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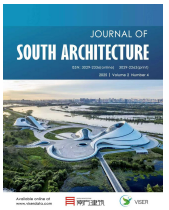

"Seeing the City from a Meter Height": Evaluation of Enjoyment of Comprehensive Parks from a Child-Friendly Perspective

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ABSTRACT: A green space for children's outdoor activities is an important measurement indicator for building a child-friendly city. The construction of child-friendly cities in China has gradually shifted from theoretical research to practical exploration. As an important public space for urban children to have contact with nature and engage in outdoor activities, comprehensive parks should give special consideration to the needs of children. Children's behavioral psychology is closely related to enjoyment in the activity space. Studying the relationship between children's activities and enjoyment of parks from the perspective of behavioral psychology corresponds with the child-friendly city construction principle of "seeing the city from a meter height". This evaluation and analysis of enjoyment in comprehensive parks is expected to provide a useful reference for the design optimization of child-friendly comprehensive parks.

Based on determined behavioral and psychological characteristics of preschool children, the factors influencing enjoyment in comprehensive parks are divided into three types according to the behaviors and psychology of preschool children, including the perceptual type, sports type, and social type. Based on relevant studies, 29 representative sample sites were chosen in the Pengpu Four Seasons Park in Shanghai for field survey using the Public Space & Public Life (PSPL) survey method, behavior mapping, questionnaire survey, Analytical Hierarchy Process (AHP), and other methods.

To screen evaluation factors that influence enjoyment of comprehensive parks, an evaluation model for enjoyment of comprehensive parks was constructed. Enjoyment of comprehensive parks was evaluated from five dimensions, including space, facilities, plant configuration, waterscape design, and landscape culture. Differences in enjoyment among the same type of sample sites were analyzed and problems in enjoyment of comprehensive parks were explored. Finally, the corresponding optimization suggestions were proposed to solve shortcomings—such as the landscape and space sites not being novel enough, the science popularization of natural education needing to be improved, and the existence of single interaction modes— aiming to enrich landscape design strategies of comprehensive parks from the perspective of children.

Based on the status and enjoyment evaluation of comprehensive parks, some optimization suggestions were proposed in combination with children's behavioral and psychological needs. Based on the results of a field survey and interviews with parents, the basic principle of children participating in construction under the premise and guarantee of their safety was proposed. It is suggested that children's ideas be incorporated throughout the construction of parks. To better meet the behavioral and psychological needs of children, some specific suggestions to optimize the enjoyment of comprehensive parks were proposed according to the results of evaluating landscape elements in different dimensions. For example, the space site should meet the needs of activities, facilities should cooperate with natural elements, and landscape design should promote perceptual interaction. This study has some innovations: for example, typical sample sites were screened and classified to realize the modularization and visualization of space studies. Furthermore, based on existing studies, the degree of naturalness of materials was introduced into the enjoyment evaluation system of

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comprehensive parks, which supplements existing studies. However, this study still has some limitations. It is difficult to get rid of subjective factors in surveys of the activity preferences of children. Furthermore, only one park was chosen as the research object, but commonalities and differences in parks in different regions have not been explored deeply. This will be discussed in the next stage.

KEY WORDS: comprehensive parks; preschool children; behavioral psychology; enjoyment; evaluation

By the end of 2021, China had a child population of 263 million, accounting for 18.6% of thenational population[1)]. In October 2021, the National Development and Reform Commission, together with 22 other ministries and commissions, issued the *Guidelines on Promoting the Construction of Child-Friendly Cities*, which further proposed to formulate construction standards for various child-friendly spaces and facilities in cities to effectively guarantee children's rights to survival, development, protection, and participation[2)].

The construction of a child-friendly city in Shanghai has begun. In 2021, the Shanghai Municipal People's Government issued the *14th Five-Year Plan for the Development of Women and Children in Shanghai*, which pointed out the need to attach importance to environmental optimization and create child-friendly communities[3)]. In 2022, the *Implementation Plan for the Construction of a Child-Friendly City in Shanghai* was issued, proposing 20 specific construction tasks in 5 aspects to build a child-friendly city and promoting the concept of "seeing the city from a meter height" to be integrated into the entire process of urban development[4)].

Creating green spaces that meet the needs of children's outdoor activities is a key indicator of a child-friendly city [1]. The design of urban parks is often based on the perspective of adults, neglecting the behavioral and psychological needs of children, resulting in a lack of appeal to children [2]. Therefore, from the perspective of children's behavioral psychology, it is urgent to explore enjoyable activity spaces in comprehensive parks that meet the needs of contemporary children and provide children with friendly spaces for perception, movement, and socialization [3].

Existing research on children's activity-oriented outdoor spaces mainly focuses on children's usage preferences [4], the safety of the space, and its naturalness. In terms of spatial elements, the main focus is on plant landscape configuration, children's activity facilities, ground paving, and color schemes [5]. Research methods for outdoor activity spaces from a child's perspective are also being improved: Existing studies have combined questionnaire surveys with other methods to explore the influencing factors of children's environmental perception [6], including using methods such as content recognition, photo projection, and behavioral annotation [7]. The relationship between preschool children's behavioral psychology and space site design has received special attention. The research findings cover various spatial types at different scales, including community parks, comprehensive parks, and children's parks. From the perspectives of children's perception and needs [8], scholars explore the interactive behaviors of preschool children with the space sites, including their safety [9], playability [10], enjoyment [11], and social interaction [12].

Research on the enjoyment of space sites mainly focuses on design methodology [13], with less systematic analysis and post-use evaluation. Through the analysis of children's play spaces and play behaviors, scholars explore the factors that affect the enjoyment from perspectives such as natural factors, the introduction of the spirit of exploration, terrain shaping, and sensory engagement [10], and propose design strategies focusing on space, facilities, and terrains [14]. Evaluation-oriented studies select evaluation factors related to activity space, play facilities, plant configuration, hardscape, and landscape culture to systematically analyze the space site's enjoyment and conduct post-use evaluation, and propose corresponding countermeasures.

In summary, existing research mainly focuses on the activity preferences of preschool children and the design approaches for enhancing the enjoyment of outdoor spaces, while post-use evaluation still needs further in-depth exploration. Therefore, by comprehensively utilizing

methods such as the PSPL survey method, behavior mapping, questionnaire survey, and Analytical Hierarchy Process (AHP), this study evaluates and analyzes enjoyment of space sites in a comprehensive park from the perspective of the behavioral psychology of preschool children, taking Shanghai Pengpu Four Seasons Park as an example, from five dimensions: space, facilities, plant configuration, waterscape design, and landscape culture. The aim is to provide useful insights for optimizing the design of child-friendly comprehensive parks.

