

Child-Friendly Community Landscape Design: A Gamified and Participatory Exploration from the One-meter Perspective

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Abstract: *As urbanization process accelerates continuously, children's outdoor activity space has been severely squeezed, and the contradictions have become increasingly prominent between their physical and mental development needs and the community environment. This paper takes gamified design as the core theoretical framework, combines child behavioral psychology and environmental perception theory, explores how to transform negative community space into empowering places to stimulate children's creativity and social skills through participatory design, conducts an in-depth analysis of the problems in the current construction of child-friendly space, such as adult-oriented space design, poor physical safety, lack of natural elements, and absence of children's engagement, and proposes a three-layer design framework of natural exploration, social gaming, and safety protection. Empirical research shows that gamified landscapes can increase the frequency of children's outdoor activities and enhance intergenerational interaction in communities to provide innovative ideas and practice pathways for the promotion of child-friendly city construction.*

Keywords: *Child-friendly Landscapes; Gamified Design; One-meter Perspective; Participatory Design; Spatial Empowerment*

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1.Introduction

At present, China's urbanization rate has exceeded 60%, and the urban built-up area is constantly expanding. However, children's exclusive activity space is severely squeezed in the high-density urban environment. Lack of contact between urban children and nature has become a key factor affecting their physical and mental health. Traditional community landscape design is mostly dominated by adults' eye view, and lacks special consideration for children's behavioral characteristics and psychological needs. This has led to that a large number of community parks have the problem of homogenization, which cannot meet children's basic needs for exploration, social contact and growth.

This contradiction is particularly prominent in old communities. Some old communities have problems such as monolithic functions, aging facilities and high canopy density in their activity space, which limits the types of children's activities and leads to low utilization efficiency of the venues. Qingdao City has transformed closed nursery gardens into child-friendly parks through the model of converting nursery gardens into parks, which shows that spatial reconstruction based on children's needs can significantly enhance the vitality of venues and the sense of community identity. These positive and negative cases reveal that child-friendly landscape design is not only the optimization of spatial form, but also the deep implementation of children's rights and the philosophy of sustainable urban development.

Against this backdrop, as an important bridge connecting children's behaviors with spatial functions, gamified design can effectively stimulate children's intrinsic motivation to participate in outdoor activities by organically integrating game elements with natural scenes^[1]. Based on this, this paper focuses on the one-meter perspective, that is, the vision and experience of children under the condition of their height, explores the practice pathways of participatory design in community micro-regeneration, and aims to build activity space that truly conforms to children's cognitive rules and behavioral characteristics.

2.Current Problems in the Construction of Child-Friendly Community Landscapes

2.1 Adult-Oriented Spatial Design and Lack of Children's Eye View

At present, there is a widespread problem in community landscape design that it is dominated by adults' eye view. Designers often start from their own experience and aesthetic sense, and neglect the real needs of children. The layout of activity space is simple and random in some community parks, and fails to take into account the psychological characteristics and behavioral patterns of children of different age groups. This adult-oriented design thinking leads to a lack of pertinence and professionalism in children's activity space, and fails to satisfy children's nature to explore the world.

The absence of children's eye view is also manifested in the mismatch of spatial scales. Conventional community parks mainly feature adult activity areas. Even if children's activity areas are set, they are often just scaled-down version of adult space and fail to be truly designed from the one-meter perspective. For example, there are some common problems, such as the height of elevator buttons that are not suitable for children to operate and steps that are too high for children. This neglect in details cause many inconveniences for children when using the space.

2.2 Inadequate Prevention and Control of Potential Safety Hazards and Risk

Safety issues are a prominent shortcoming in the current construction of child-friendly space. On the one hand, inadequate is the physical safety design. For instance, some communities use exposed stainless steel to make amusement devices, and when the surface temperature exceeds 70°C in summer, they can easily scald children. On the other hand, the safety risk assessment is not comprehensive and lacks a deep understanding of the behavioral characteristics of children. Some communities, in pursuit of safety, take excessive protective measures and eliminate all risky elements, which restricts the development of children's risk perception ability instead [2].

Road safety is also an important issue. With the increase in the number of motor vehicles, many old communities are facing prominent parking problems and serious phenomena of on-street parking, and other problems. The uneven distribution of road rights fails to create a safe transportation and environment for children. The concrete bricks laid on the pedestrian pavement are prone to loosening, and children are likely to fall down when running and jumping on the road. These potential safety hazards seriously affect children's enthusiasm for outdoor activities.

2.3 Monolithic Functions and Lack of Natural Elements

The existing activity space for children generally has the problems of monolithic functions and boring facilities. Many community parks are only equipped with simple traditional facilities such as slides and swings, lacking both interest and innovation. This uniform design is hard to attract children of different age groups. Especially school-aged children often find these facilities childish and boring, which makes them more willing to stay at home and play video games.

The absence of natural elements is particularly evident. With the acceleration of urbanization process, children's opportunities have significantly decreased to interact with nature, and nature-deficit disorder has become a common phenomenon. Most community landscape design overly emphasizes artificial and standardized amusement devices, and neglects the significance of the natural environment for children's development. Children are born to enjoy being close to nature, however, in modern communities, natural landscapes, such as grasslands, streams, hills and forests, are gradually disappearing, and are being replaced by hardscape paving and plastic facilities.

