

Research on the Configuration of Urban Public Space Facilities under the Synergy of Demand Differentiation and Spatial Adaptation: A Case Study of Zefeng Park in Taiyuan City

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Abstract

At present, China's new urbanization has gradually shifted from large-scale expansion to a stage focused on improving the quality and efficiency of existing urban spaces. In many completed parks, however, the configuration of public facilities often fails to correspond to users' actual needs, leading to problems such as facility idleness, uneven usage, and reduced service efficiency of public spaces. Taking Zefeng Park in Taiyuan as a case study, this paper observes contrasting patterns in facility use: some facilities, such as shared equipment stations, remain underused for long periods, while certain fitness facilities, including upper-limb training equipment, are frequently overcrowded. Based on environmental behavior theory, this study introduces space syntax analysis to examine the relationship between spatial accessibility and facility usage in urban public spaces. Through field investigation and analysis of facility distribution in Zefeng Park, the paper explores how differences in user demand and spatial layout jointly affect the efficiency of facility use, and proposes corresponding strategies for the optimization of public infrastructure within the park. The study attempts to develop an analytical perspective linking user demand, spatial organization, and facility efficiency, while also providing a reference for the renewal and adjustment of facilities in Zefeng Park and other urban comprehensive parks.

Keywords

urban public space, environmental behavior, space syntax, facility configuration, park renovation

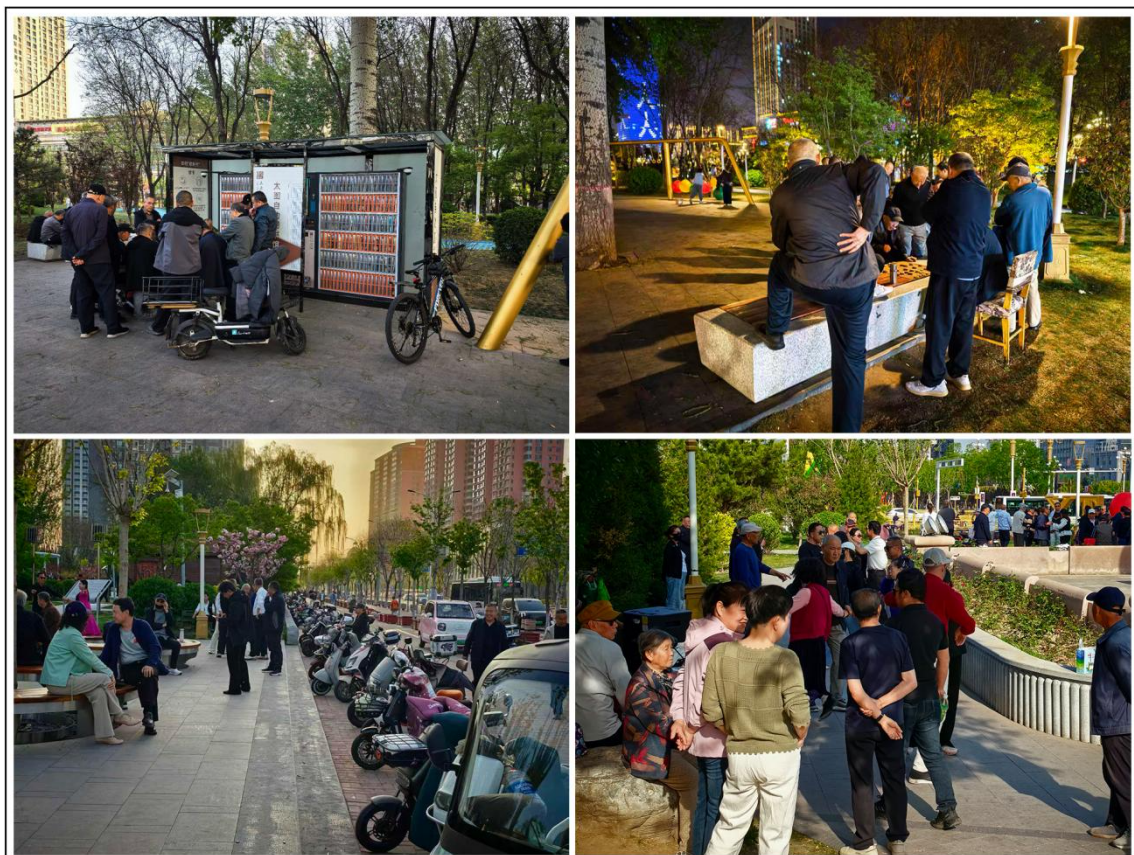
1. Introduction

As China's new urbanization process has fully entered the stage of stock improvement and quality enhancement, the improvement of urban public spaces has become increasingly important (Song, 2019). Since urban development entered this new stage, the urbanization rate has increased year by year and the scale of cities has gradually expanded. Increasing urban density has also increased residents' reliance on parks and public recreational spaces. While the quantity of urban public activity spaces has been largely guaranteed — with most urban communities and streets equipped with a corresponding number of green activity spaces (Zhou,

2005) — some facilities are rarely used, while others are used in unintended ways. Citizens have also reported that current squares can no longer meet their usage needs. Consequently, urban park planning is gradually placing greater emphasis on the quality of use rather than simply increasing the number of green spaces (Chen, 2013). As important venues for citizens' daily leisure, social interaction, physical exercise, nature education, and other diverse activities, urban parks also serve as vital spaces for residents to relieve physiological and psychological stress. The degree of adaptation between spatial supply and citizens' demands directly determines the service efficiency, vitality level, and residents' sense of happiness regarding their living environment.

