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EXPLORING AFFORDANCES IN CHILD-FRIENDLY URBAN GREEN SPACES: IMPACTS ON ACTIVITY PATTERNS AND DEVELOPMENTAL NEEDS

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Abstract

Child-friendly urban green spaces (UGS) are outdoor environments that offer diverse opportunities for play and support children's holistic development. From an ecological perspective, these spaces provide rich affordances that encourage autonomous exploration and interaction. However, planning and design remain predominantly adult-driven, often resulting in a misalignment between the affordances available and those perceived or used by children. This study investigates how different types of affordances in UGS shape children's activity patterns and behaviours. Using behavioural mapping in three distinct UGS settings, the research systematically examines the relationship between children's activity preferences and environmental attributes. Findings show that children actively explore their surroundings, discovering actual affordances while gradually recognising potential ones and transforming them into new utilisable opportunities. Their needs for environmental attributes vary, and they adjust their engagement by balancing support and challenge in line with ability levels and developmental goals. These dynamics highlight the critical role of affordance-rich UGS in fostering children's adaptive development and underscore the importance of designing spaces that align with children's perspectives.

Keywords: Affordance, Behavioural Mapping, Children's Behaviour, Urban Green Spaces

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INTRODUCTION

The relationship between children and their environment is established primarily through active interaction (Altman, 2012). As children engage in outdoor activities, they gradually form personal connections with their surroundings (Slingerland et al., 2020). These interactions are influenced by the distinct physical, social, and cultural contexts that evolve across time and space. In recent decades, however, children's independent mobility has markedly declined, particularly in China, where numerous factors constrain their freedom of movement (Tang et al., 2023). A key driver of change in child-environment relations is the emergence of the child-friendly cities agenda (Cordero-Vinueza et al., 2023; Guo et al., 2022).

Extensive research consistently demonstrates a robust correlation between frequent engagement with green spaces during childhood and improved mental health in adulthood (Lanza et al., 2021; Tandon et al., 2021). Regular interaction with nature reduces stress, enhances emotional regulation, and fosters long-term psychological well-being (Li et al., 2022). Conversely, the rising use of electronic devices and social media contributes to sedentary behaviour and may exacerbate behavioural difficulties (Girela-Serrano *et al.*, 2024; Warda *et al.*, 2023). At the same time, structured and intensive academic commitments have reduced children's opportunities for unstructured outdoor activity (Holland, 1997; Masarik & Conger, 2017).

Despite these benefits, children's opportunities to interact with nature are declining under accelerating global urbanisation (Kusumo Dewi et al., 2020; Vidal & Castro, 2022). Soga et al. (2016) observed that diminished interaction with nature remains underexplored despite its negative implications for health and well-being. Limited outdoor experiences can generate fear or hesitation toward natural environments (Mustapa et al., 2020), reinforcing misconceptions about safety. Reduced contact also decreases the likelihood of children developing an affinity with nature, weakening future motivation to protect it (Barrable et al., 2021; Leung et al., 2022).

Urban green spaces (UGS) play a critical role in reversing this trend by providing diverse opportunities for physical activity (Bao et al., 2023), stimulating imagination (Song et al., 2018), and encouraging constructive play (El-Kholy et al., 2022). Engagement is particularly strong when natural elements are integrated into play spaces rather than treated as separate features (Aminpour, 2021). Recognising children as primary users of UGS underscores the importance of understanding their behavioural patterns, which can inform design and planning practices.

This study employs behavioural mapping to document children's activity patterns in UGS. Behavioural mapping objectively links observed activity with spatial characteristics (Cheuk, 2016) and has been widely applied in

urban streets, childcare centres, schools, hospitals, and community open spaces (Blennerhassett et al., 2018; Onojeghuo et al., 2019). In child-focused research, it provides a particularly effective tool for capturing the complexity and variability of children's behaviours (Onojeghuo et al., 2019).

The analytical framework is grounded in affordance theory, which highlights the relationship between environmental attributes and the behavioural opportunities they present (Gibson, 1983; Kyttä, 2004). Affordances are directly perceived by individuals, allowing for immediate recognition of potential uses. Applying this framework enables a deeper understanding of how attributes of UGS facilitate different activities. Building on this foundation, the study explores how behavioural mapping can reveal the complexities inherent in child–environment interactions and generate insights for policies and interventions that support the design of genuinely child-friendly UGS.

