DOUBLE DEGREE

PAPER TITLE

Interactive Research on Children's Entertainment Facilities in Shanghai Newly-built Residential Communities

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Abstract

The development of urbanization in China not only led to the flourishing development of new communities, but also enriched material conditions, social life, and the various activities, which has imposed higher requirements on child-friendly entertainment environment in their growth. As an essential part of children activities, the entertainment facilities and spacesdirectly or indirectly enrich leisure life, especially for the growing children, which is the most important and sensitive stage in their life. However, the development of children's entertainment space and facilities in newly-built communities is still very slow, lacking in multi-types functions, funs and interactions with others that could be leave children out of consideration of psychological and physical needs and fails to provide children with a positive, happy childhood so that may affect physical and mental health development of children.

To this end, take Shanghai as an example, the research goal of the project is aim to analyze the children's entertainment facilities and space in newly-built residential communities, to explore the key points of designing children's interactive entertainment facilities and space through the growth of children, development, behavior, psychological characteristics, and to combine with the development status of domestic and international design as well as analysis of excellent designing cases to understand the gaps and find out the solutions to the problems based on cognitive development theory, behavioral psychology and interactive theoretical research. Meanwhile, through the field research and interactive behavior analysis of children's entertainment facilities and space in new residential areas in Shanghai, the key elements and characteristics of the interactive design of children's entertainment facilities are summarized, thus providing new ideas and methods for improving children's entertainment facilities and also building initially basic theoretical framework as well as practical design in Tianan Garden for interactive children's entertainment facilities and spaces.

Key words: ***Shanghai, Newly-built residential communities, Children, Entertainment facilities, Interactivity***

Chapter 1: Background of Paper

This chapter mainly introduces the whole structure of paper regarding the project's background, research purposes and what the positive sign is in the future. It also defines some basic concepts of new residential communities, children's physical condition and children entertainment facilities to make readers get a better understanding of paper 's primary goal.

1.1.1 The Development of New Communities in Shanghai

Urbanization is one of the most important manifestations of the country's social and economic development, and the growth of urbanization has also led to the vigorous development of new residential areas. According to data released by the national bureau of statistics in 2017, China's urbanization rate has increased to 58.52%, up 1.17% from the end of last year and rising at the rate of 1% per year[1].

Taking Shanghai as an example, by the end of 2017, the resident population of Shanghai was about 24,183,300, and the total number of newly-built residential communities was about 7,425, an increase of around 9.95% over the total number of settlements in 2003[2]. However, the over-exploitation of city has also led to an imbalance in the development of residential area, which has seriously affected the residential living environment that is increasingly concerned by residents. According to a survey conducted by the Shanghai Municipal Statistics Bureau on building a harmonious community, 46.1% of citizens are dissatisfied with community development and think their living “lacks basic public places” and 40.3% of citizens think that there “lack of living facilities”[3], which reveals that most of residents hope to have a well-established infrastructure and event venues. In addition, residential areas are nolonger limited to the providing accommodations to residents more importantly, they need to learn how to serve the residents and provide better service to them.

The residential community is the area where is composed mostly of residents living that is also regarded as a basic unit of constructing urbanization and carries the basic needs of every resident, including their living, entertainment, and culture. According to China's

[1] *Data from the 2017 National Statistical Report on National Economic and Social Development.*
[2] *Data from the China Urban Research Report in the Second Quarter of 2017.*

"13th Five-Year Plan", it reveals that improving the infrastructure construction of residential communities is one of the crucial tasks to promote the healthy development of residential communities and an essential basis for building a harmonious society and ensuring people's livelihood[4]. The government should increase more investments and guide more constructions of basic public service facilities to ensure people's livelihood, pay more attention to residents' spiritual and cultural needs, thus improve their quality of life. Therefore, many new residential communities realize how important to residents' recreational needs and have planned to invest in many new infrastructures in communities, especially for children's entertainment space.

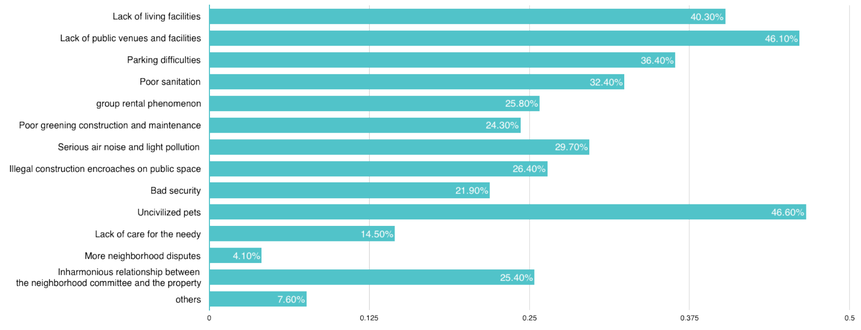

Figure 1.1 the survey results of S Shanghai Municipal Statistics Bureau on building a harmonious community in recent three years [3]

1.1.2 The Problems of Children's Entertainment Spaces and Facilities

As early as 2016, the "Code for the Planning and Design of Urban Residential Areas" issued by China has stipulated the importance of children's activity places and entertainment facilities in all different sizes of public spaces. However, in reality, the development of children's recreational facilities and infrastructure construction in residential areas is extremely not equally balanced. Most of the standards for designing entertainment facilities in communities are still based on needs of adults, not considered for children's physiological and mental needs so that it apparently leads to slow development, single type and lack of basic interactivity in facilities design and fail to give children a positive, happy and growing childhood environment.

Therefore, the current problems of children's entertainment facilities in communities

[3] *Data from the Survey of the Shanghai Municipal Bureau of Statistics on the Construction of a Harmonious Community.*
[4] *Data from the Outline of the Thirteenth Five-Year Plan for National Economic and Social Development.*

are summarized as the following three aspects:

a.Homogeneous design and lack of specific personality characteristics;

It is always easier to find a small but bright space with the dark anti-fallplastic floor in the corner of new residential communities, which is the large-scale combination or simple and crude toy that the merchant directly purchases from the markets. Those existing children's entertainment facilities are usually templates designed by suppliers, most of them are directly copying foreign entertainment facilities and venues, or copying manufacturers' designs, lacking their characteristics and features.

b. Rigid function and lack of consideration for children's needs;

Although there are some functional facilities such as rocking chairs, slides and swings that are adapt to children's energetic movement and the strong curiosity, once these functional facilities are combined into an ossified entertainment facility that is easy to make the whole functions rigid, lose children's interests, even be unhelpful to childhood development. Due to the vast differences in activity capacity, scope and habits of different ages' children, demands for recreational facilities and space are totally different. When school-age children play with younger children, inevitably will appear friction, knock, fall phenomenon for hitting children. Therefore, the existing children's entertainment facilities do not stand for all age's children, most of them are more suitable for school-age children to play, and no targeted design for toddlers and preschool children.

c.Lack of interactive experiences;

The design of children's entertainment facilities and space in China generally lacks basic interactive entertainment experiences between each player. We find that in many

Figure 1.2 Status of domestic outdoor children's entertainment facilities (images from the Internet)

cases children usually play mechanically with one of the entertainment facilities while the others only take turns waiting in line or even competing for other facilities. Meanwhile, most parents are more willing to be bystanders to watch their kids' safety rather than participating in it. This phenomenon also illustrates the fact that there are truly less positive interactive behaviors and emotions between them. One of the main reasons for this situation is the lack of interactive entertainment facilities and space in residential communities, which cannot provide an appropriate platform for people to interact and communicate with each other so that children are probably unable to get more physical and mental development to themselves.

1.1.3 Children are the Most Active Group in Newly-built Residential Communities

According to the Sixth National Census in China, the number of children with age of 0~16 is about 200 million, accounting for 12.38% of the total amount which means that China is the country with the most significant number of children in the world. And the vast population of children has also become an indispensable precondition for the fast development of children industry, especially in entertainment facilities and space. According to previous research, 87.4% of children indicated that they don't like to play indoors, and 37% of children would more prefer to play in public space [5].