At present, a large number of completed comprehensive parks in China, mostly influenced by early overall urban planning, tend to follow highly standardized layouts. Since these parks were mostly planned in a top-down manner without fully considering citizens' needs for activity spaces and facility configurations, many parks no longer match current patterns of use. Problems include: outdated and lagging park functional layouts, where the original single-function zoning struggles to meet the current the needs of different age groups and activity types; problems in circulation routes, entrances, and gathering areas, resulting in poor accessibility in some areas and the formation of large amounts of idle space; some central areas are overcrowded, while peripheral areas remain underused, with excessive pedestrian concentration in core areas while edge spaces and characteristic nodes remain long neglected, leading to low spatial resource utilization efficiency; and some facilities that are too old, not updated in time, or no longer needed by citizens, resulting in their misuse for other functions. Examples include drying quilts on parallel bars and climbing on benches for play, as shown in Figure 1. Parks often struggle to accommodate the needs of different user groups, making it difficult to achieve the construction goals of being age-friendly and shared by all.

Figure 1: Problem phenomena in Zefeng Park



2. Literature Review

2.1 Analysis of Multi-Subject Demands From the Perspective of Environmental Behavior

Environmental behavior is an interdisciplinary field focusing on the bidirectional interaction between people and the built environment. Its core objective is to explore the intrinsic relationship between human behavior patterns and spatial environment design. It breaks through the traditional design limitation of “form first” and provides architecture, planning, and landscape disciplines with a user-centered research paradigm and design logic.

In existing studies, Li Hao systematically examined the issue of vitality creation in urban public spaces from the perspective of environmental behavior. He pointed out that China’s public spaces suffer from problems such as emphasizing form over people-orientation, imbalanced scale, single functionality, and lack of participation. He proposed responding to the needs of multiple user groups in public spaces and satisfying different facility transformations under varying contexts (Li, 2008). Wang Yating and Wei Feiyu, from the perspective of multi-subject demands, took the Malianwa Street area in Beijing as a case study and used the PSPL survey method to explore the renovation and optimization of urban open spaces. The study addressed multiple subjects including residents, merchants, tourists, and managers, and put forward renovation suggestions, providing references for the public-oriented renovation design of street spaces (Wang, 2018). Duan Lingfei conducted field surveys, case studies, and quantitative analyses on Yunjing East Road in Tongzhou District. She proposed layout, integration, and refined design strategies oriented by diversified demands, and verified them using Yunjing East Road as an example, achieving the renewal of recreational spaces that are age-friendly and shared by multiple groups (Duan, 2020). Bao Yue took environmental behavior as the starting point of research, focusing on differences in demands among multiple subjects. She classified street users into four groups — children, youth, middle-aged, and elderly — revealing the differentiation in their behavioral and psychological needs, and proposed design strategies for diverse target groups to construct interactive street spaces that are suitable for all ages and shared by all (Bao, 2013). Luo Huan applied environmental behavior methods and studied community elderly care facilities in Chongqing from the perspective of diverse demand differences within the elderly group. The study identified behavior types of the elderly population and corresponding spatial characteristics, and proposed public space design strategies that match various behavioral needs of the elderly, also reflecting a response to multi-subject demands (Luo, 2020).

Existing literature has considered the demands of multiple subjects in urban environments regarding spatial places and facility configurations. However, there is still a lack of clear design-oriented and renovation strategies that can adapt to diversified design needs. Therefore, this study aims to construct multi-user groups under demand differentiation and spatial scenes under different time periods, so as to satisfy the scene transformation of urban public spaces in different spatiotemporal contexts. This will enable open spaces such as urban squares, parks, and green areas to meet citizens’ daily needs and achieve “people-oriented” planning and design in the new era.

2.2 The Explanatory and Analytical Role of Space Syntax in Urban Space

Space syntax is a spatial quantitative analysis theory and method proposed by British scholar Bill Hillier in the 1970s. Its core approach involves decomposing spatial structures through topological principles and using quantitative indicators such as integration, choice, and visual integration to reveal the intrinsic relationships between spatial morphology and human behavior as well as social activities. Compared with traditional qualitative approaches, space syntax enables a more measurable interpretation of spatial structure and human activities.