RESEARCH METHODOLOGY

Case Study Site

Shanghai, one of China's fastest-developing cities, has recently introduced a series of urban development initiatives aimed at creating a more child-friendly environment. Guided by the Shanghai Ecological Space Plan (2021–2035), the city envisions itself as a global metropolis distinguished by innovation, culture, and ecological sustainability (Shanghai Landscaping and City Appearance Administrative Bureau, 2021). Within this framework, the development of child-friendly cities has become a key priority for enhancing Shanghai's human-centred urban environment.

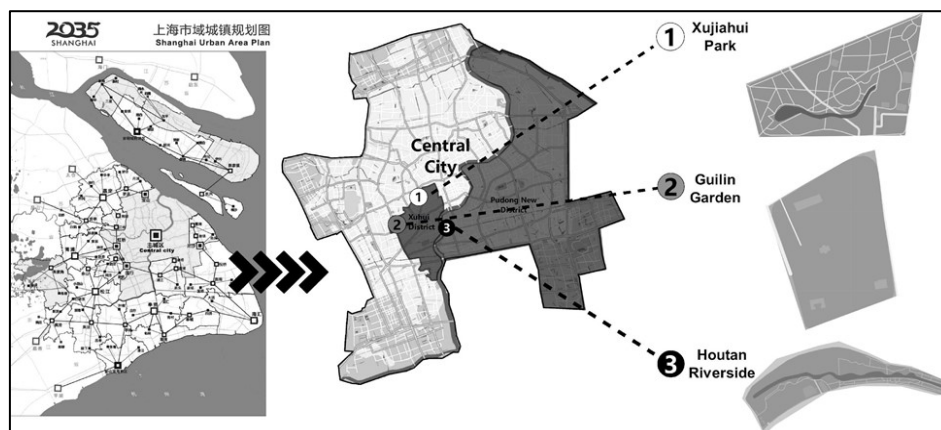


Figure 1: The location of Guilin Garden, Xujiahui Park, and Houtan Riverside in the centre of Shanghai
(Source: Author 2025)

This study focuses on the central urban districts of Shanghai (Figure), selecting high-density UGS that are representative of the environments children commonly access in their daily lives. According to the Standard for Classification of Urban Green Space of China (CJJ/T85-2017), UGS comprise both natural and artificial vegetation and provide ecological, aesthetic, and recreational benefits, offering residents high-quality green environments (Ministry of Housing and Urban-Rural Development of China, 2017).

A preliminary survey of UGS across the central districts was conducted to evaluate variations in landscape features and facility conditions. To capture the diversity of Shanghai's UGS, three representative sites were selected: Xujiahui Park, a modern park located in a bustling commercial hub; Guilin Garden, which exemplifies the aesthetics of traditional Chinese gardens; and Houtan Riverside, a waterfront park along the Huangpu River that integrates distinctive ecological landscapes with urban design. All three sites maintain steady visitor flows and well-established facilities, making them suitable for examining children's activities and interactions with their environments.

Categories Affordances and Attributes of UGS

The study adopts an affordance classification framework adapted from Kyttä's (2002) typology of child-environment affordances (Table). In research on human-environment interactions, reclassifying physical environment attributes within different specific analytical frameworks is a common and valuable approach. Such categorisation refines understanding of how environmental characteristics shape behaviour, thereby supporting more effective alignment between environmental design and human use.

Table 1: Categories of Children's Environmental Affordances
(adapted from Kyttä, 2002; Niu, 2024)

Affordance Categories by Kyttä (2002)		Affordance Categories in UGS by Niu (2024)		
Affordances Categories	Affords	Attributes	Affordances Categories	Physical Elements
1. Flat, relatively smooth surfaces	Cycling, running, skipping, skating, hopscotch, skiing, playing (e.g., football, ice hockey, tennis, badminton)	1. Accessibility	Flat, relatively smooth surfaces	Paths, flat ground, wooden boardwalks, lawns, muddy ground, gravel, woodchip surfaces, curbs
2. Relatively smooth slopes	Coasting down, skateboarding		Relatively smooth slopes	Accessible paths, ramped steps, stairs, hillsides