The residential community is one of the most popular playing public areas for children ， it provides them with various necessary living needs, suitable activity places, playing companions, etc., and unconsciously affects children's behaviors and habits. In 2011,

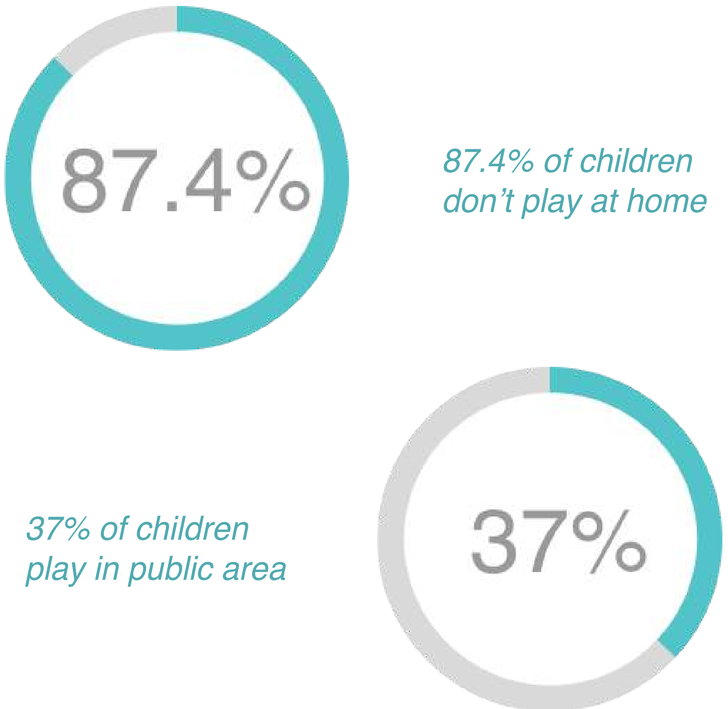

Figure 1.3 Status of Chinese Children Entertainment Space

[5] *Data from the Blue Book of Outdoor Activities for Children in Chinese Cities*
[6] 杜宝贵 杜雅琼:“中国儿童福利观的历史演进--基于改革开放以来的儿童福利政策框架”,《社会保障研究》,2016(5),P82~88

the "China Children's Development Program (2011-2020)" issued by the State Council clearly emphasized the importance of promoting the sustainable and healthy development of children in country's future and also strongly stressed the significance of improving environmental design for children's physical and mental health[6].

1.1.4 Loss of Emotional Interaction among Children’s Entertainment

Early foreign investigators have conducted research on the relationship between children and other people's growth (Figure 1.4), indicating that during the child's growth stage, the impact of children is strictly relevant to the time they get along with which means the more time they spend with parents and peers, the more affection they get. But meanwhile, the relationship will be slowly changed with the children’s growth. For instance, children between the ages of 1 and 4 are the most intimate moment of interaction with parents. As children grow up, they spend more time outdoors playing and have more chances to approaches to new peers which shows that their interactive objects slowly transform from parents to peers. However, whether it is a relationship with a partner or a parent, it still exists a subtle influence on the child's growing behavior and ways of thinking. Therefore, actively cultivating the emotional interaction between children and others can not only improve the communication and social adaptability of children but also have a valuable effect on the formation of a sound personality and health psychology.

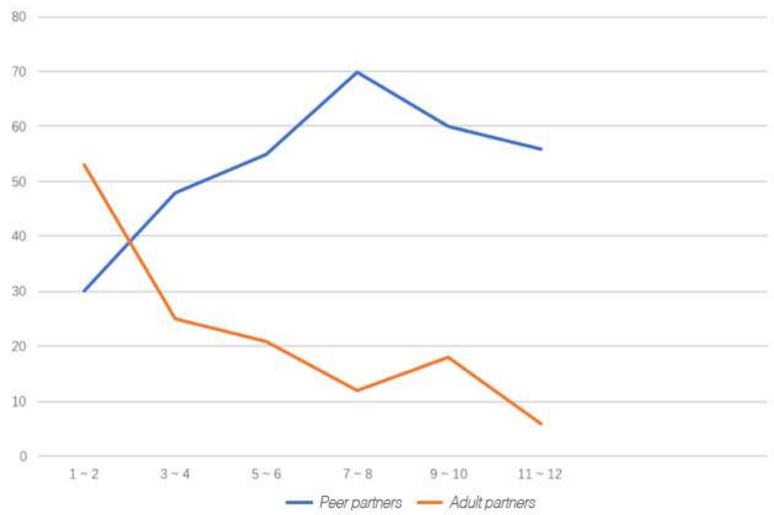

Figure 1.4 Comparison of the time spent by children, partners and adult partners in different age groups（Ellis, Rogoff and Cromer,1981）[7]

Before the 1990s, there are no any mature and high-quality entertainment facilities and playing spaces for children in the early China residential communities, but the relation-

[6] 杜宝贵 杜雅琼:“中国儿童福利观的历史演进--基于改革开放以来的儿童福利政策框架”，《社会保障研究》,2016(5),P82~88
[7] Elilis,S,Rogoff,B.,& Cromer, C. Age segregation in children's social interactions. Developmental Psychology, (1981),17, 399-407.

ship between children is very stronger and closer than nowadays. Children can organize traditional group activities spontaneously that easier to engage more and more children to play together, such as "eagles catching chickens," "throwing handkerchiefs," "rubber bands," etc. From few to the more than a dozen people to participate, children gradually become good friends through game interactions that is very helpful for children to find their identity and value in group activities and form a positive and confident feeling to themselves.

However, in modern communities, most of the game activities are individual rather than groups. Compared with the old community, children rarely know how to build favorable relationships forwardly with others in new communities. They play their own or watch other children games that are less willing to create group activities together and unaware of how to interact or communicate with others. At the same time, it also leads to a lack of personality in children's development. There is a potential insurmountable gap that gradually builds up in their mind and slowly separates themselves from each other to make them more and more introverted and isolated.

There is less interaction between parents and children as well. Most the parents are unconscious of this problem. Conversely, they commonly standby to watch their kids playing or talk about parenting tips with others. Due to the one-child policy, the overwhelming majority of China's family structure is dominated by "father-mother-only child." Parents' over-protection and fondness leads to the weakening of children's communication ability so that it is easier for them to form a self-centered psychological trait, which only concerns with their wants or needs, making it difficult for them to reach consensus on some issues, and unwillingly compromising with each other.

Figure 1.5 Group activities of early childhood
Figure 1.6 Individual activities of children today

[5] *Data from the Blue Book of Outdoor Activities for Children in Chinese Cities*
[6] 杜宝贵 杜雅琼:"中国儿童福利观的历史演进--基于改革开放以来的儿童福利政策框架",《社会保障研究》,2016(5),P82~88

1.1.5 The Importance of Improving Interactivity of Children's Entertainment Spaces & Facilities

" Child growth is the most sensitive stage in life and also the best time to promote and cultivate social-emotional feelings." [8] The thinking mode, character traits, and behavioral habits of children's growth play an indispensable and vital role in the children's future development. Children are curious about everything and easily affected by every distinct surrounding feeling that all explore by what they see, hear and touch outside of the world. The famous American sociologist Mead mentioned the understanding of children's psychological development in his study of "Symbolic Interaction Theory,"[9] he pointed out that children imitate the people's actions around them through play and interact with others during play time.

Children's recreation spaces and facilities provide opportunities and practical platform for children to interact or communicate with others. By enhancing the interactive entertainment facilities and space, children can cultivate their teamwork spirits while promoting the emotional relationship between with children and facilities, children and parents, children and other peers, so that get more physical and mental development to adapt to changeable social conditions.

1.2 The Research Purpose & Significances

[8] 阿尔弗雷德·阿德勒：《儿童教育心理学》，北京.中华工商联出版社,*2017*年版，第*123*页。

[9] *Symbolic interactionism, also known as symbolic interactionism, is a sociological and social psychological theory that advocates the study of the life of human beings from the everyday natural environment of individuals interacting with them. By American sociologist Meade GH Mead Founded.*

Due to the imbalanced between the rapid construction of newly-built residential communities in China and the lagging development of children's entertainment facilities in residential area, children lack essential interactive experiences during playing and be deficient in ability of interaction and communication with others so that are hard for them to cultivate personal emotions and healthy characters during the growth.

To this end, the main goal of project takes Shanghai as an example to analyze the children's entertainment facilities and space in newly-built residential communities in Shanghai, focusing on the growth of children, development, behavior, and psychological characteristics, proposing to enhance the interactive experience of outdoor children's entertainment facilities and space, and building initially basic theoretical framework as well as practical design in Tianan Garden for interactive children's entertainment facilities and space.

1.3 Defining Basic Concepts

1.3.1 Newly-built Residential Communities

The concept of the term "residential communities" was first proposed by Japanese and Taiwanese scholars and was gradually introduced and used by Chinese scholars until 1970s. Literally, "residential communities" usually describes a place which provides every basic living needs to residents and help them build a harmony dwelling environment.[10] Nowadays, people have new understandings of residential communities, which mainly divided into broad and narrow sense.