1 Research subjects and methods

1.1 Researchsubjects

Preschool children are children aged 3 to 6 years who have not yet reached the age of school enrollment [15]. Infants and toddlers are too young, leading to excessive reliance on their parents for outdoor activities. School-aged children, burdened by academic workloads, lack time for play outside of school. As a result, preschool children constitute the primary child user group in comprehensive parks.

Enjoyment is a landscape feature that uses various methods to attract children's attention and generate strong interest in participation [16]. A play space characterized by enjoyment is often full of tension and fun, attracting users' attention and fostering activities in the space [8].

Taking into account the functions and facilities of the parks, a preliminary screening was conducted on 144 comprehensive parks within the outer ring road of Shanghai, and six comprehensive parks with clearly defined children's activity areas were selected (Figure 1). Pengpu Four Seasons Park, situated in Jing'an District, Shanghai, features four themed gardens dedicated to spring, summer, autumn, and winter (Figure 2). The park covers an area of 9.1 hm^2, with a children's activity area of 0.18 hm^2. It is the largest park in a residential area in the central urban area of Shanghai[5]. The park has a complete spatial composition, a natural layout, a large daily user base, and a high utilization rate, making it suitable for evaluating the park's enjoyment factor.

Figure 1 Distribution of comprehensive parks with clearly defined children's activity areas within the outer ring road of Shanghai

Figure 2 Plan view of Pengpu Four Seasons Park

1.2 Research methods

1.2.1 Questionnaire survey

(1) Questionnaire content. The questionnaires were distributed over four weekends in September 2022, with a total of 200 copies distributed. A total of 196 questionnaires were collected, with a response rate of 98%; 190 questionnaires were valid, with an effective rate of 95%. The question is divided into three parts and is distributed to children aged 3-6 and their accompanying parents. The questionnaire consists of three parts. Part 1 is a preference selection question, which includes children's preferred outdoor play space types, activity formats, and activity

types, as well as their desired improvements to the park to enhance play experience. The results of the preference survey are combined with observational records of children's behavior. Part 2 is a rating scale, which evaluates three qualitative factors of the overall park's appeal: the facility color aesthetics (C4), the comfort of landscape features (C7), and site theme storytelling (C13). A Likert scale is used, and to help children better understand, the importance is converted into a level of liking, using five levels: very dislike, dislike, neutral, like, and very like. Part 3collects basic information about the survey participants, including the frequency and duration of children's visits to the park, as well as the relationship between the accompanying parents and children.

(2) Reliability test. The reliability of the scale and data was primarily assessed using Cronbach's α as the main testing method. Analysis showed that the overall Cronbach's α value of the scale was 0.930. Among them, the α value of the facility color aesthetics C4 was 0.865, the α value of the comfort of landscape features C7 was 0.933, and the α value of the site theme storytelling C13 was 0.941, indicating that the questionnaire has good overall reliability.

1.2.2 PSPL survey method

The PSPL (public space & public life survey) method focuses on people and their activities in public spaces. It consists of three parts: public space analysis, public space life survey, and summary and recommendations. Four main methods complement each other: map marking, on-site counting, field investigation, and interview [17]. Considering the large number of child tourists during holidays, and to facilitate the survey, the time was selected from four weekends in September 2022, totaling eight days. Three time periods with the largest number of child tourists were selected: morning (10:00-12:00 am), afternoon (14:00-16:00 pm), and early evening (16:00-18:00 pm). On the one hand, the survey on children's activities served as an important basis for the preliminary designation of 29 activity sites and the selection of evaluation factors. Activity preferences were investigated using behavior mapping, with records taken every half hour and each observation lasting 10 minutes. Record the children's activities (such as running, jumping, kicking a ball, taking photos, etc.) and the distribution of the number of children within 10 minutes; on the other hand, conduct a spatial environment survey as a data source for later evaluation. Based on satellite maps, we conducted on-site surveys of the current status of 29 activity sites, including site layout, facilities (play equipment, rest seats, supporting service facilities, etc.), and spatial characteristics (size, paving patterns, terrain variation, plant enclosure, etc.). Based on the survey results, the characteristics of each activity site were statistically analyzed. At the same time, random interviews were conducted with accompanying parents to understand their attitudes toward enjoying comprehensive parks and the perceived influencing factors (such as facilities and environmental conditions). These interviews supplemented the survey, providing substantial data support and a solid descriptive foundation for children's evaluation of the enjoyment of comprehensive parks.

1.2.3 Cat's Eye Quadrant mini program

Based on image recognition technology, the location is located, photos are taken, and indicators are calculated within the program[18]. Using the WeChat mini-program "Cat's Eye Quadrant", photos of 29 sample sites were taken and uploaded to mark the activity space locations accurately. The mini program automatically calculated the visible green index of each node, which corresponded to the uploaded on-site photos [19].

1.2.4 Correspondence analysis

Using SPSS software, based on the decomposition and contribution of chi-square statistics, an interactive contingency table was constructed for the types of enjoyment activities and environmental factors, and a two-dimensional correspondence diagram was generated in the form of points to intuitively reveal the correspondence between the three enjoyment activities and the five environmental factors [20].

2 Determination of evaluation factors of enjoyment based on the behavioral psychology of preschool children

2.1 Behavioral and psychological characteristics of preschool children

Psychologist Jean Piaget's theory of cognitive devel-

opment refers to the preschool stage as the "intuitive operational stage". Children at this stage exhibit a certain degree of independent activity and thinking ability, and their emotions and cognitive development progress rapidly [21]. This is mainly reflected in the development of cognition, emotion, sociality, and personality (Table 1).

Table 1 Behavioral and psychological characteristics of preschool children

Cognitive development	Utilize various senses to better form concrete image perception.
Emotional development	Generate emotional responses and store them in memory. In this process, the most immediate emotions that arise are curiosity and a sense of mystery.
Social development	Behavioral activities and social interactions, among which peer interaction is a very common social activity for preschool children.
Personality development	Children develop emotions and personalities through activities, which prevents them from becoming withdrawn.

2.2 Types of enjoyment activities

Play is an integral part of children's development. Rubin developed the Play Observation Scale (POS) to describe game levels: social play behavior and cognitive play behavior, where social play behavior emphasizes collective participation and cognitive play behavior emphasizes construction and exploration [22]. The enjoyment activities for preschool children in comprehensive parks are conducted in the form of games. Based on Rubin's Play Observation Scale and combined with field research, the activities are supplemented with physical play behaviors, emphasizing physical training. Finally, the enjoyment activities that children engage in at the park were screened and summarized (Figure 3) and categorized into three types: movement-based, perception-based, and social.

