Hutong had advantages in three dimensions: sanitary environment (slightly leading in satisfaction), rationality of public space area (highest score), and public participation and activity atmosphere (best performance). Its Garden aesthetic design achieved particularly outstanding recognition with the highest score. In contrast, Baita Hutong exhibited significant deficiencies in hygiene management, spatial planning, community vitality creation, and Garden aesthetics, making it a priority area for enhancing residents' experience. Although Shijia Hutong leads in overall satisfaction, optimization opportunities remain in public space area, and its Garden aesthetics should align with Zhuanta Hutong standards to consolidate its advantageous position.

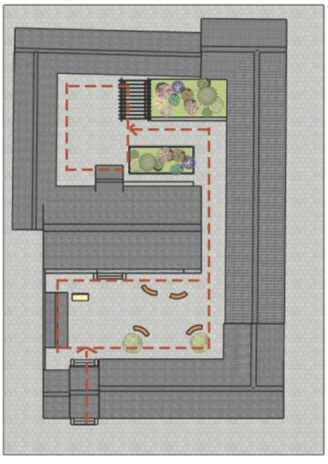
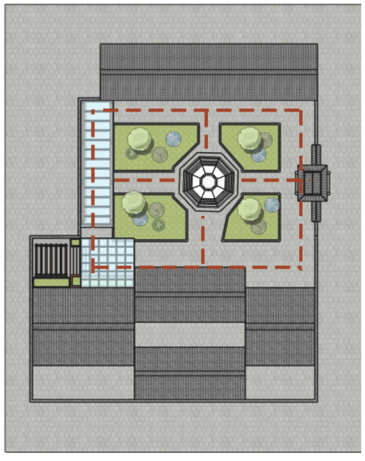
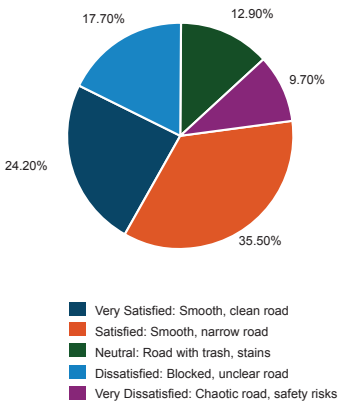
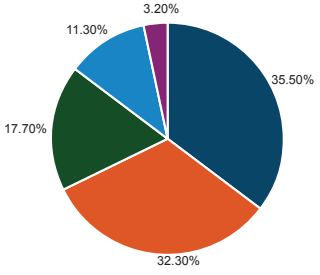
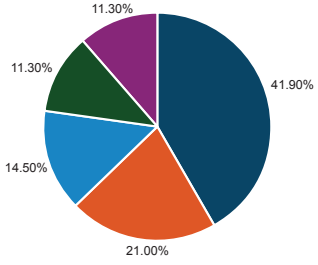
Accessibility of Roads Comparison of Micro Garden

Based on Table 4, In terms of road accessibility, Zhuanta Hutong had the highest percentage of very satisfied (41.9 %), followed by 21 % satisfied and 14.5 % and 11.3 % dissatisfied and very dissatisfied respectively. Shijia Hutong had 35.5 % very satisfied and 32.3 % satisfied, while 11.3 % and 3.2 % are dissatisfied and very dissatisfied respectively. Baita Hutong had 24.2 % very satisfied and 35.5 % satisfied, but 17.7 % were dissatisfied and 9.7 % considered it very dissatisfied. Overall, Zhuanta Hutong had the most favorable road accessibility, and Shijia Hutong performed well, while Baita Hutong had additional feedback on road problems.

Zhuanta Hutong took a culture-oriented road network, and Zhuanta historical sites acted as the central nodes. Joining in the continuous vegetation belts are suitable

wide pedestrian walkways, supported by point like landscape plants, resting chairs and small flower beds to create a linear space integrating cultural display and environmental functions (Shi, Dai, & Ma, 2019) . It is very accessible and, most importantly, organic to the use of public spaces, which helps residents greatly experience cultural landscapes and leisure facilities. The hutong of Shijia has maintained its old-fashioned spatial network, organized as a road net surrounding a quadrangle yard, which preserves the typical alley scale of 4-6 meters. The main service facilities are linked in two courtyard format open areas, which maintain the historical style but guarantee utility. In contrast, Baita Hutong was awaiting optimization: road planning was inadequate, which was manifested as a single form and a low road width of less than 3 meters; The fact that it lacked cultural elements necessitated a lack of spatial culturality; At the same time, the fundamental factors may include inadequate road surface smoothness, poor hygiene conditions, low green space rates, which are urgent to be systematically renewed in order to increase landscape value and cultural identity (Table 4).