Affordance Categories by Kyttä (2002)		Affordance Categories in UGS by Niu (2024)		
Affordances Categories	Affords	Attributes	Affordances Categories	Physical Elements
3. Graspable/detached objects	Throwing, digging, building, playing with animals, using plants in play	2. Activities	Climbable features	Big rocks, rockeries, slides, flower beds, tree branches
4. Attached objects	Jumping over jumping down from		Mouldable materials	Soil, sand, loose leaves, loose bark
5. Non-rigid, attached objects	Swinging, hanging	3. Aesthetics	Attached objects	Animals, plants, sculptures, flower beds
6. Climbable features	Climbing, looking out from		Ponds, rivers	Ponds, rivers, water features
7. Shelter	Hiding, being in peace and quiet	4. Amenities	Attached objects	Benches
8. Mouldable materials	Molding something, building of snow structures		Shelter	Pavilions, covered walkways
9. Water	Swimming, fishing, play	5. Safety	Attached objects	Fences, streetlights
10. Affordances for sociality	Role-play, rule games, playing house, noisy, following/sharing adults			

Accessibility attributes include “Flat, relatively smooth surfaces” and “Relatively smooth slopes.” These elements improve inclusivity by reducing physical barriers and enabling children of differing abilities to engage in varied activities. They are therefore fundamental to ensuring access and broad participation.

Activities include “Non-rigid, attached objects”; “Climbable feature” and “Mouldable materials.” These features encourage play and exploration, supporting development that ranges from simple physical engagement to more complex emotional and cognitive growth.

Aesthetics draws on “Attached objects” (e.g., animals, plants, sculptures, flower beds), “Water” (e.g., pools, rivers), and “Shelter” (e.g., pavilions, covered walkways). Together, they enrich visual and sensory appeal and promote psychological comfort in UGS.

Amenities are represented by “Attached objects” (e.g., benches) and “Shelter,” which provide comfort and convenience for users.

Safety is reflected in fences and streetlights, essential for ensuring security and reducing risks.

Data Collection

Behavioural mapping was conducted between May and August 2023. The initial phase involved on-site measurements to produce detailed maps of the selected UGS, incorporating recent construction and maintenance works. Preliminary site observations were then carried out to determine suitable observation areas and points. These were selected according to criteria requiring unobstructed visibility of relevant site features while ensuring observer inconspicuousness, thereby minimising disturbance to children's behaviour (Engelen *et al.*, 2018; Baker, 2006). Establishing these observation points enabled accurate documentation of children's interactions with the UGS (Romero-Ternero *et al.*, 2022).

Prior to formal data collection, an A3-sized observation checklist was prepared. The upper section contained a detailed printed map of each study site, while the lower section listed categories of children's behaviours linked to UGS affordances (Hussein, 2009). The checklist was designed to capture contextual details such as activity location, timing, and weather conditions. To ensure data accuracy, the researcher maintained sufficient distance from children to avoid influencing their behaviour. This unobtrusive approach aimed to record spontaneous behaviours within UGS and to emphasise behavioural characteristics rather than participant numbers. This distinction was important, as the study's primary aim was to identify the types of affordances present, and the validity of the analysis did not depend on the exact number of children observed.

ANALYSIS AND DISCUSSION

Preliminary Results

From the organisation and statistical analysis of observational data, the study assessed the affordance levels available to children across the three case study sites (Figure). A total of 2,237 affordance instances were recorded, categorised into perceived affordances (PA), utilised affordances (UA), and shaped affordances (SA). Children's behaviours, central to cognitive development, were observed to progress in successive stages: beginning with practice activities (repetitive movements like running or climbing), advancing to symbolic activities (using objects imaginatively, such as a stick as a sword), and culminating in games governed by rules. For these developmental transitions to occur, the functional attributes of the environment must align with the children's evolving capabilities and maturity.