Figure 3 Types of enjoyment activities

2.3 Types of enjoyment elements in comprehensive parks

Based on the behavioral and psychological characteristics and activity types of preschool children, we analyzed the environmental factors that influence the occurrence of enjoyment activities, established a connection between enjoyment activities and space sites, and classified the enjoyment elements of comprehensive parks into perception-based, movement-based, and social types (Table 2).

Table 2 Types of enjoyment elements in comprehensive parks

Perception-based enjoyment elements	Including perceptual activities in both natural and artificial environments, as well as artificially designed facilities that trigger children's senses.
Movement-based enjoyment elements	Facilities or sites that meet the needs of movements can encourage children to participate in sports and improve their physical fitness.
Social enjoyment elements	Environmental factors that promote parent-child interaction or peer interaction, including space sites and activity facilities.

2.4 Evaluation factors of enjoyment of comprehensive parks

Based on preliminary literature screening, questionnaire statistics, and field research, the environmental factors affecting the enjoyment of comprehensive parks are ultimately categorized into 14 evaluation factors across five dimensions: space, facilities, plant configuration, waterscape design, and landscape culture (Figure 4).

3 Construction of an evaluation system of enjoyment

3.1 Classification ofactivity sites

Based on spatial characteristics, the activity sites for preschool children in the park are classified into different types (entrance, park path, plaza, children's activity area, fitness area, pavilion, etc.). Based on the road network, the zones were numbered, and the types of sites in each zone were counted, totaling seven categories and 29 activity sites (Figure 5).

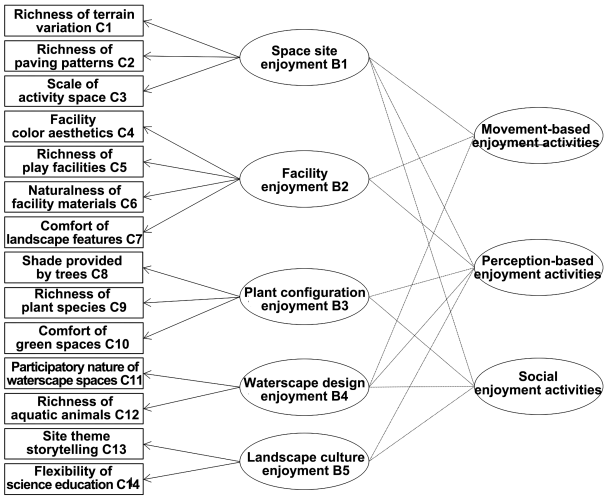

Figure 4 Evaluation factors of enjoyment

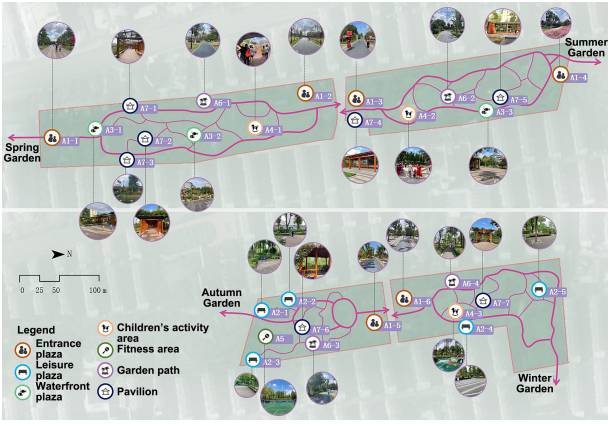

Figure 5 Plan distribution of activity sites in the comprehensive park

3.2 Evaluation model construction

3.2.1 Single-factor assignment criteria

It is divided into three layers: the target layer, the criterion layer, and the factor layer. The target layer is the evaluation of enjoyment of comprehensive parks based on preschool children's behavioral psychology. The criterion layer comprises five design dimensions that impact the enjoyment of comprehensive parks. The factor layer refers to 14 evaluation factors that affect enjoyment from different dimensions. The environmental factors affecting the enjoyment of comprehensive parks are divided into 14 evaluation factors from five dimensions: space, facilities, plant configuration, waterscape spaces, and landscape culture. The three qualitative evaluation factors include: the facility color aesthetics (C4), the comfort of landscape features (C7), and the site theme storytelling (C13). For qualitative evaluation factors, a Likert scale scoring method was used to assign values, with values of 5, 4, 3, 2, and 1 points assigned from highest to lowest. The 11 quantitative evaluation factors include: richness of terrain variation (C1), richness of paving patterns (C2), scale of activity spaces (C3), richness of play facilities (C5), naturalness of facility materials (C6), shade provided by trees (C8), richness of plant species (C9), comfort of green spaces (C10), participatory nature of waterscape spaces (C11), richness of aquatic animals (C12), and flexibility of science education (C14). For quantitative evaluation factors, their scores are mapped to 1-5 points according to specific data standards (Table 3).

3.2.2 Construction of comprehensiveevaluation models

Ten experts, scholars, and children's space designers were invited to fill out a judgment matrix. Each factor was compared pairwise using a scale of 1 to 9 to quantify the relative importance of the two factors. Use the YAAHP software to calculate the weight scores. After obtaining the weight results, CR= CI/RI is used to perform a consistency test on the weights of each criterion layer and factor layer to ensure logical consistency and model validity (CI < 0.1). The final ranking weights of index factors for evaluating the enjoyment of comprehensive parks, based on the behavioral psychology of preschool children, were determined (Table 4).

Based on the weights of the factors at each level determined above, the comprehensive evaluation model for the enjoyment of comprehensive parks is as follows:

$$B = \sum_{i=1}^{n} a_i r_i$$

In the formula: B is the comprehensive evaluation value of the enjoyment of comprehensive parks; B is the weight of the evaluation factors; r_i is the rating score of the evaluation factor.

3.2.3 Classification of enjoyment levels

Based on the evaluation scores, the enjoyment level of comprehensive parks is divided into four levels: Level I (Excellent), Level II (Good), Level III (Average), and Level IV (Poor) (Table 5), which reflects how well comprehensive parks meet the enjoyment needs of preschool children.