Table 4: Accessibility of Roads Comparison of Beijing Baita Hutong, Shijia Hutong ,Zhuanta Hutong Micro Garden

Analysis of Road Accessibility		
Baita Hutong	**Shijia Hutong**	**Zhuanta Hutong**
		
		
Very Satisfied: Smooth, clean road Satisfied: Smooth, narrow road Neutral: Road with trash, stains Dissatisfied: Blocked, unclear road Very Dissatisfied: Chaotic road, safety risks	Very Satisfied: Smooth, clean road Satisfied: Smooth, narrow road Neutral: Road with trash, stains Dissatisfied: Blocked, unclear road Very Dissatisfied: Chaotic road, safety risks	Very Satisfied: Smooth, clean road Satisfied: Smooth, narrow road Neutral: Road with trash, stains Dissatisfied: Blocked, unclear road Very Dissatisfied: Chaotic road, safety risks
Accessibility of roads		

(Source: Author, 2024)

Leisure Facilities of Roads Comparison of Micro Garden

In general, Shijia Hutong and Zhuanta Hutongwei Garden were primarily made of chairs, corridors, and pavilions. Shijia Hutong was a place with numerous facilities and seats. The only rest facilities, chairs, and the type were single at Baita Hutong (Table 5).

Satisfaction evaluation of leisure facilities . Based on Table 6, in terms of leisure facilities, Zhuanta Hutong performed the best, with 46.8 % of the respondents being very satisfied and 17.7% being satisfied. Shijia Hutong scored 40.34 % very satisfied and 37.14 % satisfied, while Baita Hutong scoredd 29.03 % very satisfied and 30.63 % satisfied, with 17.72 % dissatisfied and 9.71 % very dissatisfied. Overall, Zhuanta Hutong achieved the highest score in terms of leisure facilities, and Shijia Hutong followed, with a relatively low degree of satisfaction regarding leisure facilities.

Demand Assessment of Leisure Facilities. with respect to the number of facilities for leisure services required, three Hutongs varied their opinions. Contrary to 24.20% in Baita Hutong and 40.34% in Shijia Hutong, 48.40% of the respondents in Zhuanta Hutong believed that leisure facilities were very necessary. For the 'necessary' option, Baita Hutong and Shijia Hutong had similar proportions of 38.70% and 37.14% respectively, compared to 16.10% in Zhuanta Hutong. In addition, Shijia Hutong had the lowest percentage of respondents who considered the facilities 'unnecessary' or 'not at all necessary', totaling 6.40%, compared to 22.60 % in Baita Hutong and 21.00 % in Zhuanta Hutong. Overall, Zhuanta Hutong had the strongest demand for additional leisure facilities, while Baita Hutong and Shijia Hutong had a more balanced demand(Table 6).

Evaluation of demand for fun and interactive leisure facilities. Based on Table 6, in terms of the need for more interactive or interesting services. Zhuanta Hutong had the highest percentage of 'very necessary' at 45.20 %, significantly higher than Shijia Hutong at 32.30 % and Baita Hutong at 25.80 %. For 'necessary', Shijia Hutong had the highest percentage of 40.30 %, slightly higher than Baita Hutong's 37.10 %, while Zhuanta Hutong had a lower percentage of 17.70 %. For the 'Neutral' option, Shijia Hutong also had a relatively high percentage of 21.00%, while Baita Hutong and Zhuanta Hutong had 9.70% and 17.70% respectively. In addition, Baita Hutong and Zhuanta Hutong had higher proportions of 'unnecessary' and 'not at all necessary' options, totaling 27.40% and 19.40% respectively, compared to Shijia's 6.40%. Overall, Zhuanta Hutong was the most demanding in the respect of more interactive or interesting services, whereas Baita Hutong and Shijia Hutong had low demands.

Regarding leisure facility evaluation, Zhuanta Hutong ranked highest, followed by Shijia Hutong; thus, Baita Hutong had relatively low demands; no further analysis could display that the residents of Zhuanta Hutong have the most prominent demands, whereas the demands of Baita Hutong and Shijia Hutong were relatively equal. This data chain suggests that the demand for leisure facilities among the residents of various Hutongs is significantly different. Being a high level satisfaction area, Zhuanta Hutong was more willing to improve facilities, whereas the other two Hutongs might need more specific improvement strategies to make residents more involved and satisfied.

In summary, relative to the analysis of leisure facilities, Zhuanta Hutong has the highest and best performance, followed by Shijia Hutong, and the demand of Baita Hutong and Shijia Hutong was relatively low (Table 5-6). Such a chain of data suggests that there were certain breaks in the demand for recreational facilities among the residents of various Hutongs. Since Zhuanta Hutong is a high satisfaction area, it is more inclined to developing facilities; the other two Hutongs might be in need of more specific approaches to developing facilities to increase the participation and satisfaction of residents.