[10] 朱锡金:*"21*世纪人类生态型住区规划述要*"*, 《城市规划汇刊》, *1994*（*5*）, *P1*。

(1) The broad sense of "residential communities"

The concept of "residential communities" in a broad sense refers specifically to "habitat environment" or "human settlement area,"[11] covering a more general scope, including all human life, residence, work, entertainment, rest in villages, towns, cities, etc. It not only focuses on the individual but also regards the area inhabited by human beings as a whole community and emphasize the interrelationship and interplay between human beings and their local economic culture, social life and political environment. In 1992, Global Agenda 21 pointed out that the development of human settlements needs to rely on the support of social, economic, environment, life quality, and thus it will go further.[12]

(2) The narrow sense of "residential communities"

The "residential communities" in the narrow sense mainly refers to the urban residential area, especially the different scales of population live in a relatively independent area, which is surrounded by streets, walls, buildings or natural boundaries, including the basic living materials and infrastructure construction and meet all residential needs in terms of spiritual culture and social life.[13] Meanwhile, the development of the residential community is also a significant symbol of China's urbanization and a major component of China's residential functional structure. In 2002, the Code for Planning and Design of Urban Residential Communities (GB50180-93) released in China and divided the urban residential communities into three different levels based on the size of the population: "residential area"、" residential community"、" residential cluster." Among them, the "residential area" covers a wider range, and the population size has reached around 30,000 to 50,000 people and 50 to 100 hectares of land. The "residential community" can also be called "community." The size of the accommodated population is 10,000 to 15,000, and the land is between 10 to 35 hectares, which are a medium-sized residence. The "residential cluster" of the smallest regional level is generally called "group," and its resident population ranges from 1,000 to 3,000, covering an area of 4 to 6 hectares.

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[11] 陈晓键，陈志新，钱紫华:《陕西关中地区人居环境研究》，西安.陕西人民出版社, 2004年版
[12] Global Agenda 21 is one of the important documents adopted by the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil from June 3 to 14, 1992,which also called the "Worldwide Action Plan for Sustainable Development"
[13] 朱家瑾主编：《建筑设计指导丛书居住区规划设计》北京.中国建筑工业出版社,2006年版

Due to the advancement of commercial housing-reform was issued by State Council in 1998, marking the end of a decades-long welfare housing distribution policy and the beginning of housing marketization, which namely the residential communities of commodity houses. Under the dual background of rapid economic development and marketization of residential communities, the construction of residential communities in Shanghai has entered a golden period of rapid growth equipped with relatively complete infrastructure and service institutions, especially the children's entertainment facilities are receiving increasing attention, bringing great convenience to the lives of residents. In the current commercial housing market, most of the real estate development is independent residential communities or residential cluster, which is the principal object and field we discussed for this paper.

1.3.2 Children

The range of children's research discussed in this paper generally refers to the age of 3~8 years old, mainly based on the following four reasons:

Survey results: After several weeks of questionnaire surveys and field interviews, it was found that 90% of children like to play with children's entertainment facilities, and most of these children are concentrated in aged 3-8 years, which is the preschool-aged children and early school-aged children because They are still growing up in the stage of loving play and maintaining the appeal of "entertainment," but different from the younger children, who are only satisfied with simple entertainment activities. To this end, the selection of two different ranges of aged 3-8 years as main research objects can be more targeted and appropriated to study children's entertainment facilities for this topic;

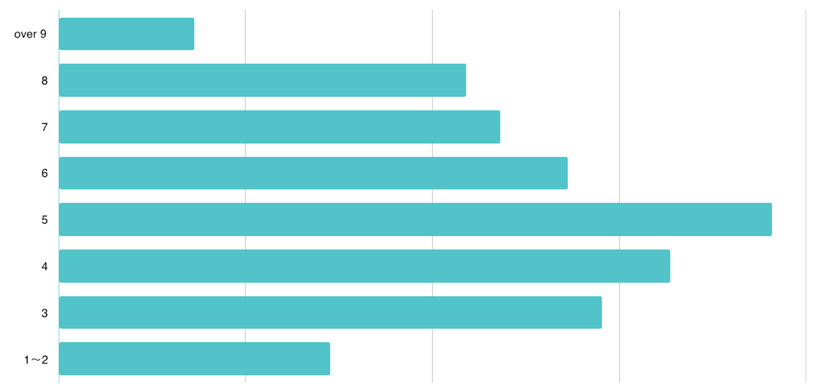

Figure 1.7 the age distribution of children in survey

Physical reason: As shown in the figure, children are in a period of moderate development from the age of 3 to 8 years old. Their height, weight, head circumference, and average standards tend to be stable, compared with other periods, the changes in body development index values are small; and as the child grows older, their bodies also undergo changes in body shape and structure, which gradually resulting in thinner slender, stronger muscles and more robust bones.

Behavioral reason: the children's behavioral ability depends on the brain development, meanwhile, the brain development also, in turn, determines the children's behaviors. As shown in the figure, the brain development of preschool-aged children is growing more faster than other organs in children's body, which means the motor skills have developed better started from early childhood. In the age of 3~5 years old, the child has mastered various skills and knew well to control himself to get up, turn around and keep balance. When they are 6~8 years old, their physical development begins to flatten, the skills they acquired are more diverse and challenging. Therefore, the age of 3~8 years old children have certain similarities in behavior development, and their activity is also comparable level.

Psychological reason: The mental condition of the age of 3~8 years old children is relatively stable. They begin to think about their nature to form self-awareness, to improve thinking and language abilities.

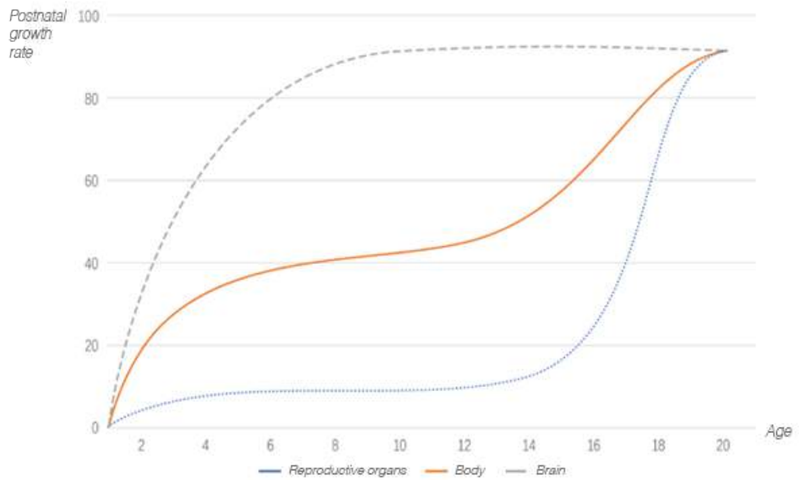

Figure 1.8 Relative growth rates of the brain, reproductive organs, and body (Tanner,1962) [14]

1.4 Literature Review

1.4.1 Relevant Research in Foreign Countries

[14] Tanner JM. Growth at adolescence, 2nd ed. Oxford, England: Blackwell Scientific Publications; 1962.

Researches on children's facilities first started from overseas, especially in some developed western countries where increasing attentions were paid to the importance of children's entertainment facilities and a unified standard for children's entertainment venues in residential areas was formulated. The United States was the first country to research and build children's entertainment space and children's facilities.As early as 1868, the first outdoor children's entertainment venue in the United States was set up in a public elementary school in Boston. Then in 1886, a children's home in the city established a “Beach Paradise” for children to entertain.The establishment of “Beach Paradise” was quickly welcomed by children of all ages and gradually integrated into a game venue designed for older children.The entertainment venues of the early 20th century were mainly characterized by man-made facilities produced by the factory, which were biased towards sports equipment, emphasizing the development of children's physical fitness.The early entertainment venues were built in two places of Massachusetts, Charles Bank and Boston, respectively in 1889 and 1900. At about the same time, Massachusetts issued a law requiring all towns with a population of 10,000 or more to establish public gaming venues and facilities.[15] As early as 1905, 35 cities in the United States built supervised outdoor children's entertainment venues and facilities. The number of cities increased to 90 in 1907, and it had risen to 336 by 1909. The growing interest in building children’s entertainment facilities in cities also gave birth to the establishment of the Playground Association of American (PAA) and began to promote the “Playground Movement” in major cities, which guided the planned construction of outdoor children's facilities across the nation[16].