Table 3 Definition of evaluation factors

Target layer	Criterion layer	Factor layer	Meaning and scoring criteria of the factor layer
Evaluation system of enjoyment of comprehensive parks based on preschool children's behavioral psychology A	Space site enjoyment B1	Richness of terrain variation C1	Terrain variations (including hills and sunken spaces). 1= Basically flat; 2= 1 change; 3= 2 changes; 4= 3 changes;5= There are 4 or more changes [27].
		Richness of paving patterns C2	1= No variation in paving; 2= 2 variations in paving; 3= 3 variations in paving; 4= 4 variations in paving; 5= 5 or more variations in paving [27].
		Scale of activity spaces C3	The number of people allowed to participate in activities simultaneously within the plaza space. 1= For1 person only; 2= Provides space for 2 people; 3= Provides space for 4 people or two small groups; 4= Provides space for 6 people or 4 small groups; 5= Can provide activity space for 8 or more people or 4 or more groups [23].
	Facility enjoyment B2	Facility color aesthetics C4	The pleasant and comfortable feeling brought by the color of the facility's exterior. 1= Disharmonious colors; 2= Dull colors; 3= Mediocre colors; 4= Rich colors; 5= Bright, cheerful, and comfortable colors[27].
		Richness of play facilities C5	The following types of facilities are included: swinging, climbing, rotating, sliding, suspended, crawling, walking/running, and jumping. 1= 1 type; 2= 2-3 types; 3= 4-5 types; 4= 6-7 types; 5= 8 types or more[23].
		Naturalness of facility materials C6	The quantity and distribution of natural materials (wood, fruit, branches/bark/leaves, wood chips, grass, stone, water, sand, moss, soil, etc.) used. 1= Present in some areas or not present in any area, using 0-1 methods; 2= Present in some areas, using 2 methods; 3= Present in all areas, using 1-2 methods; 4= Present in all game areas, using 3-4 methods; 5= Present in all areas, using 5 or more methods [23].
	Plant configuration enjoyment B3	Comfort of landscape features C7	The novelty and aesthetic appeal of the landscape features. 1= Landscape features are dilapidated and have disharmonious colors; 2= Landscape features are monotonous and damaged, with relatively disharmonious colors and relatively poor materials; 3= Landscape features are of average appearance, color, and materials; 4= Landscape features are relatively interesting, have relatively beautiful colors, and use relatively novel materials; 5= Landscape features are interesting, have beautiful colors, and use novel materials [27].
		Shade provided by trees C8	The shades provided by tree canopies, and their scale and the extent of shaded coverage 1= None; 2 = Yes, but located on the edge of the site; 3= Yes, but it surrounds the entire edge area of the site; 4= distributed in some areas inside the site; 5= distributedin the whole area inside the site [23].
		Richness of plant species C9	Measured by the diversity index. The number of species in a site of aspecific size is defined as the diversity index. The higher the index, the better the richness. R= (S-1)/lnN (S: number of species; N: total number of trees), scored from 1 to 5 based on the diversity index.[24].
	Waterscape design enjoyment B4	Comfort of green spaces C10	The level of comfort brought about by the greening effect. The Cat's Eye Quadrant mini-program calculatesthe visible green index. The higher the percentage (x) of green in the field of vision, the higher the score. When $x < 5\%$, 1 point is awarded; when $5\% \leqslant x < 15\%$, 2 points; when $15\% \leqslant x < 25\%$, 3 points; when $25\% \leqslant x < 15\%$, 4 points; when $x > 35\%$, 5 points [19].
		Participatory nature of waterscape spaces C11	Participate in (touchable) water activities. 1= No water body; 2= Water body present, but no water activities allowed; 3= Water body present, water activitiespermitted on the shore (e.g., watching fountains and swans); 4= Water body present, water activities allowed (e.g., fishing, catching tadpoles); 5= With a body of water, one can flexibly and freely participate in and carry out water-related activities [25].
		Richness of aquatic animals C12	Animal species that can be observed/contacted in the water. 1= None; 2= Observable/Contact with 1 type; 3= Observable/Contact with 2 types; 4= Observable/Contact with 3 types; 5= Can contact/observe 4 or more types [23].
	Landscape culture enjoyment B5	Site theme storytelling C13	The concept story is combined with landscape expression methods, making it the guiding principle of the design. 1= No theme story; 2= Theme story, but incomplete; 3= Has a complete theme story; 4= Has a complete theme story that is integrated with the function of the venue; 5= Has a complete theme story that is both educational and entertaining [26].
		Flexibility of science education C14	Popular science education activities take many forms and are rich and interesting in content (including plant information boards, regular flower shows, tree planting in parks, and sculpture information boards). 1= None; 2= There is 1 type; 3= There are 2-3 types, but not complete; 4= There are 2-3 types, and relatively complete; 5= There are 4 or more types [26].

Table 4 Weights in the evaluation system of enjoyment in comprehensive parks

Target layer	Criterion layer	Criterion layer weights	Factor layer	Factor layer weights	Factor layer normalization Weighting
Evaluation System of Enjoymentof Comprehensive Parks based on the behavioral psychology of preschool children A	Space site enjoyment B1	0.4706	Richness of terrain variation C1	0.2583	0.1216
			Richness of paving patterns C2	0.1047	0.0493
			Scale of activity spaces C3	0.6370	0.2998
	Facility enjoyment B2	0.2999	Facility color aesthetics C4	0.2331	0.0699
			Richness of play facilities C5	0.0846	0.0254
			Naturalness of facility materials C6	0.0773	0.0232
			Comfort of landscape features C7	0.6050	0.1814
	Plant configuration enjoyment B3	0.0901	Shade provided by trees C8	0.6491	0.0065
			Richness of plant species C9	0.0719	0.0585
			Comfort of green spaces C10	0.2790	0.0251
	Waterscape design enjoyment B4	0.0901	Participatory nature of waterscape spaces C11	0.8333	0.0751
			Richness of aquatic animals C12	0.1667	0.0150
	Landscape culture enjoyment B5	0.0492	Site theme storytelling C13	0.2500	0.0123
			Flexibility of science education C14	0.7500	0.0369

Table 5 Standards for classifying the enjoyment level of comprehensive parks

Score	4.0< Y≤5.0	3.0< Y≤4.0	2.5< Y≤3.0	1.0≤Y≤2.5
Enjoyment level	Level I (Excellent)	Grade II (Good)	Level III (Average)	Grade IV (Poor)

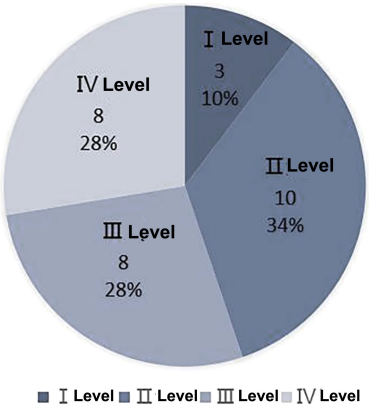

Figure 6 Distribution of the number of activity sites at different levels of enjoyment

4 Analysis of the enjoyment of space sites

4.1 Comparative analysis of overall levels of enjoyment evaluation

The evaluation scores show that there are three sites with an overall enjoyment rating of Level I, accounting for 10%; 10 sites with a rating of Level II, accounting for 34%; and eight venues with a rating of Level III and Level IV, each accounting for 28% (Figure 6). The average enjoyment score for the 29 activity venues was 3.0440, indicating that the overall enjoyment level of the activity venues in the park was relatively good. The highest score was 4.5658, and the lowest score was 2.3638 (Figure 7), indicating significant differences in enjoyment levels among different activity sites.