Table 5: Types and Features of facilities comparison of Beijing Baita Hutong, Shija Hutong ,Zhuanta Hutong Micro Garden

Types and Features of Facilities			
Features of facilities	**Baita Hutong**	**Shija Hutong**	**Zhuanta Hutong**
Seat Facility Position: On the roadside Material: Wood, stone, rattan weaving			
	Only one type		
Function: Rest; Chat			
Gallery Frame Position: On the road Material: Wood, glass, combined with plants	Not Have		
Function: Rest; Chat;			
Pavilion Position: On the road Material: Wood, glass, combined with plants, cements, bricks and tiles	Not have		
Function: Rest; Chat;			

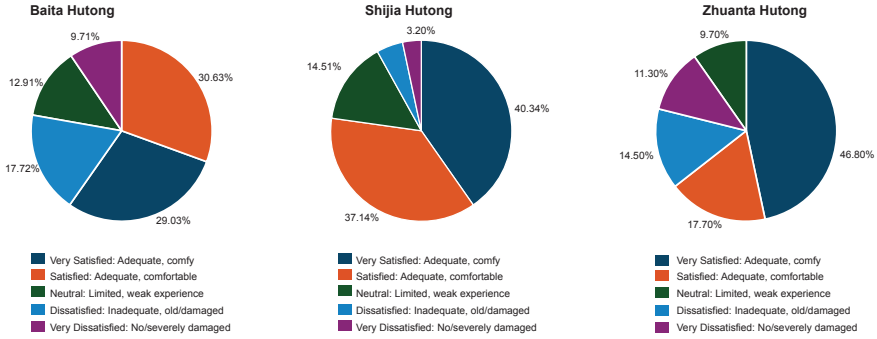
(Source: Author, 2024)

Table 6: Comparison of Evaluation of Public Leisure Facilities of Beijing Baita Hutong, Shijia Hutong

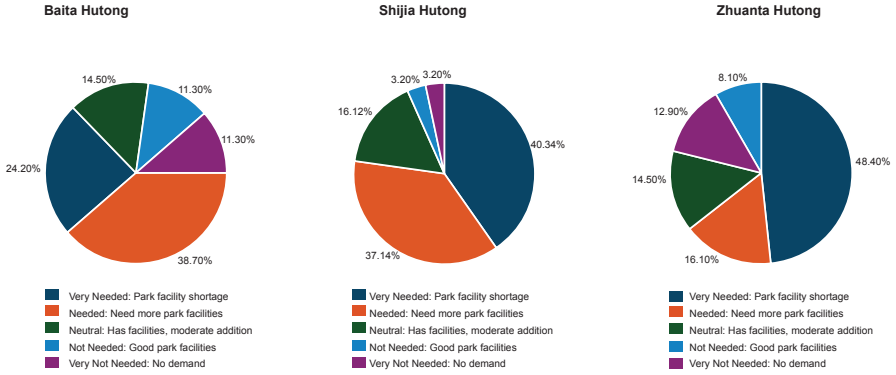
Comparison of evaluation of public leisure facilities

Baita Hutong	Shijia Hutong	Zhuanta Hutong

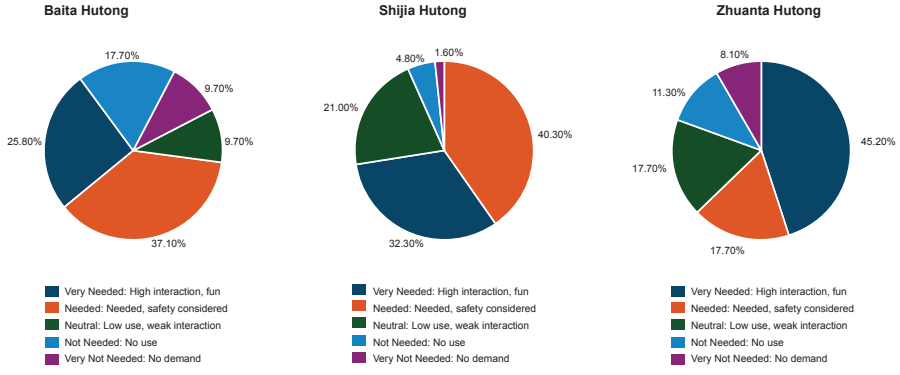




Satisfaction evaluation of leisure facilities



Evaluation of Demand for Leisure Facilities



Evaluation of demand for fun and interactive leisure facilities

(Source: Author, 2024)

Greening of Roads Comparison of Micro Garden

Level of greening in the Garden. According to Table 7, in terms of the greenness of Hutong, Zhuanta Hutong had the highest percentage with 33.90 which was higher than Shijia Hutong with 27.40 and Baita Hutong with 22.58. In the case of the satisfied, Baita Hutong and Shijia Hutong recorded higher percentages of 41.86 and 40.34 respectively but Zhuanta Hutong recorded 27.40. The percentage of Shijia Hutong was much higher in the Neutral option (22.62) than in the Baita Hutong (6.49) and Zhuanta Hutong (12.90). The proportion of dissatisfied and very dissatisfied was higher in Baita Hutong and Zhuanta Hutong at 29.07 and 25.80 respectively, with the lowest proportion at Shijia Hutong which was 9.6%. As a whole, Zhuanta Hutong and Shijia Hutong were greener and Baita Hutong could improve some of that.

