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Research of urban waterfront space planning and design based on children-friendly idea

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Abstract

The natural environment is vital for the healthy growth of children. The absence of exposure to Nature in cities is an important cause of physical and psychological health problems in children. With the objective of a healthy growth environment for children, this paper states the active role of the urban waterfront space, analyses the relationship between children and urban waterfront space, summarises the characteristics of children's outdoor activities, proposes the principle and methods of planning and designing a children-friendly urban waterfront space, and provides some improved design strategies.

Keywords: children-friendly; activity space; urban waterfront space

1 Introduction

Children are the future of a country and the hope of a nation. As the Two-Child Policy is released in China, the number of children will steadily increase. People have begun to realise that a quality living environment is essential for the healthy growth of children. At present, the key to a children-friendly city is in creating a good environment that contributes to their healthy growth. With rapid economic development and high urbanisation, most Chinese urban children are growing in the company of electronic products such as cell phones and computers; their heavy schoolwork also takes much of their time, so they have less and less opportunity to contact with the natural environment. Modern research has proved that there is a direct relationship between some physical and psychological health concerns of children, including their rising obesity rate, depression, lack of focus and the absence of being in the open air during their developmental stage. If the natural urban waterfront environment can be blended into the urban space comprising high buildings and large mansions, it will be undoubtedly beneficial to the healthy growth of children. Not only would rivers and lakes in the city give urban children an

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opportunity to get close to and understand Nature, they would also improve their holistic personality, physically and psychologically [1].

2 The relationship between urban waterfront space and children

The waterfront space can display the natural ecological environmental state of a city to the greatest extent. Compared to urban public spaces like streets and community parks, the waterfront space can bring children an abundant sensory and spiritual experience. Compared to the rural area, the urban waterfront space is convenient and accessible as well as a natural scenic spot. Thus, a good urban waterfront space gives the benefits of both the natural environment and artificial space, which can greatly help children in their growth.

2.1 Physical and psychological impact on child development

A good waterfront space facilitates child development physically and psychologically. Although fast economic and social development is instrumental for people to lead a better life, it also brings some serious environmental problems like turning children into a victim of many diseases. According to the World Health Organization (WHO), one-third of global diseases originate from environmental risk factors, among which 40% happen to children under 5 years old (who form one-tenth of the world population). A healthy waterfront space is helpful to establish a close relation between children and Nature and affect children positively in body and spirit. For example, it can improve self-confidence, enhance sports skills, train their independence, and reduce the incidence of some childhood diseases like attention deficit disorder and hyperactivity. Meanwhile, under the natural state without any solid game modes, children can be in contact with companions of different ages and personalities and create game forms on their own; boys and girls can also co-develop their abilities to lower gender differences and get their interpersonal skill trained (see Figure 1). Research indicates that Nature can enhance children's language and cooperation skills, stimulate more imaginary and creative playing ways, and promote their intelligent, emotional, social contact and physical development. The natural elements in the urban waterfront space exactly furnish the necessity of a pure and diversified outdoor space for children.

Fig. 1 Boys and girls can co-develop their abilities to lower gender differences.

2.2 Impact on the shaping of children's ecological view of nature

The healthy growth of humans relates closely to the natural environment. However, a pure natural ecological environment is rarely found in cities, thus making urban children know little about Nature; they also do not possess a healthy and wholesome view of nature. Recent problems, like environmental pollution, shortage of water resources, soil desertification, sharp decline in biodiversity, and decrease in forest and land resources, are

adverse to the healthy growth of children. Although urban children lead a better material life, and enjoy advanced technology and a convenient life, these aspects also stop them from getting close to nature. Children's education about Nature and the relation between human beings and Nature need to be studied in-depth. In terms of shaping children's ecological view of Nature, the urban waterfront space is of utmost significance. A high-quality urban waterfront space allows children to know his/her relation to the natural environment and set up a correct and healthy ecological view of nature. As human civilisation proceeds, the education of ecological morality also develops. The well-known American psychologist Erich Fromm said, 'in the 20th century, although possess material prosperous, and freedom in politics and economy, human are even more sicker spiritually than the 19th century'. Urban waterfront spaces create an opportunity for children to know and to embrace Nature [2]. The worldwide urban waterfront space is presently being used to guide children to know and understand the natural environment; although not far away, children are actually unacquainted with Nature, which teaches them to embrace, know and respect Nature in playing, and help them to form a correct value of living in harmony with the environment.