4.2 Comparison of the enjoyment levels of different types of activity sites

The analysis and evaluation results show that the children's activity area scored the highest at 4.5225, followed by the fitness area, waterfront plaza, pavilion, entrance plaza, and leisure plaza in descending order. The garden path scored the lowest at 2.4652 (Figure 7). All three children's activity areas scored highly, featuring ample space, comfortable greenery, and varied terrain; the tailor-made theme park stories were well-matched with thesites and facilities. Among the six entrance plazas, A1-3, A1-5, and A1-6, which scored higher, were more open and suitable for activities, while A1-1, A1-2, and A1-4, which scored lower, were smaller and lacked activity space and facilities. The seven pavilions showed significant differences in scores; A7-1, A7-2, and A7-3 were adjacent

to the water, offering expansive views and high levels of greenery comfort; A7-4, A7-5, A7-6, and A7-7 were hidden deep in the woods, with smaller spaces and simpler facilities. The three waterfront plazas also showed significant differences in scores. The areas are relatively large. A3-1 is quite large, with ornamental animals such as swans and goldfish in the water. A3-3 has a wide view, pleasant greenery, and a fountain. Although A3-2 has comfortable greenery, the space is small and lacks interactive water features. A5 is the only fitness area in the park and scores highly. It is open, surrounded by trees, and has new and complete supporting facilities, meeting the needs of ball games. The five leisure plazas all scored low. These areas are generally small in scale, mostly with rest seats, lacking activity space, and lacking variation in paving and terrain. The four garden paths all scored low. They have high comfort and protection, but are narrow and lack variation, have a monotonous visual experience, and lack space to accommodate activities.

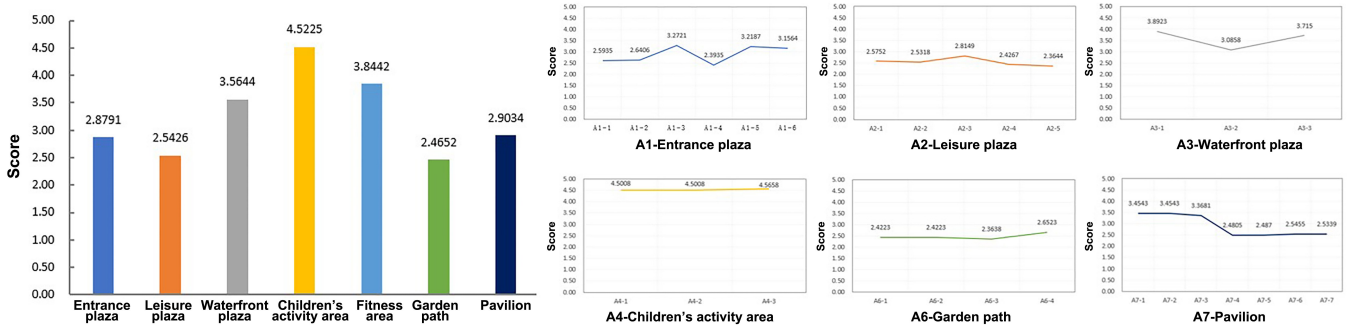

Figure 7 Comparison of the enjoyment levels of different types of activity sites

4.3 Correspondence analysis between types of enjoyment activities and influencing factors

A correspondence analysis was conducted between three types of enjoyment activities for preschool children and five environmental factors in Pengpu Four Seasons Park. The chi-square value was 38.346, and the significance level was sig= 0.000 ($P < 0.01$ indicates an extremely significant difference). This indicates that the types of enjoyment activities and environmental factors are not completely independent and have a certain correlation.

Overall, different types of enjoyment activities show different correspondences with the environment (Figure 8). The correspondence between different types of enjoyment activities and facilities is relatively small. The preference for these environmental factors among the three types of enjoyment activities is ranked as follows: movement-based > social > perception-based. Movement-based enjoyment activities are closer to spatial factors, meaning they tend to favor spatial factors and have a higher demand for spatial scale and richness. Perception-based enjoyment activities are closer to two environmental factors: plant configuration and landscape culture, meaning they are more dependent on plant configuration and landscape culture. Social enjoyment activities are closer to waterscape factors, meaning they have a strong preference for water features. Interactive and nature-friendly water features are more conducive to social-based recreational activities.

4.4 Comparative analysis of the enjoyment levels of single-factor activity sites

The comparison of single-factor enjoyment scores for different types of activity sites (Figure 9) shows that C4, C7, C8, and C10 all scored relatively high in different sites; C1 and C13 scored relatively high in the children's activity area, while the other six types of spaces did not show much difference; C2, C3, C5, C6, C9, C11, and C12 showed significant differences in scores in different sites; and C14 scored relatively low in all different sites. This indicates that different space types vary significantly in terms of the appeal of the space sites, facilities, plant configuration, waterscape design, and landscape culture. The children's activity area and fitness area performed well in terms of space, facilities, and plants; the entrance plaza scored highly in terms of space and facilities; the waterfront plaza performed excellently in terms of water features and plants; the garden paths, leisure plazas, and pavilions showed similar scoring trends, performing well in terms of plants, but exhibiting shortcomings in terms of space and facilities.