Under the influence of this movement, the number of children's playground in the United States increased rapidly from 90 to 530 in the three years from 1907 to 1910. The association also created a specialized journal, Game Grounds, which is a rich source of information on the early development of the playgrounds and facilities in the United States.

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[15] Everett B. Mero, American playgrounds: Their construction, equipment, maintenance and utility (New York :Nabu Press 2011)
[16] In 1910, the Playground Association of American (PAA) expanded to Playground and Recreation Association of America (PRAA), and in 1963 merged with the other four organizations NRA, AIPE, ARS, NCSP into the National Recreation and Park Association. (NRPA)

The entertainment facilities of the early 20th century in the United States were mainly artificial swings, slides, climbing frames, carousels, giant slides, seesaws, etc. As the steel materials used to make entertainment facilities turned to war facilities during World War II, less steel materials were available for many designers, manufacturers, engineers began to make suggestions for recreational facilities that lacked steel, and invented many novel children's facilities. The creation of this series also laid the foundation for the new development of children's facilities in the later period.In the 1950s and 1960s, children's facilities were characterized by fixed, plastic solid shapes, with theme-oriented design styles covering grotesque colors, animal images, and spacecraft. Whereas, the 1970s and 1980s saw a gradual emergence of the design of modular wooden facilities. The facilities increased the challenge and linkage of the entertainment experience through breaking through the original building materials and combining the platform and game activities. Jay Beckwith was the famous children's facility designer of this period, and was the first person to apply “multi-functional” structure in the practice of children's facilities.

In the 1980s and 1990s, after the US Consumer Product Safety Commission (USCPSC) issued the Handbook for Public Playground Safety: Volume I and Volume II in 1981, American Society for Testing and Materials (ASTM) issued the Standard Consumer Safety Performance Specification for Playground Equipment for Public Use in 1993. The United States first proposed standardized norms for children's playgrounds and enter United States first proposed standardized norms for children's playgrounds and entertainment facilities, and these norms have also raised people's attention to gradually return from children's facilities to the essence of children's needs, and began to think about how to inspire children through "Play".

Joe L. Frost was one of the most representative scholars researching on children's en-

tertainment facilities in the United States. In his book, *A History of Children's Play and Play*[20], he traced the history of children's play and the entertainment environment, which showed us why we need to pay attention to children's entertainment and the tendency of children's natural plays from its birth in ancient Greece and Rome to the current theoretical analysis. At the same time, it emphasized that the construction of children's entertainment facilities requires the support and participation of many aspects. Only with the concerted efforts and participation of parents and the communities as well as children, can a children's facilities featuring enjoyment, diversity and creativeness be built to promote children's physical and mental health. In another book, *Game and Child Development*, he offered a deeper analysis of the nature of the game and its value to children, and referred to relevant research theories to explore the relationship between various behaviors including games and the development of children in all areas, as well as the necessity to develop children's games and outdoor children's entertainment facilities.

Japan is also one of the first countries to actively advocate the establishment of new children's entertainment facilities for children. Before the WWII, there were only about 600 children's entertainment venues in Japan. With the recovery and development of the Japanese economy after the war, it provided an opportunity for the rise of children's entertainment facilities. By 1965, the number of children's entertainment venues had grown to more than 6,000, up to over 10,800 in 1973, to about 23,700 in 1978 and around 45,300 in 1988 accounting for 43.3% of the total living space in Japan.

The most representative scholars studying on children's growth environment are Professor Nakamura of Chiba University and Professor Sumida Man of the Department of Architecture and Building of Tokyo Institute of Technology.

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[20] Joe L. Frost，A History of Children's Play and Play Environments: Toward a Contemporary Child-Saving Movement（New York :Routlege Pulisher 2010）
[21] 乔 L · 佛罗斯特 (Joe L. Frost)，苏 C.沃瑟姆 (Sue C.Wortham):《游戏与儿童发展》，北京.机械工业出版社, 2015年版

Professor Nakamura mainly focused on the planning of children's entertainment space and the research on children's activity behaviors, especially conducted the systematic study of children's safety response under such dangerous situations as being trafficked or hurt in the entertainment space. He pointed out that there are various risky spaces that will be harmful to children in cities at present. It is believed that only a reasonable planning of such areas in urban cities, residential quarters, surrounding shopping malls and the active construction of infrastructure in public areas such as parks and green areas can children play in a safe, comfortable and recreational space with potential dangerous spaces eliminated, thus ensuring the safe and healthy growth of children. The book *Analysis of Children's Vulnerable Space and Its Countermeasures* is one of the important works concerning this aspect.

Compared with the macro theory of Professor Nakamura, Professor Sumida more centers on children's entertainment venue environment, and has published books and research treatises including Children and Games and Children's Play Environment and An Approach to Environment Design based on his theoretical research and design practice for more than 40 years. In view of his rich experience to do with the design theories and practice of children's entertainment space, he is regarded as the pioneer in the study of children's entertainment space environment.

He emphasized that a good environmental space is of great significance for cultivating children with extroverted personality and sociality. He also indicated that children's entertainment environment is a comprehensive and complicated space, which needs to an effective coordination of multiple factors embracing entertainment time, space, activities, and the relationship between children and others. He gave special emphasis on the hardware design related to children's activities.He believed that hardware design is not only an important element in building children's entertainment environment space,

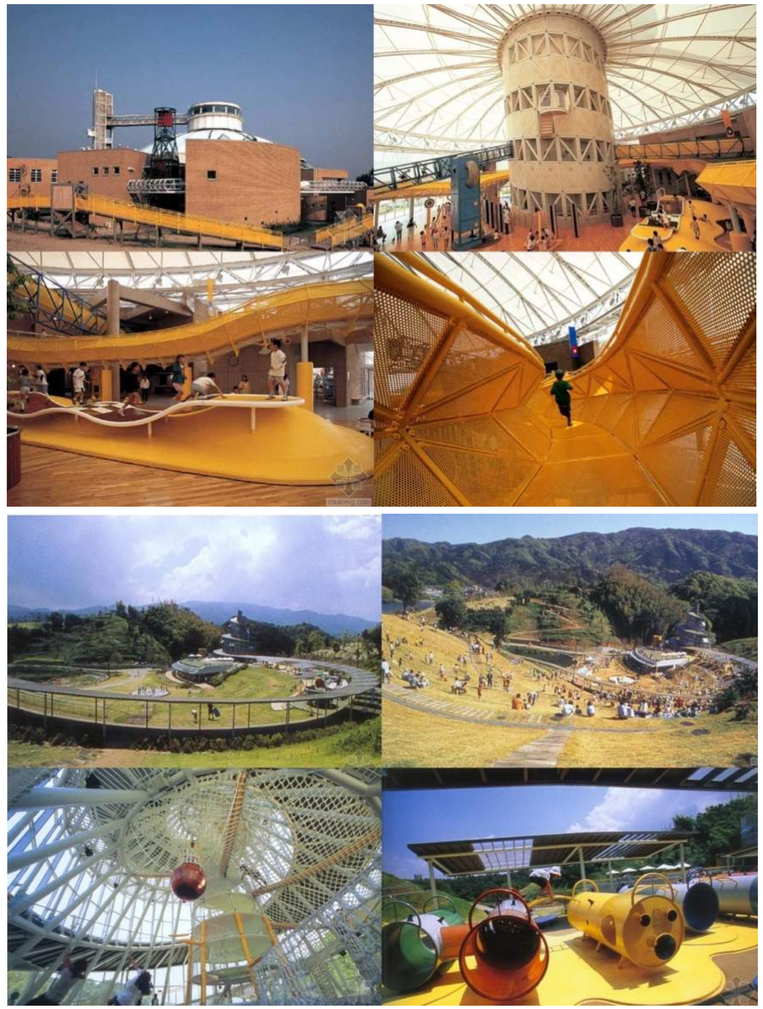


Figure 1.9 Aichi Children's Center (1996)
Figure 1.10 IKainan Wanpaku Park (2000)

but also a carrier for children's entertainment emotional communication. What's more, hardware facilities have the function to inspire children and good for the long-term development of children's physical and mental health with their educational and interactive nature.but also a carrier for children's entertainment emotional communication. What's more, hardware facilities have the function to inspire children and good for the long-term development of children's physical and mental health with their educational and interactive nature.