3 Insight into the problems of planning and design of urban waterfront space in China from a children-friendly perspective

3.1 The design mainly considers the needs of adults

In terms of the planning, design and supporting facilities of the urban waterfront space, serving the adults is the main consideration, while children are seldom considered or given much less attention. Some administrative departments of urban public space like urban green land, squares and parks also state that, compared to children, they have paid more attention to the needs of the retired and elderly people. They are of the belief that the urban waterfront space is designed for demonstrating the urban landscape, rather than a main public space for the use of citizens (especially children). Waterfront space, as the best-quality urban public space in a city, is built only to elevate the visual expression and cultural value, while its social and ecological significance on education is marginalised, the results of which will be bad. In a stage of life that demands for games, sports, and applying creativity and imagination, children should not be deprived of these basic rights due to designs made due to some other social factors [3].

3.2 Seldom consider the site selection of children's activity space

In China, a separate children playing area is scarcely set in the urban waterfront space. Only assembled toys and sandpit are added in the design of the urban waterfront space in a few cities, but these facilities are only fit for younger children, which is far from enough (Figure 2). Children aged 6–14 experience fast physical growth having more energy and an active mind, so a simple and easy playing facility would not entirely satisfy their needs. In most cities, the design of the waterfront space considers less about children and does not provide them with a separate and suitable play area. Besides, the children's play area overlaps with that of other age groups, and thereby they are liable to run into adults, dissatisfying the children-friendly requirement.

3.3 Urban waterfront space lacks attraction for children

The majority of Chinese urban waterfront space ignores the needs of children during planning and construction, so such space with minor differences is unable to provide abundant, interesting and suitable activities to children. On account of the natural tendencies of children, they are likely to be tired of a stationary environment and lose enthusiasm. A monotonous and tedious waterfront space not only cannot stimulate children's interest to play, but will also cut down the information delivered from Nature. Children are unable to appreciate the charm of Nature or feel any site spirit. At the same time, they will lose enthusiasm for play and become restricted from creation [4].

Fig. 2 Monotonous waterfront space dissatisfies children's needs for play.

3.4 No emphasis on children's safety is seen in the design

Among the numerous urban waterfront space development and construction projects, the consideration of safety is mostly for adults, as well as the relevant laws and regulations and design specification. Although children are the important users of the urban waterfront space, they form the weakest of all the user groups. Taking the waterfront space design safety into consideration from this angle, the 'barrel effect' applies. The safety of children, the weakest users of waterfront space, should be the main focus of the designer.

4 Characteristics of children's outdoor activities

4.1 Active, casual, poor endurance

Children are always very active. They are curious about things, stay vigorous and can continue to play for a long time. However, it is difficult for children to remain enthusiastic to one thing. They may lose interest in the same game soon, shift their attention within an hour, and show interest in something else. In addition, since children are easily dominated by their surroundings and feelings, an ambient environment and things are full of attraction to them, and their focus and activity mode can be positively affected. Therefore, their psychological state and behaviour are arbitrary, and they may change the activity space and game mode frequently.

4.2 Not subject to rules, self-centred

Younger children have limited cognitive competence and observe the world from their own (himself/herself) perspective. They often start from 'themselves' to conduct behaviour selection and activity, which process is totally unconscious. While playing, they merely notice what appears before them, with no more attention to the surrounding vehicles or pedestrians. So the relevant safety factors should be considered in the design [5].

4.3 Full of creativity and imagination

Children belong to a world which adults cannot see, and everything can become a source of their pleasure. At the same time, they love to imitate adults to know and understand the world, and solve their own 'emotional conflicts' by imaging and imitating adults' social practices. For example, children are keen on 'family role-playing' by imitating the process in which adults raise a baby, including feeding a doll, washing its face, rinsing its mouth, matching clothes for it, and so on. Their ingenious games also reflect their rich and purposive imagination, like 'riding a horse', 'driving a train' and so on.

4.4 Spirit of discovery and exploration

Children like to know Nature from the trees, water, insects, flowers and grass and perform creative games using malleable materials like sand, stone, mud and building blocks, because through this process of discovery and exploration, they can obtain satisfaction and happiness. Many children are fond of the adventure type of computer games which may give them an exciting experience, the reason for which lies in their inborn adventurous traits. Allowing children to freely play under controllable risks and challenging themselves via games could help them accumulate life experiences and facilitate physical and psychological development synchronously. By repeated trial and error, they will search for their own limits and possibilities, face dangers prudently, and be trained on their consciousness and muscle reaction of how to respond to dangerous conditions. With the power of solving problems on their own, they can feel successful and become confident. When indulging themselves in what they really want to do, they will show amazing concentration and energy, know the happiness of 'being alive', make sure of their relation with the world, study and exceed themselves constantly, establish self-confidence and toughness, explore the world in their own way and create their own identities [6].