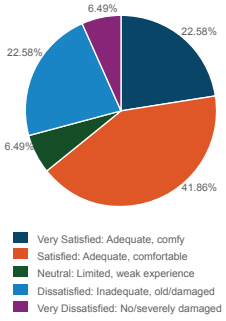
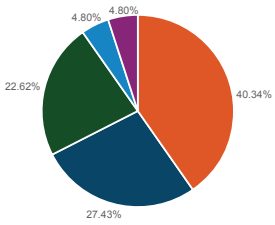
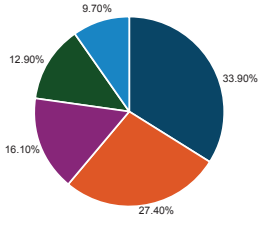
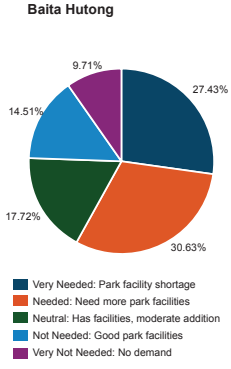
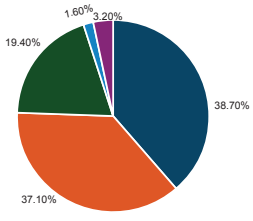
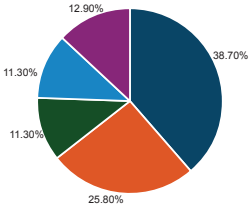
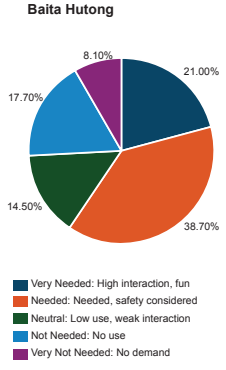
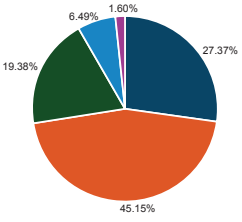
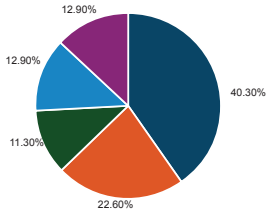
Necessity evaluation of ornamental landscape plants. Based on Table 7, in terms of opinions on the need for more ornamental landscape plants. In Zhuanta Hutong and Baita Hutong, 38.70 % of responds choose 'very necessary', which was higher than Shijia Hutong's 27.43 %. For the 'necessary' option, Shijia Hutong had a slightly higher percentage of 37.10 %, while Zhuanta Hutong and Baita Hutong had 30.63 % and 25.80 % respectively. In the 'Neutral' option, Baita Hutong had a higher percentage of 17.70%, while Shijia Hutong and Zhuanta Hutong had 19.40 % and 11.30 % respectively. In addition, Baita Hutong and Zhuanta Hutong had higher percentages of 'unnecessary' and 'not at all necessary' options, totalling 24.22% and 24.20% respectively, while Shijia Hutong had a relatively low proportion of 4.80 %. Overall, Baita Hutong had a low demand for more ornamental landscape plants, while Shijia Hutong and Zhuanta Hutong had strong demand.

Adding landscape with local characteristics. In terms of adding landscapes with local characteristics, the Hutong on which added landscapes with local features were rated with the highest demand, with 40.30% of the sample respondents rating the addition as very necessary, compared to the other two Hutongs, 27.37% and 21.00% respectively. In the case of the optimum necessary, Shijia Hutong was the most popular with 45.15, implying people in this neighborhood feel that there was a great need to make the garden have more local features and cultural attributes. Baita Hutong and Zhuanta Hutong received the support of 38.70% and 22.60, respectively. In the case of the neutral option, the highest percentage was Shijia Hutong at 19.38%, which is just a little more than Baita Hutong with 14.50% and Zhuanta Hutong with 11.30% In general, the residents of Zhuanta Hutong were the most supportive of adding landscape with local characteristics compared to Shijia Hutong and Baita Hutong residents, who were less supportive of the addition of landscape with local characteristics.

To put it briefly, in terms of green environment, Zhuanta Hutong and Shijia Hutong had excellent performance and a high level of greening, whereas Baita Hutong had evident deficiencies and required considerable enhancement. The people of Zhuanta Hutong and Shijia Hutong expressed strong interest in decorative garden plants, whereas Baita Hutong was comparatively unconcerned. In terms of cultural landscape assessment, Zhuanta Hutong considered the incorporation of local cultural aspects the most, followed by Shijia Hutong, while Baita Hutong was neutral. Moreover, the residents of Zhuanta Hutong supported the inclusion of local characteristic landscapes the most, whereas the support of Shijia Hutong and Baita Hutong was relatively low. These findings revealed important differences in the value that residents of various Hutongs attached to greenery and cultural identity and provided a valuable foundation on which to focus the renewal of Micro Gardens.

Table 7: Comparison of Evaluation of Greening and Landscape

Comparison of evaluation of Greening and Landscape

Baita Hutong	Shijia Hutong	Zhuanta Hutong
		
		
Degree of greening in the garden		
		
Necessity evaluation of ornamental landscape plants		
		
Evaluation of the necessity of local culture of the garden landscape environment		

(Source: Author, 2024)

Results

A questionnaire survey was conducted on 180 residents in the Micro Garden of three Hutongs, and evaluation indicators of the Micro Garden of the Hutongs were analyzed using SPSS, obtaining residents' satisfaction evaluation results for the three Micro Gardens (see Table 8 and Table 9 for details). The key findings were as follows:

Overall Experience and Basic Environmental Indicators

Zhuanta Hutong scored the highest on overall experience, at 2.53. It topped all the basic environmental indicators: cleanliness and hygiene (2.48), public space organization (2.47), public participation and atmosphere of activity (2.52), and environmental aesthetics (2.52), indicating great awareness among residents.