In this regard, Professor Sumida had created a variety of children's entertainment hardware facilities of various shapes, and he also proposed theories of "touring structure" and "circular game system" based on the research of children's entertainment environment. He argued that "the game activities of children's entertainment facilities are mostly chasing and hiding", so the game sports line of facilities should also be a closed, circular form, allowing children to stimulate their exploration and desire in plays to consume their "excessive energy." He integrated these theories into the design works of the Aichi Children's Center and the Kainan Wanpaku Park, receiving warm welcome and attention from the public, and as an architect, he continued to carry out child-related public buildings and hardware facilities. The design practice has played an crucial role in promoting the development of children's entertainment facilities in Japan.

1.4.2 Relevant Research in China

China's concern on children's entertainment facilities started much later. In the early 1980s, with the deepening of reform and opening-up, the rapid development of the national economy, the continuous improvement of living standards, and the baby boom-

ing, people began to pay more concern on the importance of children's development under the influence of developed countries.Children's entertainment spaces have begun to spread in parks in major cities and entertainment venues and diverse outdoor children's facilities exclusively developed for children. Given this dynamic, the design and production of children's entertainment facilities in domestic have gradually formed an industrial chain. However, most of the domestic entertainment facilities have never been able to get rid of stereotypes and the distribution was mainly concentrated on children's parks and playgrounds. It's only in the recent ten years that children's entertainment facilities have begun to popularize in the new urban settlements.

In theory, China's research on children's facilities is still in its infancy. The urban planning regulations on children's activities open space should be set up in public green spaces such as residential areas and parks to meet the living needs of residents can only be found in the published Park Design Code and Code for Planning and Design of Urban Residential Areas, but there is no detailed description of the area scale and orientation of the space. In 1986, the Planning and Design of Children's Playgrounds in Residential Areas, complied by Fang Xianfu et al, provided some specific planning suggestions for children's entertainment space in residential areas and supplied corresponding design guidance according to the characteristics of children's entertainment activities in different ages. However, discussions about children's facilities are mostly concentrated on public facilities, and there are no specific norms and standards for outdoor children's entertainment facilities.The public still have difficulty in distinguishing the children's facilities from public environmental facilities.

The earliest concern for domestic children's facilities was the book *Garden Pieces and Facilities 1: Children's Play Facilities* written by Zhu Tangchun, published in 2004 [22].The book mainly collected successful examples of domestic children's playground design,

[22] 朱堂纯的：《园林小品与设施*1*:儿童游乐设施》，北京.中国建筑工业出版社,*2004*年版

and systematically analyzed the design principles and characteristics of general children's entertainment facilities, theme-based children's amusement parks, scientific and educational children's amusement parks, and children's sculptures. At the same time, it reflects the development status and future trends of children's recreation facilities in mainland China, and thus helps the design of children's facilities in virtue of the comparison with Hong Kong children's entertainment facilities with Chinese and Western characteristics.Although the types of facilities shown in the book are relative comprehensive and the cases are representative, there is a lack of innovation in the overall appearance, and there is limited reference to the design of children's facilities today.

Domestic research theories mostly explore outdoor children's entertainment facilities from the perspective of landscape and architecture, with which to guide the design of entertainment space and landscape design. Therefore, children's facilities are often become the attachments of environmental space, and the connection between them is very weak,lacking of research from the perspective of children's psychological and physiological needs.

Based on the characteristics of children's growth, behavior and mentality, this paper will sort out the problems of existing children's facilities to provide new ideas and methods for improving children's entertainment facilities.

Figure 1.11 Partial illustration of Garden Pieces and Facilities 1: Children's Play Facilities written

Chapter 2: Basic Theoretical Construction

In this chapter, we will carry out further specific research and analysis on the target children to summarize the development of various aspects and the real needs of children for entertainment facilities and spaces, and integrate the theoretical research and educational theories of children .

2.1 Children’s Physiological Characteristics
2.1.1 Children's Physical Development

Children's physiological development is the key to children's growth and health, and it is also the carrier of children's psychological activities. Understanding the physiological characteristics of children is of great significance to the study of children's psychological characteristics.In China, the period of 3 to 6 years old is generally referred to as preschool age, and the period of 6 to 12 years old is called school age. Therefore, the children aged 3-8 years referred to in this article belong to the pre-school and early school stages, that is, these children are still in the process of continuous growth and improvement.However, in contrast with the babies and toddlers, the children's physical development values tend to a steady increase. Children's height will increase by about 5 to 7 centimeters per year; body weight will increase by 1.5 to 2.0 kilograms a year; fat will decrease; body shape is relatively slender, and lymphoid tissue begins to develop rapidly.

Due to the rapid development of children's physiological development and metabolism during this period, children's vigorous energy is also showing a relatively obvious activity and playability, and an increase in exercise capacity.However, the acceleration of physical development does not mean that children's physical functions are mature. On the contrary, children in development are generally weaker in adapting to the external environment and against uncertain factors such as external diseases and aggression.

		2	3	4	5	6	7	8	9	10	11	12
Height	boy	85.3	93.4	99.9	107.6	113.7	120.5	125.3	130	135.1	141.9	146.8
	girl	89	92.9	99.5	106.5	112.8	118.8	123.4	130.2	134.4	141.1	145.5
Head width	boy	13.3	13.5	13.8	14	14	14.2	14.2	14.3	14.4	14.5	14.6
	girl	13	13.3	13.5	13.6	13.7	13.9	14	14.1	14.1	14.2	14.5
thickness of the chest	boy	11.6	12	12.5	13	13.3	14.1	14.3	14.8	15.2	16.2	16.8
	girl	11.3	11.8	12.2	12.7	13.2	13.5	13.7	14.4	14.7	15.7	16.2
Hand diameter	boy	4.24	4.51	4.57	4.82	4.99	5.16	5.28	5.42	5.56	5.85	6.03
	girl	4.1	4.3	4.5	4.66	4.79	5.01	5.08	5.22	5.42	5.6	5.82

Figure 2.1 2 to 12 years old body development chart [23]

Figure 2.1 2 to 12 years old body development chart [23]

2.1.2 Children's Movement Skills

[23] 江帆鸿:“小区儿童游乐设施在人机工程学中的应用”，《设计》，2017（3），P126～127

Movement skills are the most direct manifestation of children's behavioral abilities. Movement skills can be divided into gross movement skills and fine movement skills. Gross movement skills refer to the ability to allow children to exercise body flexibly, while fine movement skills refer to the ability of children to use their hands and fingers.but also a carrier for children's entertainment emotional communication. What's more, hardware facilities have the function to inspire children and good for the long-term development of children's physical and mental health with their educational and interactive nature.The nerve center in which the brain dominates the movement of the large muscle group, will have priority to develop. In view of this, the gross movement develops earlier than the fine movement. Nevertheless, the two movement skills are complementary and play an important role in the development of children.

However, the difficulty of motor skills that can be mastered by children of all ages varies. David L. Gallahue proposed the theory of Gallahue's Movement Phases [24] and stated that the acquisition of children's movement skills is a progressive process.

Reflexive Movement Phase: refers to infants from 0 to 4 months, and the behavioral abilities that occur at this stage are mainly described as conditioned reflexes which include the adaptation of a baby to the environment, the response of a baby to a specific object. Taking the sucking action for example, it only happens when a baby notices such specific objects as rubber nipples, and nursing bottle.

Rudimentary Movement Phase: refers to children aged 0 to 2, including not only the movement skills acquired during infancy, but also other basic movement skills such as climbing stairs, walking, grasping objects, loose hands.include the adaptation of a baby to the environment, the response of a baby to a specific object. Taking the sucking action for example, it only happens when a baby notices such specific objects as

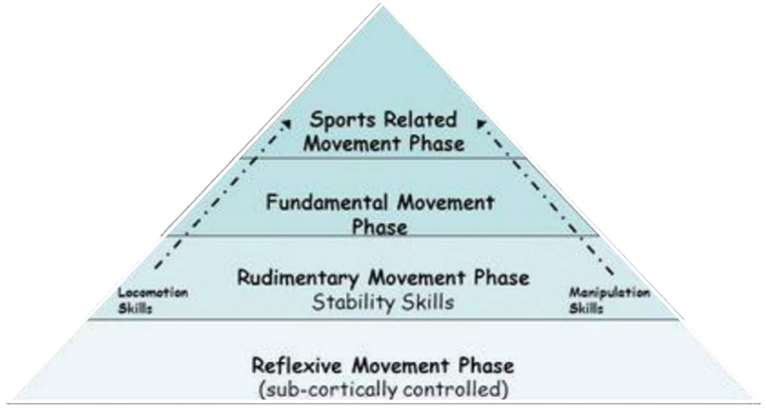


Figure 2.2 Gallahue & Ozmun's stages of motor development

[24] *Gallahue, D.L., Ozmun, J.C. and Goodway, J. Understanding Motor Development: Infants, Children, Adolescents, Adults* (*New York: McGraw-Hill, 2012*)

climbing stairs, walking, grasping objects, loose hands. The rudimentary movement skills acquired in the first two years also laid a solid foundation for the subsequent basic action phase;

Fundamental Movement Phase: refers to children between the ages of 2 and 7 and indicates mainly to the preschool age group. Children in this stage, have a growing better control of the muscles, and the skills will be more refined. The movements such as running, jumping, throwing, catching the ball will receive a long-range progress and gradually become more skilled.When a single action is proficient, one can complete a set of actions in a coherent manner.