In the field of urban open space research, Chinese scholars have conducted extensive targeted explorations. Wu Jingjing used space syntax as a quantitative tool and employed Depthmap to perform axis and integration analyses on typical traditional villages in Hunan. She extracted the common spatial characteristics of traditional villages in Hunan and proposed targeted protection and optimization strategies. These studies also demonstrate the applicability of space syntax to small-scale spatial analysis (Wu, 2018). Sun Ying applied space syntax in her statistical analysis of the spatial morphology of Hakka traditional villages in Meizhou. With the assistance of Depthmap for qualitative research support, she analyzed the spatial topological structure of traditional villages and identified the unique characteristics of Hakka traditional village spatial morphology, providing references for the spatial morphology and regional facility layout of the target site in this study (Sun, 2015). Yang Tao used space syntax as theoretical support in his research on multi-scale urban spatial network morphology. By exploring the intrinsic logic and underlying mechanisms of multi-scale embedding,

convergence-divergence efficiency, network interweaving, and functional adaptation in urban spatial networks, he analyzed the causes of similarities and differences in spatial morphology across scales from communities to mega-regions, which further expanded the application of space syntax in studies of urban morphology in China (Yang, 2017).

Space syntax has been widely disseminated and applied worldwide, and foreign scholars have also begun related research and discussions. Ingy Ibrahim El-Darwish applied space syntax to the study of open activity spaces on university campuses, analyzing spatial integration and choice behavior, and ultimately proposed theoretical optimization decisions (El-Darwish, 2021). In addition, in the exploration of special urban public spaces, Reza Askarizad and Hossein Safari used space syntax methods in their study on the influence of semi-open spaces on the sociality of public libraries, ultimately concluding that semi-open spaces have a positive impact on the sociality of public libraries (Askarizad & Safari, 2020).

Existing studies have attempted to interpret urban spatial structures using space syntax, but they are mostly limited to certain districts or to spatial morphology and spatial utility at the city or regional scale. There is still relatively little use of space syntax to interpret facility configuration issues in small-scale urban squares and open spaces. Therefore, this study aims to extract spatial morphology indicators of Zefeng Park through space syntax analysis of integration and choice, and thereby identify suitable locations for facility configuration.

2.3 Research on Optimization and Renewal of Urban Public Spaces

In the context of urban renewal, street-corner parks along urban arterial roads, as core carriers of urban micro-renewal, have seen their renovation and optimization shift from traditional formal beautification to demand-driven adaptability improvement centered on multi-subject needs. Existing research and practical projects have conducted extensive explorations of renovation models.

In existing studies, Wang Bin addressed issues in Guangzhou's old station areas during the "large rail network" era, such as service-oriented tendencies, insufficient coordination of surrounding spaces, and hub congestion. He proposed theoretical measures including dissolving enclosed blocks, reducing the number of station sites at major road intersections, and increasing public space nodes in station areas, providing scientific references for the planning and construction of public spaces around rail transit in Guangzhou (Wang, 2018). In addition to proposing optimization and renovation strategies for single-attribute urban spaces at the theoretical level, existing research and practices have also put forward micro-renewal strategies and methods for urban spaces with historical and cultural backgrounds. Taking the micro-renovation project of Yongqing Fang in Liwan District, Guangzhou as an example, the "government-led, enterprise-implemented, resident-participated" renovation model was adopted (Tan et al., 2018). Measures such as preserving the original street layout, performing "minor repairs" on traditional buildings, renovating building facades, and transforming internal structures were used to renew the block (Chen, 2018). The Yihe Road Mansion District in Nanjing adopted measures including maintaining the original neighborhood layout and spatial morphology, renovating green landscapes, and dispersing population from core areas to protect and plan the historical character (Yu & Zheng, 2004). In Nantou Ancient City, Nanshan District, Shenzhen, strategies such as developing a creative design industry cluster, updating infrastructure, upgrading public supporting facilities, renovating and demolishing dilapidated buildings, and increasing landscape greenery were implemented. These measures helped preserve the historical character of the area while adapting it to contemporary urban use (Zhang, 2020), providing practical references for the adaptive design strategies in this study.

Current research on urban park renewal has yielded relatively rich achievements in reshaping landscape features of physical spaces, ecological restoration, and partial node renovations. However, there is limited specialized research on the systematic reconstruction of facility systems and refined optimization of spatial layouts. This study is grounded in the core requirements of urban public space optimization and renewal in the stock era. Aiming at prominent issues in Zefeng Park such as mismatch between facility supply and demand, fragmented spatial functions, and poor synergy between facilities and space, it proposes optimization and renewal strategies. The study therefore focuses on how facility layout and spatial organization can be better coordinated in the renewal of existing urban parks.

3. Research Object and Methods

3.1 Typicality of the Research Object

Zefeng Park is located at the northwest corner of the intersection of Yingze Street and Qianfeng North Road in Wanbailin District, Taiyuan City, Shanxi Province. Covering an area of approximately 23,000 square meters, it is the result of the renovation and upgrading of the former Taiyuan Triangle Leisure Garden. It is one of the 12 street-corner gardens and, together with other parks (such as Chunju Garden and Jinyang Garden), forms an urban open space network. Zefeng Park was designed as a composite urban green space intended to accommodate leisure, recreation, and everyday social interaction, while promoting public interaction and activating the vitality of urban street corners. Within a 1-kilometer radius around the park, there are 3 administrative office buildings, 2 commercial complexes, 1 primary school, 1 university, and 4 residential communities. The service population covers office workers, students, elderly residents, and parent-child families, with diverse daily pedestrian sources, as shown in Figure 2.