Immediately following this is the other, the Shijia Hutong, with an average overall rating of 2.52. Although it scored relatively well in cleanliness and hygiene with a rating of 2.44, and environmental appearance (2.14), it scored lower in terms of zoning of public space (2.39) and the atmosphere of the public participation (2.19).

Baita Hutong received the lowest total experience score of 2.00. It scored poorly on all the foundational environmental indicators, most notably on public space cleanliness (2.27) and public space planning (2.21), and it had a poor public participation atmosphere (2.08).

Road Accessibility and Leisure Facility Evaluation

Regarding road accessibility, Zhuanta Hutong was rated as the most convenient with a score of 2.53, indicating high accessibility for residents. Shijia Hutong was rated 2.32, suggesting it is rather convenient in transportation, though still, a lot needs to be improved. Baita Hutong received the worst score of 2.15, indicating poor road conditions.

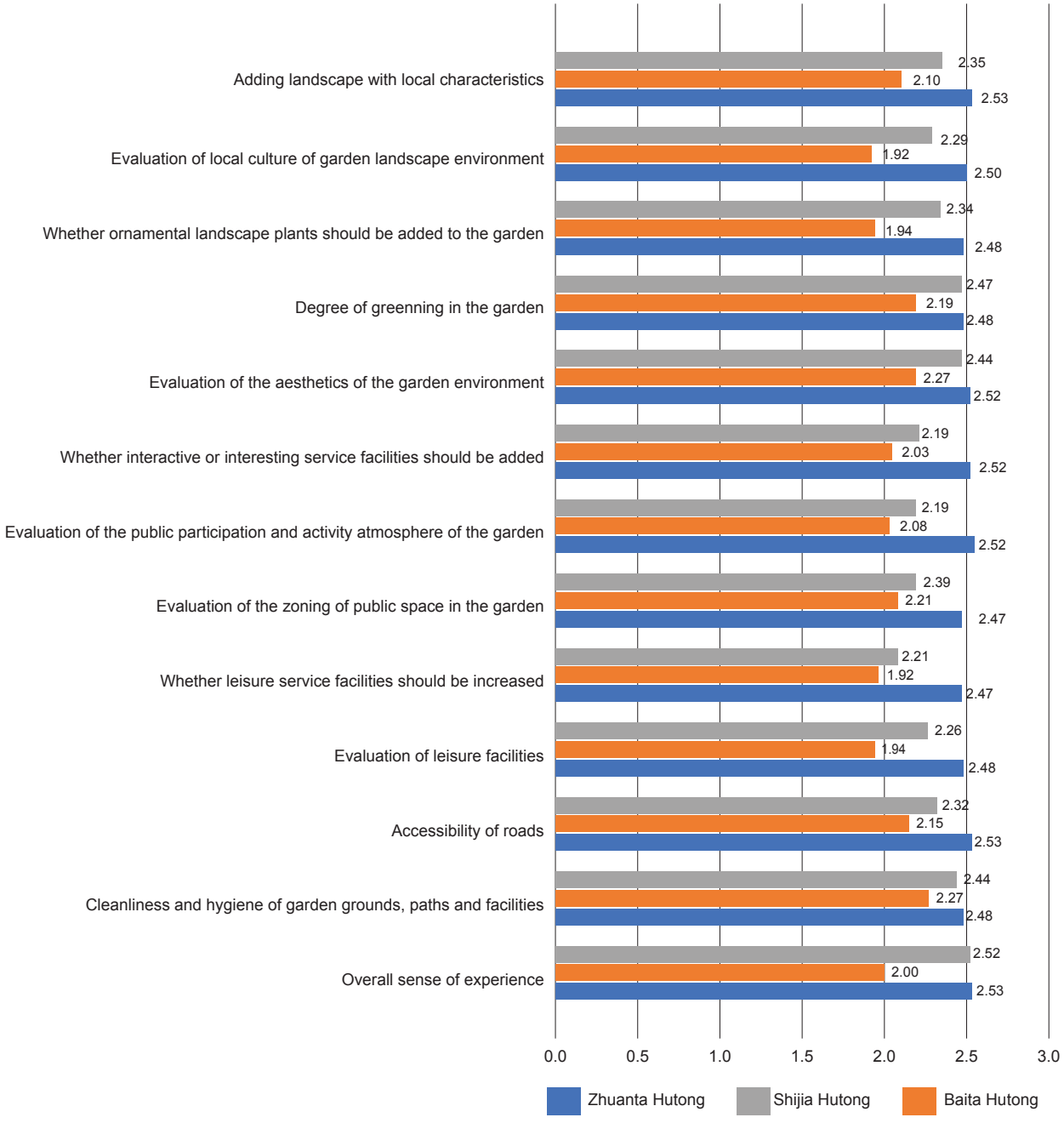
For leisure facilities: Zhuanta Hutong had a high score of 2.48, and residents had high demand for more leisure and interactive facilities (2.47). Shijia Hutong ranked in the middle with facility score of 2.26 and residents showed the lowest demand for new facilities (1.92 for leisure facilities, 2.03 for interactive facilities).