Sports Related Movement Phase: refers to the period from the age of 7 to the age of adolescents or adulthood. In this phase, the movement skills turned to be more specialized, from simple behavioral actions to precise movements. For example, children can learn to throw a ball from slow and careful action to accurately and quickly casting into the hands of others.

After getting across the theory of children's movement phases, it can be found that the target group of this article is right the children in Fundamental Movement Phase and early Sports Related Movement Phase just pursuing more activities and enhanced movement skills. The notice of the movement skills of children in different phases also laid a theoretical foundation for later research.

2.1.3 Children's Physiological Development & Entertainment Activities

Children entering the preschool stage will use wheel cars and large-scale gaming equipment independently, and will also participate extensively in large muscle action games (sliding, swinging, climbing, balancing, chasing, etc.) or practice games (grabbing, holding, throwing, etc.) and structure games (building blocks, sand, water, etc.) and systematically analyzed the design principles and characteristics of general children's entertainment facilities, theme-based children's amusement parks, scientific and educational children's amusement parks, and children's sculptures.Preschool children's play space venues will be larger, more complex, and more diverse, such as flat grass where children can play balls and chase, and sand field or rubber mats that can protect children from falling.

The entertainment focus of school-age children has gradually shifted to organized games, such as football, basketball, fighting games and other physical activities, and entertainment equipment has begun to develop towards fitness equipment, such as rings and horizontal bars. As the children continue to grow, the demand for the entire entertainment space improves constantly.

Although children of different ages have different developmental characteristics and movement ability, dividing the space by age and ability does not necessarily contribute to the growth of children. A successful outdoor recreation space still needs to consider children of all ages and hobbies in terms of facilities and planning by encouraging children to exercise their entertainment autonomy, imagination and creativity[25].Cooperative games have positive influences on children of all ages in regards to their learning from each other and a better communication as well as their own growth.

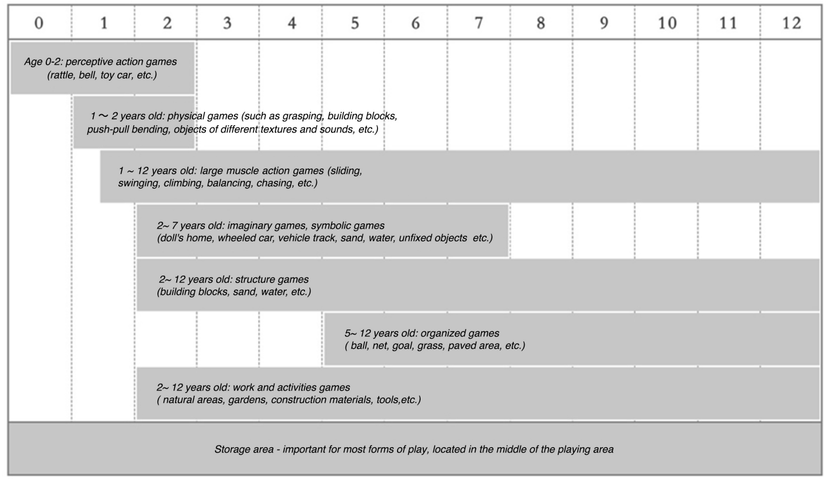


Figure 2.3 Types of children entertainment dominated in different periods[25]

2.2 Children's Psychological Characteristics

[25]布鲁斯·格利尔梅耶（*Bruce Grillmeier*）：《户外儿童娱乐设施》，桂林.广西师范大学出版社,*2015*年版，第*12*页
[26]乔 L · 佛罗斯特 (Joe L. Frost)，苏 C.沃瑟姆 (Sue C.Wortham): 《游戏与儿童发展》，北京.机械工业出版社, 2015年版

2.2.1 Piaget’s Theory of Cognitive Development

Cognitive development refers to the cognition forming process of the world based on the external knowledge acquired through understanding, reasoning, thinking, problem solving, learning, conceptualization, classification and memory, which means in short, the development of people understanding and gaining outside knowledge. The target children of 3 to 8 years old are in an important period of forming cognition.During this period, children's perception of emotion, space, color has a longer-term development than that of infants and young kids.

The famous Swiss psychologist J. Piaget is the founder of children's cognitive development research. He has proposed the theory of cognitive development that has a great impact on children's psychology and epistemology, of which the most important one is the cognitive development theory.He divided the process of children’s cognitive development into four main stages:

Sensorimotor stage : from birth to the age of two. During this period, the main approaches for babies to acquire knowledge are by sucking, grasping, biting, touching and familiarize and control the object through their response to external things rather than through the inner thinking process. However, the early stage of action-based is the premise of the development of children's conceptual activities and the beginning of children's sense of the world;

Pre-operational stage : known as the pre-logic stage where children are about two to six or seven years old. From the age of two, children's cognitive ability has begun to undergo qualitative changes instead of only performing sensory movement activities. They employ “signs” instead of existing objects, to describe or imagine the external environment. For example, they may imagine themselves as a superman with the ability to fly, imagine their own toys can talk to themselves and so like. At this point, children can symbolize various images in their minds, and create and imagine a world that is self-centered than through the inner thinking process.

Age Range	Description of Stage	Developmental Phenomena
Birth-2	Sensorimotor – Experiencing the world through senses and actions	Object permanence Stranger anxiety
2-6 years	Preoperational – Representing things with words and images	Pretend play Egocentrism Language development
7-11 years	Concrete Operational – Thinking logically about concrete events and grasping concrete analogies	Conservation Mathematical transformation
12 – adulthood	Formal Operational – Thinking about hypothetical scenarios and processing abstract thoughts	Abstract logic Potential for mature moral reasoning

Figure 2.4 Piaget’s Theory of Cognitive Development

Concrete operational stage : from the age of six or seven to eleven years old. The intellectual development of children at this stage has reached new heights and developed a primary logical thinking ability.They can make systematic reasoning, solve problems in a logical way, and abandon self-centered consciousness, especially in the concept of numbers, children have a more mature concept of numbers and they understand that numbers are interchangeable, can be conserved, and also have levels and sub-levels (such examples as: 2 plus 3 equals 5);

Formal operational stage : from the age of eleven to fourteen. At this stage, children's intellectual development has matured and their thinking is more bold and active, and they have a new understanding of the perception and understanding of things. Unlike the concrete operational stage, children's thinking is no longer confined to the actual things, but can deal with pure hypotheses and abstract concepts and detect existing or unknown fields in a logical way.

2.2.2 Children's Emotional Development

When people look at whether objective things satisfy their own needs, an internal experience called emotion will be produced. Children's emotional features are the most important part of cognitive development.In the light of Piaget's cognitive development stage, children will gradually develop self-consciousness in the pre-operational stage and realize their existence as an individual. Moreover, they will gradually understand they also exist as part of as part of society.

The characteristics of children's emotional development are mainly embodied in the following three aspects: self-awareness, emotional self-adjustment and social ability.

Generation of Self-awareness : The most important cognitive development of children aged 3 to 6 in pre-operational stage is the emergence of self-awareness. They begin to develop individual consciousness. They can gradually see the world from the perspective of others. For instance, they gradual understand their physical condition such as height, weight, and posture, or knowing their psychological characteristics

such as their interests, temperament, and personality, and their relationship with people around them, as well as realize their roles in the team.

Emotional Self-regulation : Children in the pre-operational stage not only developed self-awareness, but also started to understand their relationship with others and gave corresponding respond to it. As they learned more about the philosophy of various relationships, they will begin to engage in cooperative behaviors. They will even provide comfort and support to partners, siblings or parents. Hence, switching from the previous state to self-internalization and adjustment, children began to export emotions to others.unknown fields in a logical way.