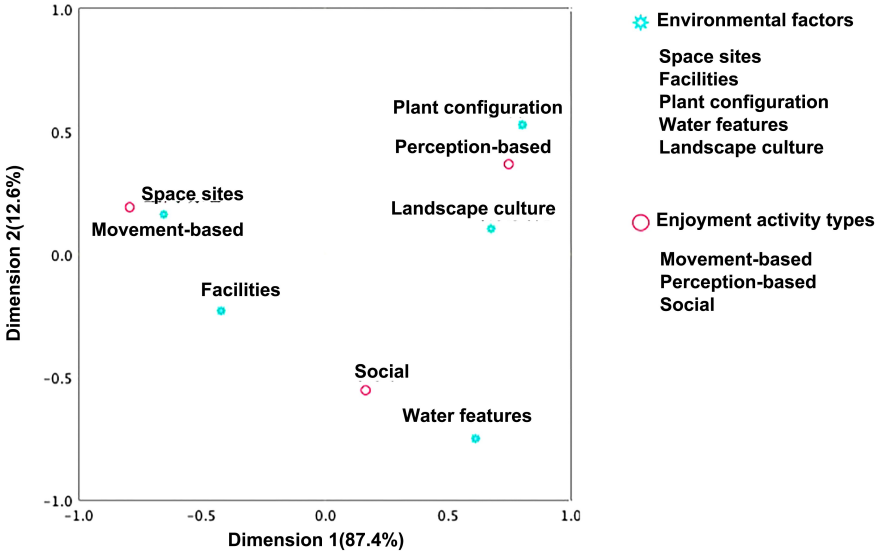

Figure 8 Correspondence analysis between types of enjoyment activities and environmental factors

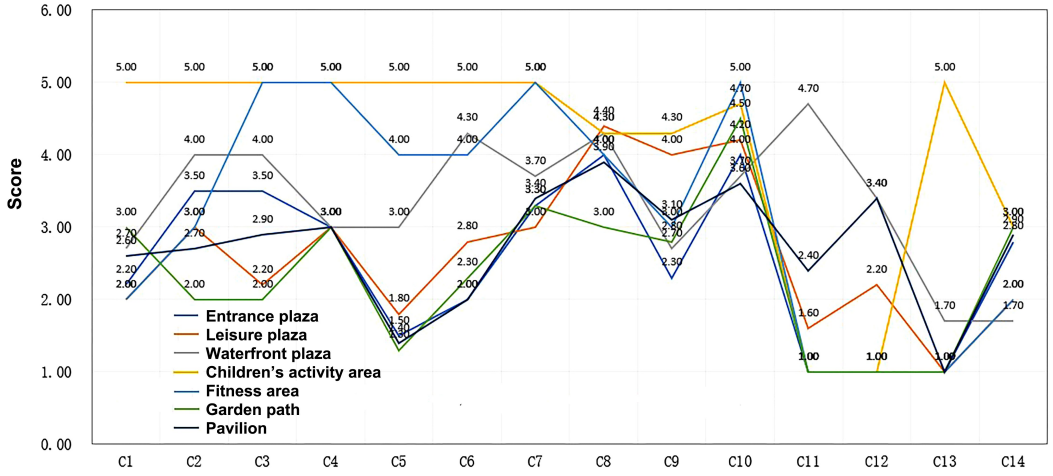

Figure 9 Comparison of single-factor enjoyment scores for different types of activity sites

Based on the comparison of single-factor enjoyment scores (Figure 10), the enjoyment of Pengpu Four Seasons Park exhibits the following characteristics: In terms of space, the paving patterns are diverse, the space is ample, and the terrain variation is average; in terms of facilities and small features, the colors are beautiful, the landscape is comfortable, the degree of differentiation is small, and the richness and naturalness are average; in terms of plant configuration, the plant species are abundant, and the greenery is comfortable; in terms of waterscape design, it is concentrated on the central water surface, which is relatively small compared to the entire park, and there is insufficient interaction with the water; in terms of landscape culture, popular science education on natural and humanistic knowledge is widely distributed, while site theme storytelling is only fully reflected in the children's activity area.

5 Basic principles and design strategies for enhancing enjoyment

5.1 Basic principles

5.1.1 Security principle

Safety is the prerequisite and guarantee for enjoyment. Through word frequency analysis of interviews with parents, we learned about their emphasis on park safety. On the one hand, children are vulnerable to risks and are easily harmed; on the other hand, with the post-pandemic era, the public's awareness of public health and safety has increased. Therefore, design and guidance should be strengthened, and spaces such as garden paths and waterfronts should be rationally laid out. Facilities should be designed with safety and sturdiness as the

basic standard, and daily disinfection during use should be taken into consideration.

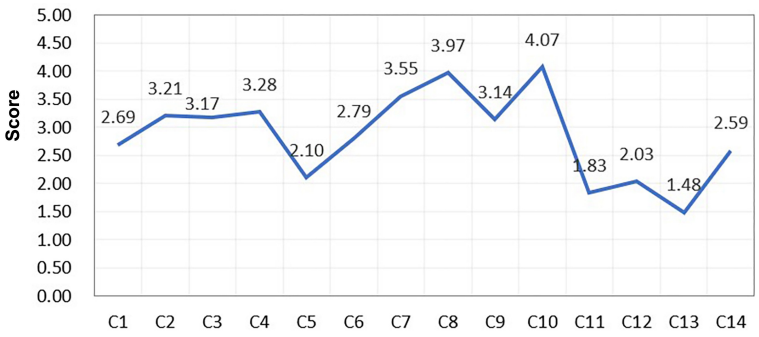

Figure 10 Comparison of single-factor enjoyment scores

5.1.2 The principle of children's participation in co-creation

Children's ideas should be incorporated into the entire process of park construction. Research has found that children's expectations of a space are often replaced by the adult perspectives of guardians and designers, resulting in park spaces becoming passive "cramming" spaces. From design and construction to operation, we should encourage and guide children to participate in expressing their needs and making joint decisions, understand their true demands from their perspective, and protect their right to participate.

5.2 Design strategies

5.2.1 The space sites meet the needs of the activities.

Based on the behavioral and psychological characteristics of preschool children, the following aspects should be considered to optimize the enjoyment of the space. Firstly, design friendly spaces that foster companionship. Preschool children often ignore their surroundings during activities, exhibiting a form of "egocentrism," which also means they require the presence of guardians. Therefore, parents become another major user group, and the design should consider a space that is friendly to accompanying children. Secondly, provide spaces for individual performances. The personalities of preschool children develop rapidly, and they often have a strong desire to express themselves. By designing a "small stage" suitable for performance, we can encourage them to showcase their talents and promote their personal growth and development. Thirdly, optimize the space for interaction with peers. The social development of preschool children is mediated by behavioral activities and social interactions. The design should take into account the number of players and the scale of activities, and encourage children to participate in different types of games with different numbers of players (Figure 11).