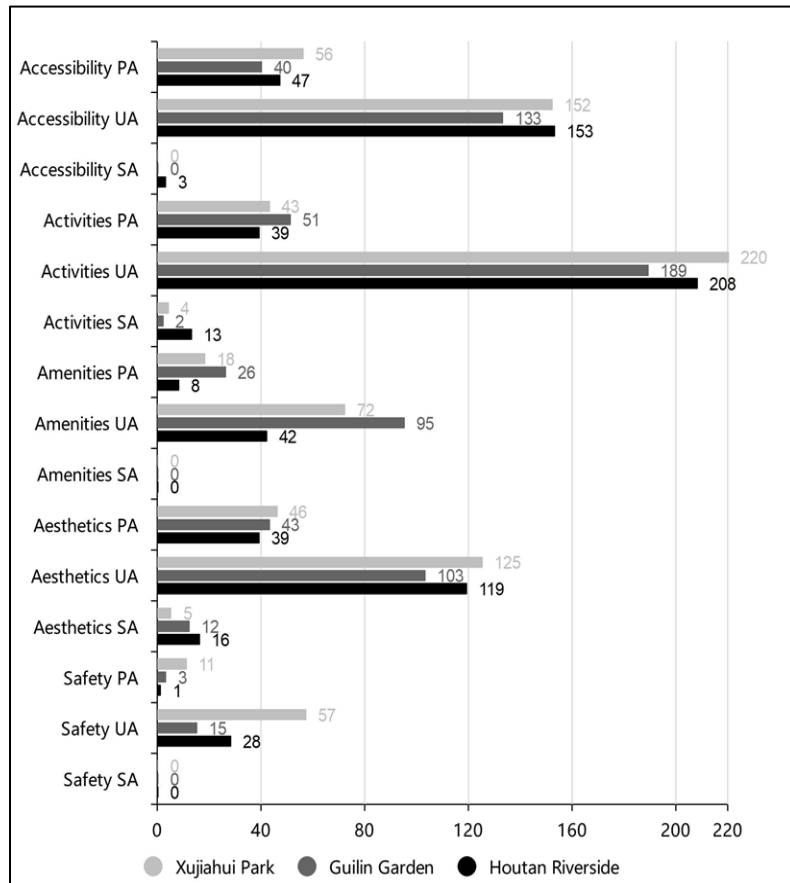


Figure 2: Distribution of perceived, utilised, and shaped affordances across attributes in the three case study sites
(Source: Author 2024)

Among the three sites, Xujiashui Park demonstrated clear advantages, recording the highest frequencies of both utilised (626 instances) and perceived (174 instances) affordances. This pattern indicates a wide diversity of perceptible features and highlights the park's capacity to provide abundant opportunities for interaction and activity. By contrast, Houtan Riverside exhibited the highest frequency of shaped affordances (32 instances), suggesting that its open and natural characteristics create greater opportunities for children to influence and modify their environment. Guilin Garden demonstrated a more balanced distribution across perceived, utilised, and shaped affordances, although the frequencies were slightly lower in each category compared with the other two sites.

Activities

This study investigates which UGS attributes provide children with the most diverse affordance experiences. The results indicate that activity-related attributes offer the richest opportunities. Children's interactions with green spaces are strongly shaped by climbable and malleable features such as boulders, rockeries, and tree planters. These features were frequently chosen as preferred sites for rest and play. Within them, children engaged in varied activities, including climbing, jumping, and standing on elevated points to experience height and speed. Such physical and sensory experiences enhanced participation and deepened engagement with UGS.

These findings align with recent research: Fajrie *et al.* (2024) observed that natural or nature-inspired elements (such as rocks) enrich children's sensory experiences and support artistic learning. However, this study also identifies limitations in these features compared with purpose-built activity facilities, particularly in functionality and safety. Previous studies show that professionally designed climbing structures more effectively promote the development of advanced motor skills (Bergen, 2021). While the boulders and rockeries stimulated exploration, they were not designed with children's needs or varying skill levels in mind.

Because the study sites generally lacked facilities specifically intended for children, their play behaviours largely represented passive adaptations to existing conditions. This reflects spatial constraints rather than a positive developmental trend.

Accessibility

As the most fundamental physical attribute encountered by children outdoors, ground surfaces significantly shape the quality and diversity of their activities. Across the three study sites, the predominant surfaces included paved brick, concrete, lawn, soil, sand, cobblestone, wooden boardwalks, and rubberised surfaces. Children's activities on these surfaces ranged from walking and observing to running, racing, and socialising with peers.

Observations revealed a clear preference for smooth and even surfaces, valued for the safety and comfort they provide. Such surfaces enable children to participate more confidently in a wide range of activities, including cycling, scooter riding, and running games.

At the same time, textured surfaces, such as pebbles, bark chips, and cobblestones, were also appealing. Their distinctive shapes and malleability often triggered spontaneous play behaviours, with children picking up loose fragments to build small towers or arrange patterns. These diverse ground materials created conditions for both high-intensity physical activities (e.g., running and cycling)

and low-intensity exploratory behaviours (e.g., digging in sand and collecting pebbles).