2.4 Lack of Children's Engagement Mechanisms and Insufficient Community Interaction

The absence of a children's engagement mechanisms is an important issue in the current construction of child-friendly space. In the planning and design process of most communities, effective channels have not been established for children's engagement, and as users of the space, children are excluded from the decision-making

process. For instance, most of the activities organized by some communities are arranged for adults. The only ones that children can engage in are formal activities like picking up garbage. And there is a lack of an engagement mechanism that truly suits children's interest.

Insufficient community interaction is also a significant shortcoming. Many children's activity areas are designed in isolation and fail to effectively connect with other functional space in communities, lacking facilities and venues that promote intergenerational communication. The settings of parental care areas are unreasonable, which makes parents feel bored when accompanying their children and reduces the frequency and duration of parent-child outdoor activities.

3. Innovative Strategies for Gamified Design of Child-Friendly Community Landscapes

3.1 Spatial Reconstruction: Participatory Design from the One-Meter Perspective

To resolve the current problem of adult-oriented space design, it is necessary to introduce the participatory design method with the one-meter perspective. This approach requires designers to squat down and observe and think about spatial design from the height and perspective of children to truly understand their needs and feelings. In the specific implementation, children can be invited as young designer to directly involve in the design process through workshops, interviews and other means. And they can be invited to participate in the design of community gardens to learn about the plants they want to know and the games they want to play in the gardens, etc., to make the design more in line with children's expectations.

Participatory design should not only focus on children's physical needs but also take into account their psychological characteristics. Children prefer imaginative and creative space. For example, designers can stimulate their curiosity and desire to explore through terrain changes, color combinations, and the introduction of interesting elements ^[1]. During the process of renovating and upgrading the Liangxi River landscape Belt in Wuxi City, representatives of teachers and students from nearby schools were invited to participate in the design discussion to collect children's preferences for plants, landscapes and amusement devices, and implement these valuable suggestions in the project design.

3.2 Safety Enhancement: Challenging Environment with Controllable Risk

Safety is the bottom-line requirement for the design of children's activity space. However, excessive protection should be avoided. Modern child-friendly design advocates challenging environment with controllable risk, that is, providing appropriate psychological challenges while ensuring physical safety. Specific measures include a hierarchical protection system, such as the use of impact absorbing surfacing, buffer zones, and monitoring points to form a triple - protection measure, which ensures safety without eliminating the fun of adventure.

Material safety is very important. In terms of facility selection, it is necessary to adapt to the physiological scales of children. The surface should be smooth, and the ends or turns should be designed with rounded corners to avoid potential safety risk. Child-friendly space avoids using metal materials that are prone to high temperatures in summer, and choose natural materials, such as wood products instead to ensure that all materials are non-toxic and environmentally friendly. For traffic safety, safe traffic environment can be created through some measures such as establishing slow zones, lowering speed limits, and setting clear sign systems.

3.3 Function Integration: Multi-Dimensional Experience Integrating Nature and Play

To address the issue of monolithic functions, emphasis should be placed on the integration of nature and play to create a children's activity space with multiple functions. Natural elements are the best medium to stimulate children's creativity, and rich sensory experience can be created by introducing native plants, water bodies, sand and other natural materials ^[3]. For instance, natural slides and hiding places can be created by taking advantage of the elevation differences in the terrain, and low-lying areas can be transformed into rain gardens, which not only satisfy children's innate hydrophilic tendency but also achieve rainwater storage.

Gamified design should focus on the differentiated needs of children of different age groups. Children aged 0-6 years need safety and sensory stimuli, those aged 3-6 years prefer symbolic play, and school-aged children aged 6-12 years have developed the ability to play games with rules. In light of these characteristics, diverse play areas can be set, such as nature exploration zones, role-playing zones, and team collaboration zones, to meet the development needs of children of different age groups. The key design points are detailed in Table 1.

Table 1 Key Points for Designing Play Space for Children of Different Age Groups

Age Groups	Development Characteristics	Key Points of Spatial Design
0-3 years old	Sensorimotor-Dominated Development	Impact Absorbing Surfacing, Parents' Rest Areas
3-6 years old	Symbolic Play Development	Theme Scenes, Variable Facilities
6-12 years old	Formation of Rule Consciousness	Complex Terrain and Team Game Facilities

3.4 Engagement in Co-Construction: Child-Friendly Environment Shared by a Community

It is the key to building the child-friendly space to establish a long-term mechanism for children's engagement. Children can be continuously involved in the construction and maintenance of the community environment through establishing children's councils, holding little designer workshops, and other forms. Nanjing Forestry University has held multiple embedded activities, such as community exploration meetings, bartering market, and garden workshops for little designers, in the child-friendly natural garden project in Aida Community, Nanyuan Street, Jianye District, Nanjing City to encourage children to actively participate in community governance and spatial design.