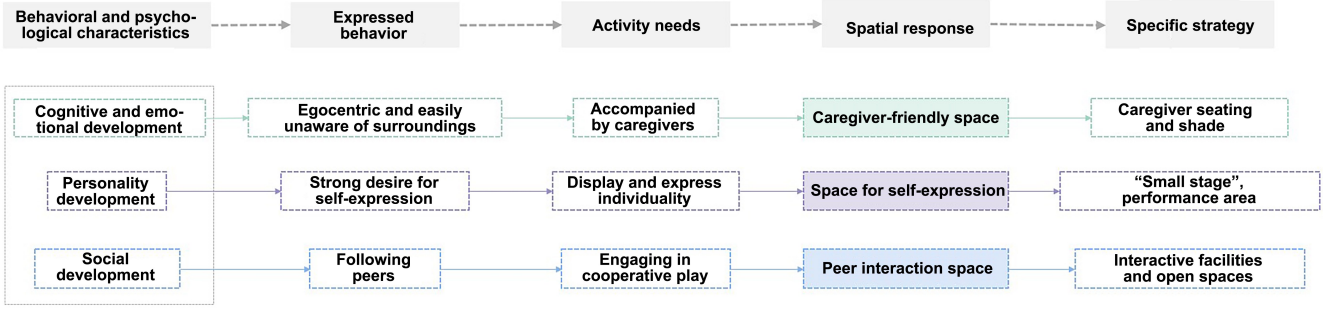

Figure 11 Spatial optimization strategy based on behavioral and psychological characteristics

5.2.2 Facility features integrate natural elements

Comprehensive parks are vital places for children to connect with nature and learn about the natural world. Materials such as flowing water, gravel, plants, wood, and stones will add natural interest to the play area. In the design, natural elements are incorporated to simulate natural surroundings, thereby blurring the boundary between natural and artificial environments, and allowing children to

connect with nature (Figure 12). This approach encourages them to engage with the natural environment in a fun and engaging way, guiding them to explore and understand the natural world.

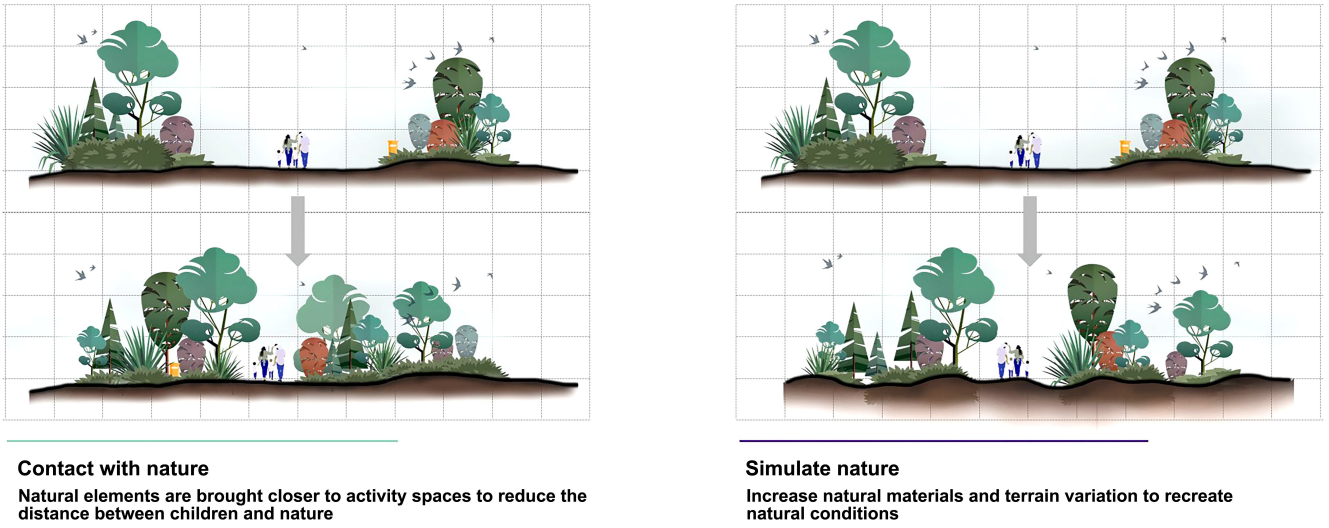

Figure 12 Naturalness Optimization Strategy

5.2.3 Waterscape design promotes perceptual interaction

Preschool children enjoy water-interaction spaces that provide enjoyment and opportunities for social play. Diverse water-related activities, aquatic organisms, and the varied forms and dynamics of water features can satisfy children's curiosity. Watching animals near the water or playing in shallow water are both ways that children enjoy interacting with water. While ensuring safety, we should actively provide children with suitable watergames and interactive spaces through environmental landscapes and facilities.

6 Conclusion anddiscussion

6.1 Conclusion

The construction of child-friendly cities in China has gradually shifted from theoretical research to practical exploration. As important public spaces for urban children to have contact with nature and engage in outdoor activities, comprehensive parks should give special consideration to the needs of children.

Based on the behavioral and psychological characteristics of preschool children, this study conducted field investigations on 29 sample sites in Pengpu Four Seasons Park, analyzing children's activity preferences and the environmental factors influencing park enjoyment. From a behavioral psychology perspective, park enjoyment and enjoyment-related activities were corresponded and categorized into three types—movement-based, perception-based, and social enjoyment activities—and the relationships between enjoyment activities and environmental factors were further examined. From five dimensions—space, facilities, plant configuration, waterscape design, and landscape culture—an evaluation model for enjoyment in comprehensive parks was established using the Analytic Hierarchy Process (AHP). Multiple data collection and processing methods, including the Public Space & Public Life (PSPL) survey and the "Cat Eye Quadrant" mini-program, were applied to assess the enjoyment within the sample spaces. Finally, targeted optimization strategies are proposed to address insufficient spatial interaction, limited richness of landscape features and facilities, and inadequate natural science education. The suggestions emphasize respecting children's behavioral psychology, encouraging child participation in spatial creation, and enhancing the naturalness and safety of the space sites, providing a valuable reference for child-friendly urban park planning and design.

6.2 Discussion

Children's activity needs and preferences in comprehensive parks are precisely a reflection of their behavioral

psychology. Studying the relationship between children's activities and park enjoyment from a behavioral psychology perspective is more in line with the principle of building child-friendly cities that allows people to "see the city from a meter height," and it is also an advantage that distinguishes it from other studies. Preschool children are curious and tend to follow the crowd, making them easily attracted to their surroundings. This leads to children's activities in parks not being limited to a specific space, with no fixed activity area and relatively random movement routes. The study aims to explore the relationship between park enjoyment and children's activities; therefore, the functional differences between various sites within the park were not considered in this evaluation model.

Drawing on existing research, typical sample sites were selected and categorized to visualize spatial research. The conclusions regarding space sites, facilities, plant configuration, and landscape culture that affect the appeal of comprehensive parks are largely consistent with existing research, thus confirming the scientific validity of the study. Meanwhile, based on existing research, this study introduces the naturalness of materials into the evaluation system for comprehensive parks, supplementing existing research on the topic.