Embodiment of Social Ability : Their social skills are mainly manifested through the approaches adopted by children to dealing with their relationship with others, including the parent-child relationship, the sibling relationship and friendship with peers.The most important relationship is the one between children and parents or caregivers who accompany children for the longest time and have the paramount impact on children in growth stage. In addition, brothers and sisters also have crucial influence on children's affective development, which can be nourishing and supporting. Besides, peer relations can also affect the development of children. The longer they play with their peers, the more opportunities of participation children will gain and better understanding to the art of interaction with others.

2.2.3 Children's Psychological Development & Entertainment Activities

Piaget also argued that children's cognitive development and entertainment activities have a corresponding continuous and phased relationship. At different stages of cognitive development, entertainment activities also have diverse developmental features. He divided the form of entertainment activities into three types: practice games, symbolic games, regular games, matching with the level of intelligence in the sensorimotor stage, pre-operational stage and concrete operational stage.

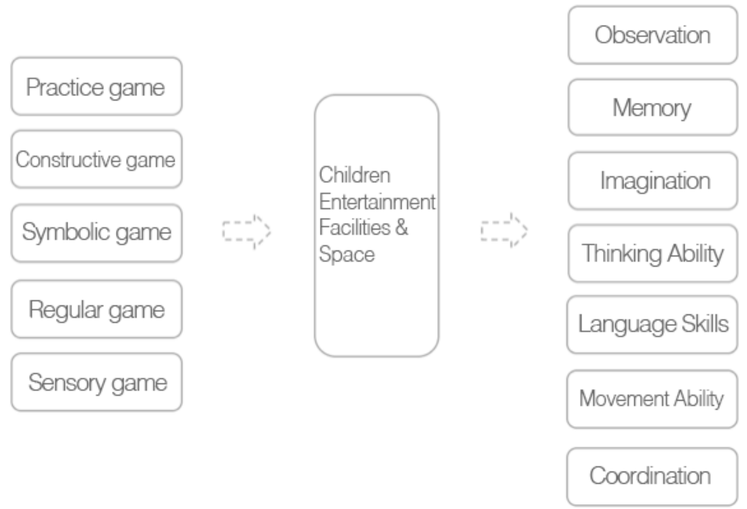


Figure 2.5 Children's game classification and game features

Sensorimotor Stage - Exercise Game: Since in the early stage, the main form of entertainment activities of children is sensorimotor, some actions are simply repeated so that a certain pleasure experience can be obtained. Such actions as are also commonly referred to as an exercise game, of which the representative performances are repeatedly snatching a toy, running around an object. But practice games are not merely in sensorimotor stage, but penetrate game activities throughout childhood.

Pre-operational Stage-Symbolic Game: In the pre-operational stage, children's cognitive schema began to generate symbolic function, that is, using "symbolization" to interpret and replace external things. While the "symbolic" schema has gradually shifted to symbolic games, and has become the main form of children's games. The typical manifestation is that children substitute and understand external things in symbolic forms, and play games through imaginary behaviors to reflect current reality and individual wishes.

Concrete Operational Stage -Regular Game: At this stage, their ability to summarize, judge, compare, reason, has been improved accordingly, due to the advancement of children's language and logic capability. Children are also beginning to break away from self-centered thinking and begin to transition to regular team activities. Therefore, it is more possible for children to formulate, comprehend and comply with the rules of the game. Regular games have become the main form of activity for children in concrete operational stage.

American psychologist Bruner once pointed out: " As an interesting behavioral activity, game’s function of psychological adjustment is mainly based on the formation and improvement of targeted activities."In real life, children's behaviors are diverse. Behind every behavior, there is a behavioral psychology that is different from that of adults. The key to solving problems relies on the psychology behind children's behavior. The main aspect of children's psychological behavior is the playing process. Children love playing, which reflects the characteristics of the game. On the other hand, in the stage of children's physical and mental development, children of different ages require different types of games, from which children can be benefited in learning and development.

2.2.4 Interaction Theory

The concept of interaction has also slowly affected the field of design. Due to the emergence of interactive technology in computer science and the development of the Internet, in the 1980s, Bill Moggridge, one of the founders of IDEO, first proposed the concept of interaction design and named it "soft face" but later renamed "interactive Design". From that time, the concept of "interactive Design" has been always used. The “interaction” now focuses on the behavior of the user when applying the product or service, and how the product promotes the interaction between people and people, and between people and things. It enhances the “interaction” between the two. At the same time, it emphasizes that the key of interaction lies in the sensory or psychological process of human perception. Unlike the direct interaction of language communication, interactive design requires media assistance from actual products and services, but the essence is still the communication between people.

Nowadays, the concept and design application of "interaction" is moving from the software interface to the field of product design, surpassing the virtual boundary and moving towards the interaction between people and people, which provides new perspectives to design.

The interaction of children's entertainment facilities refers to the interaction between facilities and users. “Interactivity” is a characteristic of children's entertainment facilities. This concept is intended to promote the interaction between people to people, and between people and things through the mutual promotion, communication and participation of children's entertainment facilities to convey emotion. In the shallow sense, it is mainly about the way of using the product and the design of user behavior; but from a deeper sense, it also pays attention to the nature and connotation of the hidden behav-

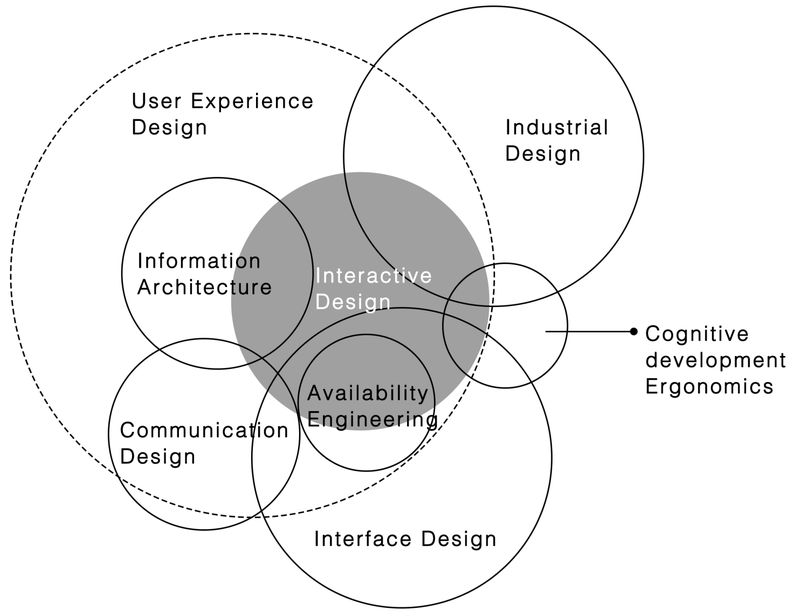


Figure 2.6 The relationship between Interactive design and other subjects[27]

Figure 2.7 the purpose of interactive design

[27] *Image from Dan Saffer, an interactive design expert at Carnegie Mellon University*

ior, that is, from the functional analysis of the product to the experience of users. As far as the user experience is concerned, it focuses on the user's external entity behavior to psychological activity. It emphasizes the experience of the user and the elements of the product interaction system (consisting of the user itself), including the children's emotions, parents' emotions, memory of knowledge and many other aspects. At the same time, the beneficial information obtained is given to children who receive and feedback the information through the entertainment facilities, which is a process of information exchange. The interactive design of children's entertainment facilities requires users to participate in it and gain a sense of body and mind. It is intended to design communication between people, communication between people and facilities, communication between people and their own spirit, so it is an entertaining design to get experience.

The application of interactive design in children's entertainment facilities is divided into the following four aspects: sensory interaction:

Sensory Interaction: children can not only feel the design elements of materials, colors and structures of entertainment facilities through visual, tactile, auditory and other sensory experiences, but also train children's sensory ability and stimulate children's curiosity to cultivate children's spirit of exploration.

Behavioral Interaction: children's behaviors have a very important impact on the structural design, combination, and functional classification of recreational facilities.The behavioral interaction of children can be summarized as the relationship between cooperation and competition.

Emotional Interaction: children participate in recreational activities to develop interactions with others (partners, parents, teachers, or others) and experience a fun, intense, surprising, attractive, and even emotional experience to achieve the emotional purpose of a pleasant experience ultimately.

Thinking Interaction: The interactive design of thinking is to start with the problem, to attract children's interest and curiosity, and to complete the entertainment activities through the children's own thinking and analysis of certain questions.

Chapter 3: Case Analysis of Children's Entertainment Construction

This chapter will analyze the current situation of domestic and abroad children's entertainment construction in residential areas , compare existing practice cases to find out an appropriate direction for Shanghai's new residential communities.