Figure 2: Panoramic View of Zefeng Park



Figure 3: Facility Locations and Current Status Map of Zefeng Park



This study divides Zefeng Park into 10 modules, basically covering the public infrastructure and important spaces within the park, as shown in Figure 3:

Distribution squares are divided into four types, mainly located in the central and eastern parts of Zefeng Park. These spaces connect the park with the surrounding road system and handle most pedestrian movement entering the site. Among them, the Distribution Square (Main Entrance) features the “Zefeng Park” signage and is equipped with a small number of resting seats. The Distribution Square (Circular Flow) is relatively unique, acting as a corridor connecting the main entrance distribution square and the sculpture distribution square, with circular seating arranged. The Distribution Square (Sculpture) is a relatively open and spacious area. The Distribution Square (Multi-Seating) is equipped with six sets of small-scale circular resting seats and one set of large-scale circular resting seats. These two areas frequently host square dance activities and are among the most crowded areas during peak usage hours. In addition, the area enclosed by these four distribution squares forms the lakeside landscape zone, which contains a wooden bridge and a lakeside promenade.

Activity squares are divided into two types, mainly located in the central and western parts of Zefeng Park. The central activity square is equipped with various children’s play facilities and a small number of irregularly shaped seats, serving as the primary entertainment space for children. The western activity square (Self-service Library) is equipped with self-service book borrowing and returning equipment, upper limb traction fitness devices, and multiple seats. As a result, this area is used mainly by middle-aged and elderly visitors.

The public restroom at the southwest corner of Zefeng Park is separately designated as a special public facility area. The region enclosed by the restroom and the two activity squares forms the internal hub area, which serves as the core of internal park circulation. The easternmost external hub area features a circular promenade that carries incoming urban pedestrian flow.

Zefeng Park is a typical urban park that radiates to multiple functional blocks around it and meets the usage needs of diverse surrounding groups. For example, nearby residents come for walks, working groups nearby use it for lunch breaks and meals, children from nearby kindergartens come to play accompanied by parents after school, and community residents gather to dance square dances or play chess. Different groups exhibit differences in usage time, activity types, and spatial requirements. This necessitates a systematic investigation and in-depth analysis of its actual usage conditions, so as to propose targeted adjustment, adaptation, renewal, and optimization strategies, thereby enabling the park to better exert its comprehensive benefits as an urban park.

3.2 Analysis of Park User Demands Based on Environmental Behavior

This study employed a questionnaire survey method to investigate Zefeng Park on Yingze Street in Taiyuan. The survey was conducted within the park from March to April 2026, covering different usage periods including weekdays and weekends, as well as daytime and nighttime. Questionnaires were distributed to actual users such as park visitors, nearby residents, office workers, and students. A total of 99 questionnaires were distributed, with 93 valid responses recovered, yielding an effective recovery rate of 93.9%. The sample size was considered sufficient to reflect the park’s general patterns of use.

The questionnaire is divided into three core sections: “Basic Information,” “User Behavior Analysis,” and “User Satisfaction Analysis.” Together, these sections focus on three issues central to environmental behavior research: “who is using the park,” “how people are using the park,” and “how people feel about the park.”

The questionnaire focuses on people’s spatial demands and the current status of usage behavior. The “A-P-T” method (Activity-Place-Time) was used to inquire about, describe, and statistically analyze the current usage of facilities in Zefeng Park. Questionnaire surveys combined with semi-structured interviews were adopted to obtain users’ demands for ideal urban public spaces. The questionnaire also inquired about satisfaction with the current situation and suggestions for park renovation, in order to better understand users’ actual needs and opinions regarding park renewal (see the questionnaire in the Appendix).

3.3 Park Spatial Structure Analysis Based on Space Syntax

This study used Depthmap software to construct a space syntax model of Zefeng Park with a 1m×1m grid precision. The axial analysis method was employed to quantitatively analyze the internal spatial structure of the park, with a focus on the two core indicators: integration and choice.

The axial model is one of the most commonly used analytical models in space syntax research. Its core idea is to use the fewest and longest straight lines (axes) to abstractly represent human visual accessibility and movement possibilities within space. By analyzing topological relationships, the model can be used to examine how spatial structure influences movement and human activity.

Integration reflects the degree of aggregation or dispersion between a particular node and all other nodes in the spatial system. Higher integration values generally indicate spaces that are easier to access and more likely to attract pedestrian activity. It can accurately identify core activity areas within the park and areas with potentially low pedestrian concentration. Choice measures the probability that a particular space is selected as the shortest path between any two points. A higher value indicates stronger transportation hub functionality of the space and can clearly reveal the organization of main circulation routes and the distribution of secondary pathways within the park. Using these two indicators together makes it possible to assess both spatial accessibility and circulation efficiency within the park.