Amenities

The primary function of amenities in UGS is to provide essential services such as restrooms, drinking water stations, and seating areas. Observations from this study revealed that facilities were generally designed with adult users in mind, often overlooking children's physical dimensions and behavioural characteristics. This limited accessibility and usability underscores the importance of designing amenities that consider children's physical size, movement patterns, and cognitive abilities (Islam et al., 2016; Jansson et al., 2022).

Pavilions and covered corridors, common features in Chinese UGS, extend beyond their intended purpose of providing shade and shelter. They emerged as key spaces for children's rest, leisure, and social interaction. For example, the pavilion in Xujiahui Park, adjacent to Huijin Lake, functioned as a primary gathering point where children shared snacks, played with toys, and engaged in peer social activities. Zhao *et al.* (2023) noted that semi-open facilities of this kind enhance children's sense of belonging and security, while also supporting social connections.

Children frequently engaged in creative "unintended uses" of these amenities. Pavilion benches, for example, became launch pads for long-jump contests or hiding spots during games of hide-and-seek. Such adaptations highlight children's active reinterpretation of environmental functions, demonstrating the flexibility of amenities as play resources (Dinkel et al., 2019; Parrott & Cohen, 2020).

Safety

Safety attributes in UGS are typically ensured through surveillance cameras, security personnel, and fences. Observational data, however, showed that fences were the only feature with which children interacted directly. Fences, while serving as physical boundaries, displayed notable functional ambiguity (Perry et al., 2018; Taylor et al., 2019). Specifically, children crawled under, climbed over, or attempted to lift them. These behaviours illustrate both children's developing understanding of spatial boundaries and their instinctive drive to test and explore their surroundings.

Fences also became focal points for social play, inspiring group activities such as chasing games and obstacle races. This indicates that, beyond their safety function, fences contribute to peer interaction and cooperative play. The findings suggest that child-friendly fence design should balance basic protective functions with opportunities for active engagement.

Aesthetics

From an aesthetic perspective, UGS function as dynamic environments that stimulate children's sensory and imaginative development. Plants, such as sturdy tree trunks or fallen leaves, provided opportunities for climbing, collecting, and creative play. Some boys showed a particular preference for collecting longer branches to use as walking sticks or play props, highlighting the multifunctionality of these materials as tools for drawing in the soil, props for role-playing, or instruments for tapping various surfaces.

Similarly, the presence of animals and water transformed landscapes from passive scenery into interactive settings. In particular, the presence of animals such as goldfish, turtles, and swans in ponds garners substantial attention from children, who can close observe and directly with these species through activities like feeding or attempts to capture them. These interactive experiences not only satisfy children's inherent curiosity and desire to explore natural environments but also deepen their understanding and awareness of biodiversity. Beery & Jørgensen (2018) highlighted that animals encounters within UGS substantially strengthen children's connection to nature and enhance their environmental awareness, aligning closely with this study's findings regarding the fulfilment of children's exploratory needs. Moreover, Melson et al. (2025) emphasized that biodiversity within UGS positively influences children's psychological well-being and emotional development.

At the same time, tensions emerged between these natural affordances and safety concerns. While unstructured interaction with plants, animals, and water is crucial for children's cognitive, emotional, and ecological development, parental restrictions often limit such experiences. This tension highlights the need to balance safety considerations with opportunities for free exploration to fully realise the aesthetic and developmental value of UGS for children.

CONCLUSION

Child-friendly UGS are outdoor environments that offer diverse opportunities for children's activities. From an ecological perspective, these spaces should provide rich affordances. However, current planning and design practices remain largely adult-driven, often overlooking children's actual needs. This disconnects results in a misalignment between the affordances intended by designers and those children perceive and use.

This study demonstrates that children actively explore UGS, seeking challenges through interactions with available affordances. Over time, such engagement enables them to recognise latent affordances and transform them into new, utilisable ones.

The findings highlight a clear imperative for urban planners and policymakers: to move beyond adult-centric approaches and deliberately create

environments responsive to children's needs and rights. Providing rich, dynamic, and non-prescriptive spaces supports autonomous exploration, which is essential for healthy development. Such transformation is not simply a matter of adding amenities but of reorienting urban design towards equity, inclusion, and sustainability.

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