Landscape Greening and Cultural Characteristic Indicators

Regarding the landscape greening, Zhuanta Hutong was 2.48, Shijia Hutong was 2.47 and Baita Hutong had scored only 2.19 points and Zhuanta Hutong was found to be trailing in terms of landscape greening. Furthermore, the growth of demand of the ornamental plants remains in good state and other form: 2.48 of Zhuanta Hutong had the highest demand rate, followed by 2.34 by Shijia Hutong and 1.94 by Baita Hutong residents respectively.

In cultural characteristics, Zhuanta Hutong performed best in the cultural integration with a score of 2.50, and in the willingness to add local characteristic landscapes with a score of 2.53; Shijia Hutong performed moderately (scores of 2.29 in cultural integration and 2.35 in the willingness to add characteristic landscapes); Baita Hutong was largely lacking in the two respects with a cultural integration score of 1.92 and a willingness to add characteristic landscapes of 2.10.

Table 8: Data Analysis of Comparative Results of Hutong Micro Garden



(Source: Author, 2024)

Table 9: Summary of Residents' Satisfaction with the Hutong "Micro Garden"

Residents' Satisfaction with the Hutong "Micro Garden"			
Comparative Evaluation	**Zhuanta Hutong**	**Shijia Hutong**	**Baita Hutong**
1.Overall Experience: (1) Residents' feelings	2.53 (highly satisfactory, highest resident satisfaction)	2.52 (moderately satisfactory, close to benchmark level)	2.00 (unsatisfactory, requiring systematic improvement)
(2) Clean and hygienic	2.48 (highly satisfactory, finely managed)	2.44(moderately satisfactory, well maintained)	2.27(unsatisfactory, insufficient cleanliness of public spaces)
(3) Public space zoning	2.47(highly satisfactory, highly efficient layout)	2.39(moderately satisfactory, local optimization required)	2.21(unsatisfactory,planning urgently needs adjustment)
(4) Public Participation and Activities atmosphere	2.52(highly satisfactory, with highly community cohesion)	2.19 (moderately satisfactory,requires stimulation of vitality)	2.08 (unsatisfactory, low participation)
(5) Environmental aesthetics	2.52 (highly satisfactory, highly outstanding design aesthetics)	2.44 (moderately satisfactory, highly recognized)	2.27 (unsatisfactory, not attractive enough)
2. Road accessibility	2.53 (highly satisfactory, convenient to pass)	2.32 (moderately satisfactory,requiring partial improvement)	2.15 (unsatisfactory, with prominent maintenance issues)
3. Facility evaluation: (1) Facility functional evaluation	2.48 (highly satisfactory, with High Satisfaction)	2.26 (moderately satisfactory,additional functions needed)	1.94 (unsatisfactory, low level of facilities)
(2) Add leisure facilities:	2.47 (high demand)	2.21 (moderate demand)	1.92 (low demand)
(3) Add interactive facilities	2.48 (high demand)	2.19 (moderate demand)	2.03 (low demand)
4. Landscape greening evaluation: (1) Greening degree	2.48 (highly necessary, highly ecological integration)	2.47 (moderately necessary, moderate level development)	2.19 (low necessary, priority for Enhancement)
(2) Demand for ornamental landscapes	2.48 (highly necessary)	2.34 (moderately necessary)	1.94 (lowly necessary)
(3) Integration of local culture	2.50 (highly necessary, distinct cultural identity)	2.29 (moderately necessary, Partial Fusion)	1.92(lowly necessary, lack of correlation)
(4) Intention to add distinctive landscapes	2.53 (highly necessary)	2.35 (moderate necessary)	2.10 (lowly necessary)

(Source: Author, 2024)

Discussion

Differentiated Development Characteristics of the Three Hutongs' Micro Garden

Empirical study of the Micro Garden of the three Hutongs indicates differentiated development styles (Wartmann & Purves ,2018).

Zhuanta Hutong has established an excellent developmental framework with the following features: high resident satisfaction, full functional support, and high cultural connotation. Its merits in the general environment, road access, recreational amenities, and cultural accommodation not only entirely satisfy the existing living and leisure requirements of residents but also arouse high potential demand for facility upgrades and landscape optimization, which provides a solid background to the viable renewal of the Micro Garden. This development model confirms that the practice of combining "practical functions + cultural inheritance" is a good route to add value to Hutong Micro Garden.

Shijia Hutong exhibits a "balanced but to-be-optimized" developmental state. Despite its relatively high overall experience grade, which is similar to that of Zhuanta Hutong, and the fact that the traditional Hutong texture has not been destroyed, the lack of efficiency in public space utilization and the richness of the leisure facilities and depth of cultural integration restrict the further enhancements of the experience of the residents. This implies that for Hutongs with a strong base, optimization of the weak links is the main factor in quality improvement, rather than massive reconstruction.