4. Research Results

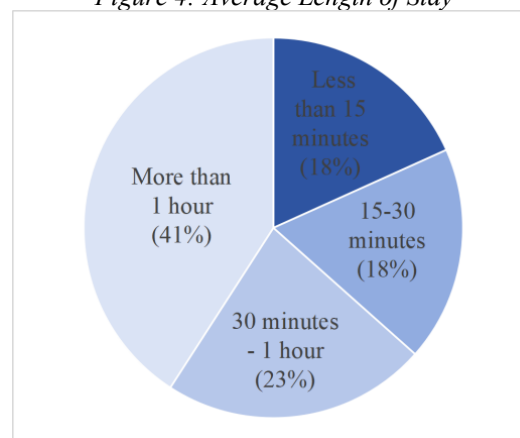
4.1 Analysis of Demand Differentiation Among Multiple Subjects

According to the survey statistics, the age structure of users in Zefeng Park is as follows: elderly (41.9%), middle-aged (22.6%), adolescents (19.4%), and children (16.1%).

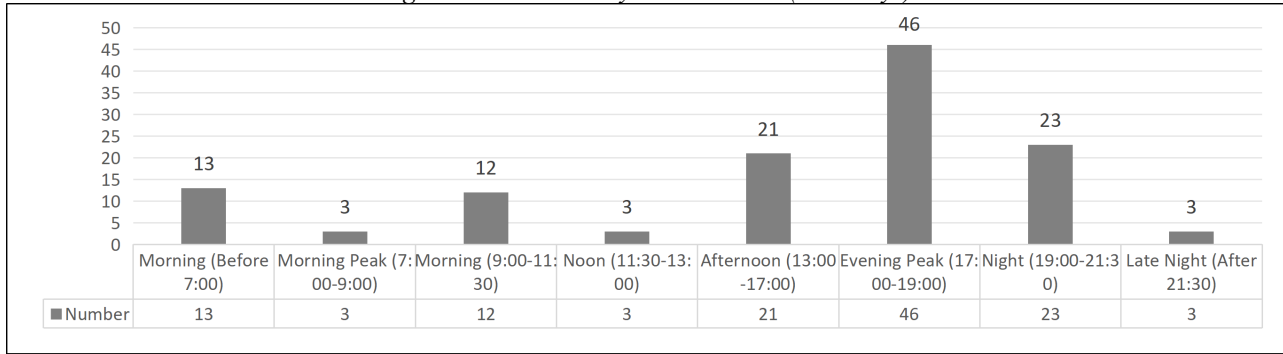
(1) Average Length of Stay and Main Activity Times

The survey found that 41% of users stayed in Zefeng Park for more than 1 hour on average — the largest proportion. The proportions of users staying less than 15 minutes and 15–30 minutes were the smallest, both at 18%. The elderly group had the longest average stay, mostly exceeding 1 hour, while other groups rarely stayed for more than 1 hour, as shown in Figure 4.

Figure 4: Average Length of Stay



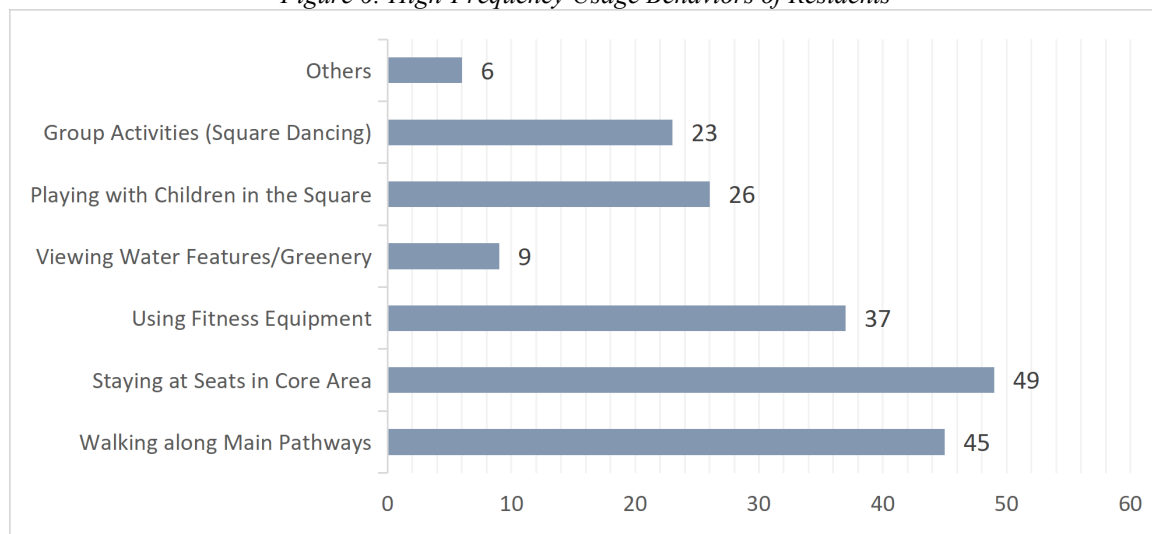
During weekdays, park use peaked between 17:00 and 19:00, as many middle-aged and younger users visited the park after work. This was followed by two other peak periods in the afternoon (13:00–17:00) and at night (19:00–21:30). Additionally, a small morning peak occurred before 7:00, mainly due to elderly people engaging in morning exercises (Figure 5). On non-workdays, the distribution characteristics of user groups were generally consistent with weekdays, except for an increase in the number of people during peak periods.