Equally important is the construction of intergenerational interaction space. By arranging the children's play area adjacent to the elderly fitness area and setting up facilities such as parent-child co-planting gardens and interactive seats, it can effectively promote communication among all ages. This mentality of designing breaks the isolated state of traditional children's activity areas, making children's games an organic part of the community social network and enhancing community cohesion.

4.The Implementation Pathways for the Construction of Child-Friendly Community Landscapes

4.1 Systematic Planning and Cross-Departmental Collaboration Mechanisms

The construction of child-friendly communities requires systematic planning and the collaborative efforts of multiple departments. It is suggested that the philosophy of child-friendliness can be incorporated into all levels of urban master planning, special planning and detailed planning to form a complete planning system. At the zoning level, designers can implant functions suitable for children such as nature education, camping and hiking by controlling ecological space and at the detailed planning level, designers can make refined land classification or facility configuration rules for children's activity areas.

Cross-departmental collaboration is of vital importance. Lessons can be drawn from the experience of the Shanghai Child-Friendly City Co-construction Alliance to establish a government-led and multi-party collaborative working mechanism. Planning, Housing and Urban-Rural Development, Parks and Woods, education, transportation, and other departments should enhance communication and coordination to jointly make construction standards for child-friendly space and implementation guidelines. At the same time, an assessment system should be established for the construction of child-friendly cities, and incorporate the efficacy of child-friendly renovation into the job assessment of relevant departments.

4.2 Community Micro-Regeneration and Spatial Function Integration

In view of the reality that the space resources are limited in built-up areas, especially in old residential areas, efforts should be made to actively explore the pathways of community micro-regeneration. By systematically sorting out and comprehensively utilizing the fragmented space within communities, such as zombie carports and abandoned

boiler rooms, designers can transform them into children's activity space. The Lyucheng · Lanyuan project in Chongqing has laid out undulating mountain-shaped walkways in the limited community public space, and integrated children's amusement devices into nature through splicing, overlapping, interweaving, and other forms, providing reference for the design of children's space in high-density urban communities.

Spatial function integration is an effective strategy to enhance the efficiency of resource utilization. The Luh Lake Line Park Water Division Park in Chengdu combines water conservancy science popularization with amusement functions. Its design draws on the philosophy of water diversion and distribution, irrigation and flood control of Dujiangyan, and it builds multiple small embankment checkpoints in the hundreds of meters of water channels in the park, which not only meets children's needs for water play but also has educational function. This multi-function integration design philosophy is particularly suitable for urban built-up areas with tight land use.

4.3 Long-Term Mechanisms for Children's Engagement and Community Co-Construction

It is the key to ensuring the suitability of space for children to establish a long-term mechanism for children's engagement. Children's councils can be established to regularly organize children to participate in discussions on community environmental construction, and make children the main body of space co-governance. Through holding various participatory activities, the enthusiasm of children and community residents can be effectively stimulated to engage in, and a good atmosphere of community co-construction can be created.

Community co-construction requires innovative governance models. A community garden chief system can be implemented, with a maintenance team composed of enthusiastic parents and children responsible for daily management and activity organization. At the same time, a maintenance fund for children's activity space should be established to guarantee the later operation and maintenance through government subsidies, social donation, and crowd funding from residents. Children's parks can adopt a resident adoption model to encourage community residents to participate in garden maintenance. This not only reduces management cost but also enhances community cohesion.

5. Conclusion and Prospect

This study systematically analyzes the problems in the current landscape construction of child-friendly communities and proposes gamified design strategies from the one-meter perspective. Research shows that the construction of child-friendly space needs to fundamentally shift from an adult-centered mindset and truly start from the needs and experience of children. Through four strategies of spatial reconstruction, safety enhancement, function integration and engagement in co-construction, the current problems can be effectively addressed, such as adult-oriented spatial design, insufficient safety, lack of natural elements and absence of children's engagement.

Gamified design can significantly enhance the quality of children's outdoor activities and promote intergenerational interaction in communities. The construction of child-friendly communities in the future needs to be advanced systematically to integrate the philosophy of child-friendliness into all aspects of urban planning, construction and management, and establish a long-term mechanism of multi-party collaboration. At the same time, it should focus on community micro-regeneration and the composite utilization of space, creating unlimited possibilities within limited space.

Children are the future of a city. The construction of child-friendly communities embodies a city's humanistic care and development foresight. When we truly integrate the one-meter perspective into the planning system and when children's laughter becomes the core indicator of community vitality, cities can truly fulfill their people-oriented development mission.

The construction of child-friendly communities is an important part of sustainable urban development. In the future, more emphasis should be placed on the deep integration of child-friendly philosophy with urban development, and the one-meter perspective should be incorporated into all aspects of urban planning and construction. At the same time, we should enhance international exchanges and cooperation and draw on advanced foreign experience.

With the advancement of technology, the design of child-friendly space should also keep pace with the times. The integration can be explored between digital technology and physical space, such as creating interactive learning experience through AR technology. However, it is necessary to maintain a balance between technology and nature and avoid over-reliance on electronic devices. Most importantly, the construction of child-friendly space should return to the essence of children and create growth environment that can stimulate children's imagination, creativity and social skills.

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