Baita Hutong faces comprehensive developmental challenges of Micro Garden. Backward infrastructure (such as poor road conditions), insufficient basic environmental management (such as chaotic public space and poor hygiene), low-level leisure facilities, and lack of cultural connotation have jointly resulted in low resident satisfaction and weak participation willingness. This has created a vicious cycle of "poor environment → low resident demand → slow renewal progress," indicating that systematic and focused improvement is urgently needed (Shi et al., 2019).

Practical Improvement Suggestions for Baita Hutong

Based on the analysis outcomes in Baita Hutong across each dimension, the following pragmatic improvement tips should be prioritized to address the challenges facing the Micro Garden in Baita Hutong and improve the feeling of benefit and involvement of residents as soon as possible:

Urgently Improve Basic Environmental Hygiene and Public Space Planning

Strengthen public space hygiene management: Organize daily cleaning of the public spaces in the Hutong, focus on the elimination of garbage accumulation and sanitary dead corners along the narrow passages and curved spaces, and establish a dual hygiene management mechanism of "resident supervision + community inspection" (like organizing a Hutong environmental volunteer group).

Optimize public space functional zoning: Dismantle or reorganize disordered illegal auxiliary structures in the Hutong to create linear passages; use low-cost materials (such as low flower beds, wooden railings, and green fences) to separate the public spaces in the leisure activity zone, greening zone, passage zone, and address the issue of disorderly layout of public space.

Quickly Upgrade Road Accessibility and Basic Leisure Facilities

Thoroughly check the Hutong roads, repair potholes, even the roads, change roadblocks that inconvenience the travel of the residents in order to guarantee that the travel of the residents is comfortable, particularly the residents who are elderly and kids. In narrow streets with tough street lines, we ought to install the anti-slip handrails, place warning sign plates to improve the safety of traveling. Make basic leisure amenities, which are simple to upkeep and possess great utility, like outdoor rock benches, basic exercise apparatus (arm-exercise machines, waist-twisting machines), and common storage racks, a priority. Locate such facilities in public spaces (where there is a high flow of residents) (central square of the Hutong or near residential entrances) to address the simplest leisure needs of the residents.

Implement Targeted Greening Enhancement and Cultural Activation

Launch a "Micro greening" project: Use fragmented areas on either side of the Hutong and surrounding the community amenities in order to undertake greening enhancement. Plant low maintenance ornamental plants (such as Chinese roses, jasmine, and creepers) by using portable flowerpots, strip flower boxes, and small flower pools and encourage the residents to be involved in the process of planting and daily maintenance to make them feel belonging to the Micro Garden.

Carry out low-cost cultural activation: Paint the exterior of the public structures in the Hutong with traditional scenes of Hutong life (such as courtyard daily life, old street vendor images) or have small cultural signs introducing the history and

story of Baita Hutong hung. These initiatives can contribute to the improvement of the cultural environment of the Micro Garden without any massive reconstruction, so that the residents can feel more connected to the cultural connotation of the Hutong.

Stimulate Resident Participation Through Small-Scale Interactive Activities

Organize regular small-scale community interactive activities related to the Micro Garden, such as “Hutong Greening Experience Day”, “Traditional Handicraft (Paper-Cutting, Kite-Making) Workshops”, and “Micro Garden Improvement Suggestion Collection Meeting”. Such activities can draw the residents to engage in the public affairs, assist in gathering the detailed needs of the residents for the Micro Garden, and slowly mobilize the residents to engage in the renewal and maintenance of the Micro Garden, which is where the low rates of resident participation can be broken.

Implications for the Organic Renewal of Historical Hutong Micro Gardens

The comparative analysis of the three Hutongs’ Micro Gardens provides important practical implications for the organic renewal of Beijing’s historical Hutong Micro Garden:

First, renewal work should not use the “one-size-fits-all” model but needs to develop specific strategies, depending on the stage of development and peculiarities of each Hutong (Lin,2020). To improve Hutongs such as Zhuanta Hutong (high-quality), the development of smart facilities (such as solar-powered street lamps, intelligent environmental monitoring equipment) is needed to sustain the development benefits of such places; to improve Hutongs such as Shijia Hutong (balanced), the optimization of weak links (public space zoning, facility richness) can achieve small improvements with big effects; and to improve Hutongs such as Baita Hutong (lagging), the main development can be achieved through bettering basic environments and facilities.

Second, the essence of Hutong Micro Garden renewal lies in the fact that the needs of residents are considered the initial point. It is essential to take into account the real needs of residents in terms of life, readiness to participate in the process, both when it comes to facility configuration, greening design, or cultural activation (Liu et al., 2019). Only when the results of the renewal are “visible, usable, and loved” by residents can the Micro Garden become public space that enhances the quality of life of residents and preserves the culture of Hutong.

Lastly, consider the renovation of Hutong Micro Garden as a project of “low-cost, sustainability, and progressiveness”. Oppose blind and mass renovation; rather, it must select low-cost and well-maintained methods and continue to enhance environmental enhancement with small adaptations over time for better utilization (Yin,2019). Meanwhile, introduce a lifelong maintenance system involving residents, communities and other associated institutions to ensure that the Micro garden is in permanent circulation and good health.