Figure 5: Main Activity Time Periods (Weekdays)

(2) High-Frequency Usage Behaviors and Facility Usage Frequency

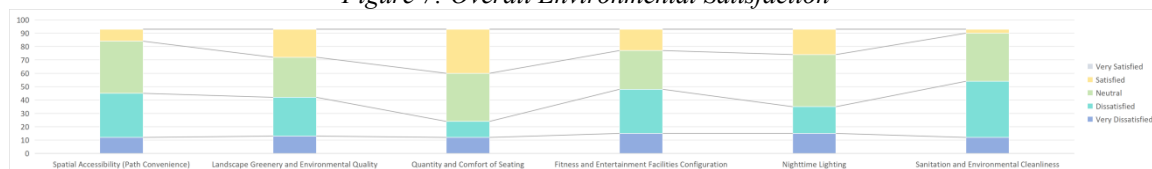
As shown in Table 2, according to the survey data, the high-frequency behaviors of users in the park are primarily staying on seats in the core area, walking along the main paths, and using fitness equipment. This is followed by collective activities and playing with children in the square. Very few people enjoy the water features or greenery. Users of all age groups use the seats and fitness equipment in the park. Almost only the elderly participate in collective activities such as square dancing, while middle-aged people often bring children to play.

Residents most frequently use square spaces. Very few people use the self-service library and public restrooms, while other facilities such as fitness equipment are used to varying degrees.

Figure 6: High-Frequency Usage Behaviors of Residents

(3) Satisfaction and Expectations

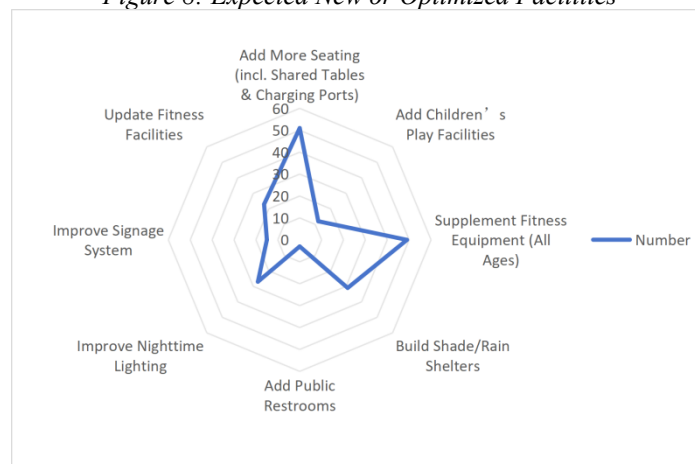
The survey on residents' overall environmental satisfaction with Zefeng Park revealed that residents are relatively satisfied with basic living functions such as landscape greenery, sanitation, and environmental cleanliness. However, satisfaction with public service facilities is low, including spatial accessibility, the quantity and comfort of seating, the configuration of fitness and entertainment facilities, and nighttime lighting, as shown in Table 3. The results suggest that existing public spaces are generally more successful in providing greenery than in meeting users' needs for facilities and activities.

Figure 7: Overall Environmental Satisfaction

During interviews with residents, they reported that nearby residents regularly come to the park after dinner for walking, exercising, and square dancing, while residents from surrounding areas occasionally visit for sightseeing. Regarding their own usage, the existing facilities are relatively complete and are generally sufficient for everyday use. However, residents also provided suggestions regarding fitness facilities, such as their concentration in one area, which leads to insufficient supply during peak hours; insufficient lighting in the children's activity area at night, making the ground hard to see; and occasional parking in the square that interferes with square dancing activities.

Among all optimization options, the highest number of respondents (51 people) expressed the strongest demand for “adding more seating (including shared tables and charging ports).” The second strongest demand was “supplementing fitness equipment (suitable for all age groups),” with 49 people. The next moderately demanded items were improving nighttime lighting, building shade/rain shelters, and updating fitness facilities, each supported by 25–30 people. The remaining three items had lower priority and support: improving the signage system (15 people), adding children's play facilities (about 12 people), and adding public restrooms (fewer than 10 people). This suggests that users are relatively satisfied with the current signage system, children's facilities, and restroom provision. And the urgency for their optimization is much lower than that for core recreational and fitness facilities, as shown in Figure 8.