4.5 Cooperation and friendship

Children have a fondness for outdoor activities, and the gathering of their parents tends to increase it. During their mutual contact, based on social needs, they have to find partners. Children closer in age are similar in their physical and psychological make-up and have similar hobbies, interests and the need for finding game partners, so the children aggregation is generated.

4.6 Ambitious, competitive

Competition is a facet of human nature. Research indicates that, compared to girls, boys are more ambitious and competitive and enjoy competitive games better, such as chess, basketball and so on. Boys desire to prove themselves in these games, so they show a stronger willingness to win and are more proactive so as to gain satisfaction and a sense of achievement.

5 Design principle of children-friendly urban waterfront space

5.1 Safety principle

Jane Jacobs mentions in her book, *The Death and Life of Great American Cities*, that children are born yearning for freedom but lack the self-protection ability, so urban public spaces should be designed that are both vivid and interesting and ensure children's safety from the architectural, material and streamline dimensions. The design of traditional public spaces in the commercial market lack the consideration of children's safety and behaviour modes. The planning and design of urban waterfront spaces should first take safety into consideration, by taking site selection, supporting facilities and traffic of children-friendly activity area into account, rather than merely preventing them from being hurt and forbidding them to get close to Nature. Richard Louv states in *Last Child in the Woods* that, 'children always grow up in company with danger, and moderate risks can enhance their confidence, make them to be independent and brave'. Children may scratch their clothes, stumble by a stone, or fall and hurt themselves during play. The objective of a children-friendly waterfront space design is not to completely shield these inevitable problems, but make risks to be controlled and accepted. In other words, the safety principle here denotes much for moderate safety and tends to cultivate children's vigilance and precaution awareness of dangers [7].

5.2 Amicable and caring principle

The planning and design of the waterfront space needs to emphasise amicability and care for children, and satisfy their physical and psychological features using requirements to the maximum extent. For children, a

flower, a stone or a discarded tyre in the natural environment can be more interesting than a toy bought from the store. To be amicable to children and show care for them starts from what they are fond of and respect in their heart. Public facilities should be designed according to the physical features of children. For example, children may be short, hence facilities in the activity space like chairs should not be too high. If planting beds are kept in the waterfront space, their span should not be large; 30–40 cm is suitable. The net width of a wash basin is suitable at 35–40 cm, or children cannot reach it or mess their clothes [8].

5.3 Principle of adaption to local conditions

The planning and design of the urban waterfront space should reflect an idea of environmental protection, so that children can be influenced unconsciously during play and set up the idea of protecting the natural environment. Taking advantage of the original plants, water and terrain conditions of the waterfront space in the design can save construction costs and meanwhile let children to know the natural landscape of the city.

6 Design method of children-friendly urban waterfront space

6.1 Build a rich game space

Site moulding by integrating multiple elements in the waterfront space, such as plant, water, sand and stone, we can build a rich game space for children and meet their needs for various games. Creating a green natural environment is a key content of children-friendly waterfront space. The natural activity supplied in the waterfront space will enable children to generate game behaviour autonomously, depending on artificially transformed natural elements. Only with a protective design of sand, stone, water, soil, plants and even creatures, a waterfront space with appropriate sports and play area for children can be created.

6.2 Terrain

Flat terrain or wide slope can be built as an open game space. In such spaces, children can bathe in the sunshine, run or jump at their will, and conduct various collective games, while a rugged terrain may arouse children's desire for discovery and exploration, and attract them to play games in activity space spontaneously. It is feasible to increase the earth mound, sunny slope and steps in the site, change the material on the ground, and utilise the elements that exist in Nature, such as grass, sand, stone and soil. As for the micro-topography, the rights of construction can be left to the children: provide tools like a small cart, some soil or small stones, let them excavate a ditch, build a sand dune, or build a small dam for a thin stream by hand and so on.