Conclusion

This paper systematically demonstrates the applicability dilemma of conventional garden design technologies in the special space scale of Hutongs, and demand-driven Micro Garden renewal route of locals under the empirical investigation of the Beijing Hutong Micro Garden. Its primary findings are as follows:

Spatial Functional Preference

Micro Garden is a functional zone marked by important characteristics among residents. High accessibility and a reasonable road network make Zhuanta Hutong an organic combination of leisure, transport, and social functions, whereas narrow roads make Baita Hutong a mixed area.

Hierarchical Facility Demands

The leisure facilities demanded by residents are in a progression between “basic comfort” and “interactive upgrading.” As an example, Zhuanta Hutong residents demonstrate a high willingness to have sunshade seats and smart interactive facilities, whereas Baita Hutong lacks basic lighting.

Landscape Value Recognition:

The role of greening environments in cultural empowerment cannot be disputed. Zhuanta Hutong is able not only to enhance the aesthetic assessment of its streets and develop the cultural identity of the place with the help of local flora and art objects but also to create a sense of attachment to Baita Hutong in people in spite of the existing homogeneity between the local plants.

In summary, due to the miniature size of the Hutongs, the application of traditional landscape methods cannot be applied directly to design and creation; therefore, the design of the modern Micro-park is more of a personal undertaking with no formal planning. The three cases reflect their individual gradation: Zhuanta Hutong is a well-equipped and satisfactory Micro-park, offering a rich sense of experience, great accessibility, and an appealing appearance; in contrast, Shijia Hutong performs generally well but requires improvements in its space arrangement and service level, particularly regarding cultural aspects.

Moreover, residents’ needs are stratified: basic needs (access to roads, comfort of the facilities) determine conditions for use; environmental quality (green, landscape beauty) defines the level of experience of people; and cultural value, the local element, and the interactive facility define the local identity. The demand structure based on the “functional quality value” provides a scientific foundation for differentiated updating strategy.

The transformation of Hutong Micro Garden should employ methods encompassing “precise functionality, humanized facilities, and localized landscape.” In well-developed areas such as Zhuanta Hutong, priority should be given to deepening cultural narratives and upgrading intelligent infrastructure systems. Optimization for moderately developed locations such as Shijia Hutong should prioritize spatial organization and activity integration. In underdeveloped zones such as Baita Hutong, “cultural micro-renewal” should serve as the primary strategy, concentrating efforts on improving basic facilities while gradually strengthening cultural identity recognition. This approach provides valuable references for establishing a systematic planning and design framework for Hutong Micro Gardens, thereby guiding the organic renewal of historical districts.

Research Contributions

Theoretical contributions

In this study, a thorough examination of how traditional methods of Garden design can be adapted to the peculiarities of space in the Hutongs was performed, and the limitations on the application of these methods were also unambiguously determined (Lin ,2020). The study expanded upon this by developing a new hierarchical framework of the Micro-Garden requirements of residents, based on “function-quality-value”. This structure not only seals gaps in the theoretical

framework of Micro-space renewal in historical neighborhoods but also gives a new theoretical interpretation of the demand logic of residents in narrow and complex historical spaces, which adds depth to the theoretical system of Micro-space study in historical neighborhoods.

Practical contributions

Through a systematic study of the gradient properties of three common varieties of Hutong Micro-Gardens (high-quality, moderate-level, and underdeveloped), this study suggested specific, differentiated renewal policies based on the varying levels of development. In particular, the Baita Hutong "cultural Micro-renewal" and Shijia Hutong spatial optimization strategies exhibit high operability. They can directly provide path guidance on the organic renewal practice of Hutong Micro-Gardens as well as offer practical solutions to enrich the quality of life of the residents and to improve the living environment of Hutongs.

Applied contributions

Through detailed analysis and classification of behaviors, demands, preferences and other characteristic peculiarities of individuals who dwell in Micro Garden, this study provided the primary basis for determining principles of the spatial structuring of Hutong Micro Gardens. The study also provides a practical guiding paradigm for renewing historic city blocks to optimize Micro spaces in Hutongs and recreate the sense of community in the public spaces, which can serve society and have an essential guiding role in other related studies and practical functioning as well as the scientific development of the field.

Research Limitations

Limitations in Spatial Scope

The three Hutongs in Beijing that were used in the study are not adequately representative of the Hutongs in different parts of Beijing (e.g., Hutongs in core historical areas vs. marginalized Hutongs). The absence of cross-regional case comparison can result in confining conclusions to analogous Hutong settings.

Limitations in Temporal Dimension

The research was based on a single questionnaire survey to gather data on satisfaction and demand of residents, without the use of long-term tracking (Yin,2019). It was not able to capture the dynamic variation in the needs of residents (e.g., seasonal variations in greening demands, post-renewal variations in satisfaction) or the long-term operation impact of the Micro Garden renovation actions.

Limitations in Research Objects

The study mainly analyzed the subjective assessment of residents (satisfaction, demand) and does not deeply study the objective factors affecting Micro Garden construction, including the intensity of policy support, community management capacity, and external fund injection. Over-looking such objective factors can result in an incomplete grasp of the constraints on Hutong Micro Garden renewal.

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