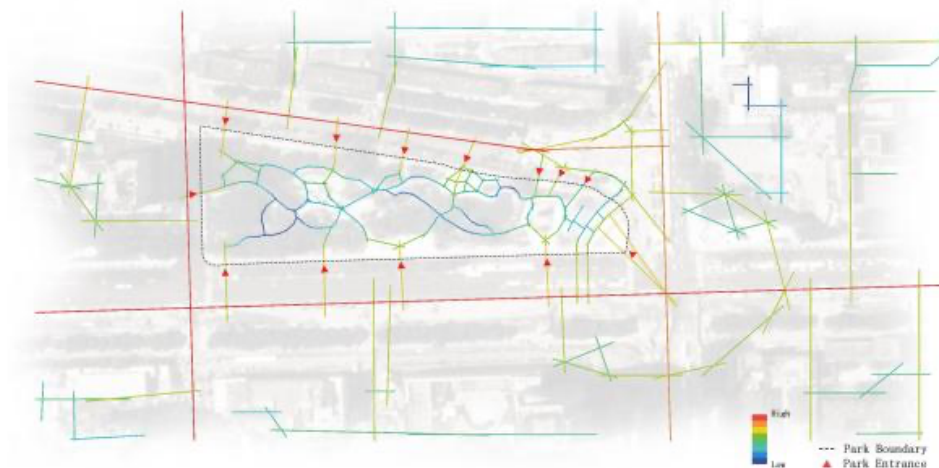
Figure 8: Expected New or Optimized Facilities



4.2 Space Syntax Analysis Results

4.2.1 Integration Results

Figure 9: Integration Analysis of Zefeng Park



The space syntax integration analysis map of Zefeng Park was generated based on the axial model, visually presenting the differences in accessibility and publicity among various nodes in the spatial system. Red represents the highest integration, while blue represents the lowest integration, as shown in Figure 9.

Overall, integration values are higher in the eastern and southern parts of the park and lower in the western interior areas. The integration of urban roads surrounding the park is generally higher than that inside the park. In particular, the main urban arterial road on the south side adjacent to Yingze Street shows bright red, suggesting that these roads are closely connected to the surrounding urban network and serve as the primary source of urban pedestrian flow entering the park.

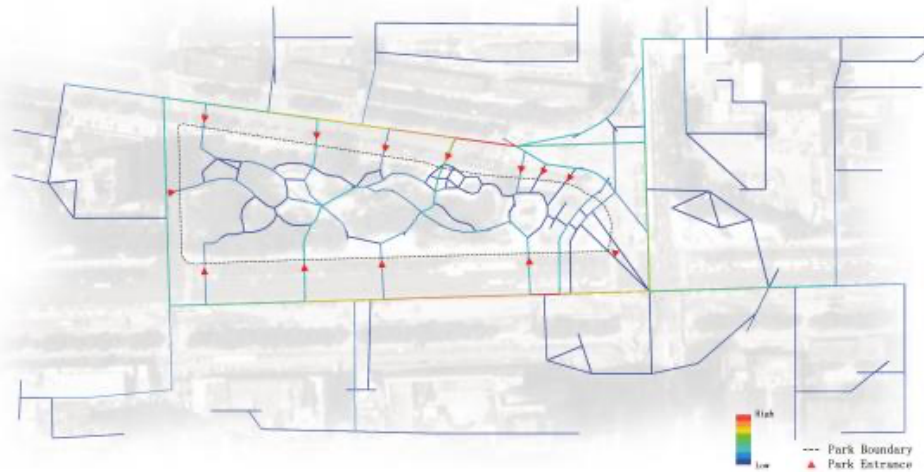
Inside the park, the axis of the Distribution Square (Sculpture) area appears bright yellow, representing one of the spaces with the highest integration in the park. The external hub area to the east of the Distribution Square (Sculpture) and the Distribution Square (Main Entrance) to the south follow closely, with yellow-green axes, making these areas secondary activity centers within the park.

The activity squares in the central part of the park and the internal hub area show moderate integration levels, with green axes. The activity square area is the largest hard-surface activity space in the park and is mainly used for collective fitness and square dancing. This area attracts a relatively high level of pedestrian activity while remaining less affected by through-traffic, making it an ideal dynamic activity space.

The western area of the park has significantly lower overall integration than the eastern area. In particular, the Activity Square (Self-service Library) on the far west side and the Special Public Facilities area in the southwest corner mostly show deep blue axes, indicating they have the lowest integration in the park. This means these areas have relatively weak connections with other spaces in the park, poor accessibility, and relatively low pedestrian activity.

4.2.2 Choice Results

Figure 10: Choice Analysis of Zefeng Park



The space syntax choice analysis map of Zefeng Park was generated based on the axial model, showing the likely distribution of pedestrian movement within the park and its surrounding streets. Red represents the highest choice, while blue represents the lowest choice, as shown in Figure 10.