6.3 Plants

Local plants should be selected as far as possible to create a natural environment in alignment with the local climate. Children need to take in sunshine to promote calcium absorption, so their activities in winter should happen in a sunny area, while in summer, shades must be taken care of. From the overall consideration, deciduous trees are a good choice, which can form a safe and rich plant landscape space and show seasonal changes. In sum, the selection of plants should be as follows: (1) Plant safety: plants should be free of thorn, poison, hairs, catkins, and irritant and allergic substances. Spinous plants include shoot thorn, prickly, stem thorn, fruit thorn and so on. Safe and common plants mainly include Rosaceae, Rutaceae, Asteraceae, Rhamnaceae, Leguminosae, Berberidaceae, Cataceae, Fagaceae and Aquifoliaceae. (2) Plants with peculiar leaf shape and colour: plants with peculiar leaf shape and bright colours can attract the attention of children easily, and strengthen their perception to shape and colours. Coloured foliage plants are also an option, because the obvious change in their leaves enable children to directly notice the change of seasons, for example, ginkgo, red maple, Chinese tallow tree, Chinese parasol, nandina and Japanese maple. (3) Food plants: invite children to participate in food planting or pick by their own hand. Thus, they can enjoy the gift of Nature, and increase their knowledge as well. In

addition to some common trees, like the mulberry, peach, plum, fig, loquat, orange, waxberry and pear, some wild varieties are also optional, which not only provide food for wild animals but also add joy to children, such as wild *elaagnus pungens*, *rubus parvifolius* and wild matrimony vine. (4) Interesting plants: native varieties should dominate, because they are easy to manage and form landscapes, such as dandelion, *xanthium sibiricum*, *setaria viridis*, yacca fruit or a small moss garden. They will definitely bring natural joy to children. (5) De-dust and de-noise plants: children grow up day by day, so the selection of plants should be good for the physical and psychological development of children. So some de-dust and de-noise plants can be a good choice, such as sweet-scented osmanthus, wintersweet and orchid [9].

6.4 Water body

The construction of a water body where children can come close and play freely and safely is a vital content in the design of children-friendly urban waterfront spaces. Children are born with a liking for playing in water, so the urban natural water could be imported to the children activity area and formed into an artificial natural streamlet of suitable dimensions, availing children to play with water and catch small aquatic animals. The depth of the water in the children play area should not exceed 40 cm, while the depth of the wading pool can be within 15–30 cm; the pool surface should be paved with skid-proof walking stones (of dimensions less than 45 cm × 45 cm). Phycophyta should not be planted at the bottom of the pool, and anti-skid treatment must be applied to the waterfront and bottom of the pool to prevent slipping. Besides, the water should be replaced regularly for sanitation. In view of the self-cleaning capacity of a water body, the lakebed slope should be gentle, within 2 m from the lakeside, with shallow depth. In the centre of the lake above 2 m away from the lakeside, the water is deep to enhance the growth of aquatic plants in the lake [10].

6.5 Waterside safeguards

Some risks may exist when children are playing in water, so the following aspects should be paid attention to: (1) The revetment material should be firm, smooth and hard to fall off. The shoreside is suitable for anti-skid face brick and stone, or shingle beach or sand beach. (2) The off-shore sludge needs to be cleared on a regular basis, to avoid accidental near-drowning. (3) Where the water is more than 35-cm deep, safeguards like safety fence and stone revetment should be set, with a warning board of 'No Paddle or Swim' clearly installed. (4) Regular check and repair should be conducted to the shoreside fence and wooden trestle, which are liable to risks, to minimise near-drowning risks [11].

6.6 Supplement accompany facilities

During outdoor activities, children and babies require non-stop care. But recently, in children's public activity space, the attention to companions is merely in providing seats, communication space and so on, but remains short of an adequate child-parent interaction design [12]. Regarding the setting of children-friendly waterfront space facilities, the first thing is to set leisure facilities for companions, and satisfy the basic rest and communication functions. Meanwhile, considering to enhance child-parent interaction in game facilities, it is essential to meet the needs of both children's entertainment and parents' interaction [13]. If there is a space where parents can interact with the child, the companions will be more active. Parents-friendly is also an important content of the children-friendly urban waterfront space [14].

7 Conclusions

The urban environment attaches great importance to children's healthy growth. Recent urban constructions need to highlight children's rights, and truly fuse children-friendly ideas into each operational link of a city. This article applies children-friendly ideas to the planning and design of the waterfront space, starting from friendly to children to review waterfront space, and propose the thinking and strategies of waterfront space planning.

Based on a children-friendly idea, an analysis on the existing problems of the waterfront space is made from the spatial layout, attraction and safety, and the idea and strategies of waterfront planning are raised. To sum up, the author believes that the new-stage planning and design of children activity space will be a new research direction. When the children-friendly idea is injected into the planning and construction of more urban spaces, people's psychological needs will be taken as the principle to forge more personal urban space, and children will be called upon to take party in urban space. An urban space with vigour and quality could provide children and other citizens with an ecological and liveable urban environment.

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