The limitations of this study lie in the subjective nature of investigating children's activity preferences, which is difficult to avoid completely. In addition, only one park was selected as the research subject, and the commonalities and differences among parks in different regions were not explored in depth. This aspect will be further addressed in the next stage of research.

Source of Figures and Tables

Figure 2: Redrawn by the author based on existing maps;
Figures 6-10: Drawn by the author based on the analysis results;
Figures 1, 3-5, 11-12, and Tables 1-5: Drawn or photographed by the author.

Notes

1)Data are sourced from the Statistical Communiqué of the People's Republic of China on the 2021 National Economic and Social Development. (http://www.gov.cn/xinwen/2022-02/28/content_5676015.htm)

2) http://www.gov.cn/zhengce/zhengceku/2021-10/21/content_5643976.htm.

3) https://fgw.sh.gov.cn/sswghgy_zxghwb/20210716/264e9863ef354fe68ad18e244bca8b67.html.

4) https://www.nwccw.gov.cn/2022-09/19/content_305678.htm.

5)https://m.gmw.cn/baijia/2020-09/29/1301619430.html.

References

[1] XING Zibo, ZHANG Tianjie. Quality and Accessibility of Urban Parks from a Child-Friendly Perspective: a Case Study of Preschool Children in Barcelona[J].South Architecture, 2021(5):13-21.

[2] LI Shuang. Brief Analysis of Planning and Design of Child-Friendly Parks[J]. Chinese Landscape Architecture, 2021, 37(S1): 80-84.

[3] MITSURU S, XIN Mengyao, Design Method and Development of Play Environment[J]. World Architecture, 2016(11):27-32.

[4] WEI Xinyue. Post Occupancy Evaluation of Community Parks From The Perspective of Child-Friendly City[D]. Harbin: Northeast Forestry University, 2020.

[5] CHEN Tiantian, WANG Xia, LIN Guangsi. A Typological Study of Spatial Evolution of Children's Playground in Urban Parks[J]. Planners,2020, 36(4):58-65.

[6] HEWITT R J, PERA F A, GARCÍA-MARTÍN M, et al. Mapping Adolescents' Sense of Place and Perceptions of Change in an Urban-Rural Transition Area[J]. Environmental Management, 2020, 65(3): 334-354.

[7] LIN Zhishan, LIN Guangsi, Research Status and Prospects of Child-Friendly Open Spaces Based on Affordance Theory[J]. Landscape Architecture, 2022, 29(2):71-77.

[8] LI Xin. A Research of an Optimized Design of Chongqing's Children Park Based on Children's Behavioral Psychology[D]. Chongqing: Chongqing University,2016.

[9] WANG Nan. Research on the Interactive Design of Urban Outdoor Children Recreation Space[J]. Contemporary Horticulture, 2020,43(1):98-100.

[10] REN Peng. A Study On The Fun Landscape Design Of Field Based On The Children's Understanding Of Nature[D]. Xianyang: Northwest A&F University,2016.

[11] XU Xiao. Study on Interesting Design of Campus Space in Primary Schools[J]. Urbanism and Architecture, 2019, 16(11):23-24.

[12] ZHU Aihua. The Application of Creative and Interesting Elements in Modern Landscape: A Case Study of Z+ T Studio's Design Project[J]. China Flowers & Horticulture,2017(24):42-43.

[13] LIANG Xiao. Research Of Post-Occupancy Evaluation (Poe) And Construction Strategies of The Interestingness of The Residential Children's Playing Space Landscape[D]. Shanghai: Shanghai Jiao Tong University,2014.

[14] ZHOU Lu. Research on Design Method Based on Creating an Interesting Landscape for Children's Activities[J]. Shanxi Architecture,2020. 46(22):41-43.

[15] ZHU Jihong, ZHAO Yuechao, APP Interface Design for Preschool Children Based on Children's Cognitive Development [J]. Packaging Engineering, 2020, 41(10): 42-48.

[16] MENG Xiangzhuang, LI Bo. Discussion on the Landscape Interesting of Children Playing space[J]. Shanxi Architecture, 2012, 38(24):7-9.

[17] ZHAO Chunli, YANG Binzhang, LIU Daizong, PSPL Survey: The Evaluation Method for Quality of Public Space and Public Life:The Study on Jan Gehl's Theory and Method for Public Space Design (Part 3) [J]. Chinese Landscape Architecture, 2012, 28(9):34-38.

[18] WANG Teng, MAO Mingrui, CUI Boshu. Cat's Eye-An Intelligent Investigation Tool for Urban Planning And Design[J]. Landscape Architecture Frontiers, 2019, 7(2):112-120.

[19] XIAO Xi, WEI Yikai, LI Min. The Method of Measurement and Applications of Visible Green Index in Japan[J]. Urban Planning International, 2018, 33(2):98-103.

[20] LONG Xuewen, CHEN Dan, CHE Shengquan. Park Recreational Preference Analysis and Management Countermeasures Based on GVT-A Case Study of Shanghai Century Park[J]. Chinese Landscape Architecture, 2020, 36(5):59-63.

[21] MA Yankun, YE Haosheng. Difference and Complement: New Thinking Ab bout the Comparison Between Piaget's and Vygotsky's Views on Cognition Development[J]. Journal of Psychological Science,2004(6):1425-1427.

[22] MARIAMI M, JIANG shan, SONG Yang, et al. Playground Trees' Impacts on Children's Play Behaviors and Well-being [J]. Landscape Architecture, 2020, 27(9): 63-76.

[23] WANG Xia, HU Xinran, QIAO Xue. Research on Evaluation of Children's Outdoor Play Space in Chinese Urban Parks Based on Play Values[J]. Landscape Architecture,2022, 29(2):78-83.

[24] LUO Tianqing, NIE Puzhen, HAN Xiaorong. A Case Study in Relationship Between Scenic Beauty and Plant Diversity of Shanghai Waterfront Green Space[J]. Landscape Architecture Academic Journal, 2022, 39(6):45-52.

[25] WANG Fang, WANG Caixia. Research on Residential Waterscape Based on Preschoolers and Their Grandparents' Perspectives[J]. Chinese Landscape Architecture, 2015(8):67-71.

[26] CHENG Xiaoshan, ZHU Yunqing. Plant Science Educational Activities in Guangzhou Children's Parks[J]. Guangdong Landscape Architecture, 2016, 38(5):4-8.

[27] DING Qinqin, WANG Mengyao, YANG Fangrong. Study on the Comprehensive Evaluation of Urban Park Landscape Interest[J]. Hubei Agricultural Sciences,2021,60(12): 90-94.