Overall, the choice distribution of Zefeng Park shows a distinct pattern of “high in the east and low in the west” and “high at boundaries and low in the interior.” The roads on the north and south sides of the park exhibit the highest choice values, with bright red axes. These areas are part of the urban arterial roads, carrying large volumes of through-traffic while also serving as the concentration zone for the park’s main entrances and exits. Urban pedestrian flow and internal park flow converge and overlap here, forming the most important transportation hub of the park. The choice values along the northern and southern boundaries decrease gradually from east to west, with colors transitioning from red to yellow and then green, indicating that traffic volume decreases as distance from the main entrance increases.

The pedestrian paths inside the park generally have lower choice values than the boundary roads, showing a clear hierarchy of “high on main axes and low on secondary paths.” The activity square connecting the east and west sides is the path with the highest choice value inside the park, with cyan-green axes, significantly higher than surrounding branch paths. It connects the Distribution Square (Main Entrance), lakeside landscape area, activity squares, and internal hub, serving as the main east-west circulation artery of the park.

The western area of the park has slightly lower choice values overall than the eastern area. In particular, almost all axes in the far western region appear deep blue, indicating that this area is rarely selected as the shortest path between any two points, resulting in very low pedestrian throughput and resulting in a relatively quiet and less frequently used area.

5. Research Discussion

Based on residents’ needs, spatial analysis, and the results of the space syntax study, several targeted strategies are proposed to improve the current mismatch between facility distribution and actual use in Zefeng Park, as shown in Figure 11.

Figure 11: Hierarchical Optimization Location Map of Zefeng Park



(1) Facilities That Urgently Need to Be Added

For the elderly group, fitness equipment suitable for seniors should be supplemented and placed in highly accessible areas such as squares and lakeside spaces. At the same time, a time-sharing control mechanism for square facilities should be established to clear non-fixed installations during morning exercise peak hours, so that sufficient open space can be reserved for morning exercises, Tai Chi, and square dancing.

For children, age-appropriate children’s play and exploration facilities should be added in highly accessible areas with low through-traffic potential, such as the central square, along with accompanying parent resting seats to accommodate both children’s activities and parents’ need for supervision and rest.

For young commuters, light-office users, and leisure groups, integrated resting facilities with shared tables, USB ports, and wireless charging interfaces should be added in high-traffic-potential areas such as the shaded spaces in the lakeside landscape zone and along the southern street-facing edge of the park, creating outdoor spaces that support resting, short-term work, and leisure activities.

In addition, to meet all-day usage demands across all age groups, prefabricated shade and rain shelters should be added in distribution squares, all-age fitness zones, and children's play areas to improve the park's usability under different weather conditions.

(2) Facilities That Urgently Need to Be Updated

Although the existing fitness equipment has not yet reached its safety service life limit, some equipment shows surface rust and loose components, posing potential safety hazards. Moreover, the variety of equipment is limited and cannot cover the daily fitness needs of all age groups. This study therefore suggests replacing outdated and potentially unsafe fitness equipment. At the same time, following the principle of age-friendliness, dedicated rehabilitation fitness zones for the elderly and activity zones for children should be established in different areas, with fitness equipment updated to suit different age groups.

For the lighting system, all aging and damaged streetlights should be comprehensively replaced. Additional lighting fixtures and lawn lamps should be added in activity spaces such as shaded walkways, children's activity squares, and fitness equipment areas. The lighting system could also be upgraded with smarter controls for different time periods and usage conditions. In addition, the park's panoramic guide signs, path direction signs, safety warning signs, and barrier-free service signs should be updated to build a clear and comprehensive signage system.

(3) Facilities That Urgently Need Relocation

The existing self-service library equipment is located in the activity square on the northwest side of the park, far from the main entrance and school areas. The current location has poor accessibility and limited pedestrian flow, resulting in frequent idleness of the facility and a supply-demand mismatch. According to the research results, the self-service library should be relocated as a whole to the eastern side of the Distribution Square (Sculpture). This area is adjacent to the external hub and activity squares, serving as a core hub for pedestrian circulation in the park with relatively high accessibility and through-traffic potential. Resting seats and shade facilities can be added around it to encourage more frequent use of the facility.

6. Conclusion

This study used environmental behavior theory and space syntax to examine how different groups use public space in Zefeng Park. By combining analyses of user demand and spatial layout, it proposes directions and suggestions for the renewal and optimization of infrastructure configuration. It aims to create a public space that better responds to the needs of different users and provides a reference research method and empirical case for facility configuration and renovation of similar urban public spaces. This study also has certain limitations. The main ones are: the relatively small scale of the study site, analyzed only as an independent space without exploring its interaction with surrounding urban spaces; and the lack of consideration for dynamic changes in user behavior under different seasons and weather conditions. Therefore, the findings mainly reflect the current use conditions of the park during the study period. Future research will incorporate more urban public spaces to explore the theoretical framework of facility configuration under demand differentiation and spatial adaptation, enrich the research database, present more precise urban public space renovation solutions, and provide reference for future people-oriented urban public space design.

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Conflicts of Interest

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