3.1.1 Galicia de Alcobendas Park

The public area of Galicia Entertainment is located in Akobanda, Madrid, Spain, and was opened to the public in 1993. In 2009, in order to meet the needs of residents in nearby settlements, the Arkunda government carried out a redesign of the Galician Park, designed by Lappset company in Spain, which was completed in 2010 and re-opened to the surrounding residents.

The entire entertainment is divided into three areas, and each area corresponds to children of different stages of development. Located in the north, Area A has new children's entertainment facilities, mainly for toddlers. The central part of Area B is also the most important area in the vicinity. There are a series of anthill-themed entertainment facilities for pre-school children as the main users. Area C adds footpaths for walks, lawns for sitting down and large rebuilt areas for dogs to meet children and adults of all ages.

The most popular among children and surrounding residents is the Anthill Entertainment District, which is the most important part of the park. The material of the artificial anthills is mainly made of steel and polyethylene. The reworked labyrinth inside the anthill allows children to imitate the living conditions of ants in the anthill, freely explore through several layers of paths and steps, and drill out from the slide or the hole in the outer wall, which also confirms that the previous article mentioned Xian Tianman's theory of "touring structure" and "circular game system" that children's entertainment facilities should be a closed, cyclical form, while the artificial anthill maze is the representative work of this practice,, which not only allows children to deepen their exploration and curiosity in a recurring game line but also deepens the interactive experience of children and facilities and others.

Figure 3.1 Galicia de Alcobendas Park

3.1.2 Entertainment Construction of Tianhe District

With the public's concern about the healthy growth of children, the relevant domestic departments have gradually realized the importance of the entertainment environment to children. For example, Tianhe District of Guangzhou is the first region in China to be led by government-led children's facilities. According to the survey, the proportion of children aged 0-14 in Tianhe District is about 10.57%, ranking second in the city, but the only children's entertainment facilities cannot meet the children's entertainment needs. In order to effectively meet the demand of 45.9% of residents in Tianhe District for building children's facilities in residential areas, the Tianhe District Government has issued the Tianhe District Children's Play Facilities Community-based Construction Work Plan and Tianhe District Children's Recreation Facilities Community-based Pilot Construction Plan in 2015. On the basis of the two plans, the government is to complete the community construction of 80 children's entertainment facilities in the next three years (2016-2019). In this regard, nearly 10 million RMB has been invested to the Project of Community-based Children's Entertainment Facilities in Tianhe District, which has been included as one of the top ten people's livelihood of the Tianhe District Government.

Since its initiation in 2016, the program has been enacted for two years. In the past 2015, Tianhe District has completed three pilot projects of Haikang Community, Fangcaoyuan Community, and Yinpailing Park of Kemulang Community. Based on this, the project began to be promoted to the whole district with the speed of building about 20 recreational facilities per year. At present, it has completed 33 residence-based children ‘s entertainment facilities in 21 streets including Tianhe South Street, Wushan Street, Changxing Street and Longdong Street, with the investment over 3.3 million RMB in aggregation, more than 3,000 square meters in total, benefiting at least 25,000 children at the age from three to twelve.

Figure 3.2 Entertainment Space & Facilities of Tianhe District

3.2 Comparison of Children's Entertainment Facilities and Space in Residential Areas at Home & Abroad

3.2.1 Space of Entertainment Venues

Foreign countries have clear specifications for children's entertainment venues.

Chicago, USA: if the population of the area is less than 800, the scale of children's entertainment venues should be 0.8 hectares; if the population of the area is less than 4,000 people, the scale of children's play field should be 0.8-1.6 hectares;

Germany: the standard of children's per capita activity area is controlled between 1 and 3 square meters, which basically meets the static space required for children to stretch their arms;

Japan: the space requirements of dynamic activities are more considered in standard setting, so the per capita activity area is more abundant, reaching 3 to 12 square meters.

However, China has not yet had a rigid indicator specification for children's entertainment venues in residential areas, but it has been generally referred to in relevant documents. In the *Guidelines for the Design of Environmental Landscapes in Residential Areas*, the following is stipulated for the setting of public green spaces at all levels of residential areas and the green spaces of courtyards. Based on population size, the public green space index is divided into:

the group level is not less than 0.5 square meters per person; the community (including group) is not less than 1 square meter per person; the residential area (including the community or group) is not less than 1.5 square meters; the green rate stipulates that the construction of the new district should be equal or more than 30%; the transformation of the old district should be equal or more than 25%; the survival of planting should be equal or more than 98%;

Name of Green Space	Content	Requirment	minimum specifications (hm^2)	Maximum Service Radius (m^2)
Residential area	Flower lawn, flower bed water surface, pavilion sculpture, small tea shop, old and young facilities, parking lot and paved ground, etc	The layout of the park should have clear functional division	1.0	800—1000
The Small Garden	Flower lawn, flower bed water surface, sculpture, children's facilities and paved ground, etc	The layout of the park should have certain functional division	0.4	400—500
Group green space	Flowers and trees lawn, tables and chairs, simple children's facilities	Flexible layout	0.04	

Table 3.3 Guidelines for the Design of Environmental Landscapes in Residential Areas

3.2.2 Design Specifications of Entertainment Space

The United States was the first country to standardize children's playgrounds and entertainment facilities. In 1981, the US Consumer Product Safety Commission (USCPSC) published the *Public Playground Safety Handbook: Volumes I and II* provides an authoritative specification for the safe design of children's entertainment venues. The manual covers a wide range and detailed classification, and provides recommendations for children's facilities, laying, supervision and so on.

In Europe, the European series of standards (European Norm) is the main basis and reference for the safety design of children's playgrounds. It is developed by the European Committee for Standardization (European Standardization Committee) and enacted *EN 1176 Playground Equipment and Surfacing (a total of 8 volumes)* and *EN 1177 Impact Attenuating Playground Surfacing - Determination of Critical Fall Height* and other design criteria for children's playgrounds, whose content includes design guidelines for the installation of recreational facilities and site materials, installation procedures, and maintenance operations.

In China, some guidelines on the design of children's playground facilities are also mentioned in the *Guidelines for the Design of Environmental Landscapes in Residential Areas*. In the choice of facilities, the primary consideration is to attract the enthusiasm of children to participate in recreational activities, considering practicality and aesthetics, and coordinate with the surrounding environment. At the same time, the scale of the facility needs to meet the child's physiological characteristics, avoiding safety issues. Although some standards have been proposed for children's facilities in the relevant documents, the concept is still abstract and shrinkable. China does not have a complete set of systematic and standard regulations.

设施名称	设计要点	适用年龄
沙坑	56、沙坑一般规模为10-20 平方米 57、沙坑深40-45cm，以中细沙为主，并经过冲洗。沙坑四周应竖10-15cm的围沿，防止砂土流失和雨水灌入。围沿一般采用混凝土、塑料或木质，上可铺橡胶软垫。 58、沙坑内应敷设暗沟排水，防止动物在坑内排泄。	3-6岁
滑梯	59、滑梯由攀登段、平台段和下滑段组成，一般采用木材、不锈钢、人造水磨石、玻璃纤维、增强塑料制作，保证滑板表面平滑。 60、滑梯攀登梯架倾角为70° 左右，宽40cm，踢板高6cm，双侧设扶手栏杆。休息平台周围设80cm 高防护栏杆。滑梯倾角30° -35° ，宽40cm，两侧直缘为18cm，便于儿童双脚制动。 61、成品滑板和自制滑梯都应在梯下部铺厚度不小于3cm 的胶垫，或40cm的砂土，防止儿童坠落受伤。	3-6岁
秋千	62、秋千分板式、座椅式、轮胎式几种，其场地尺寸根据秋千摆动幅度及与周围游乐设施间距确定。 63、秋千一般高2.5m，长3.5-6.7m（分单座、双座、多座），周边安全护栏高60cm，踏板距地面35-45cm。幼儿用距地为25cm。 64、地面须设排水系统并铺设柔性材料。	6-15岁
攀登架	65、攀登架标准尺寸为2.5m×2.5m（高×宽），格架宽50cm，架杆选用钢骨和木制。多组格架可组成攀登架式迷宫。 66、架下必须铺装柔性材料。	8-12岁
跷跷板	67、普通双连式跷跷板宽1.8m，长3.6m，中心轴高45cm。 68、跷跷板端部应放置旧轮胎等设备作缓冲垫。	8-12岁
游戏墙	69、墙体高度控制在1.2m 以下，供儿童跨越或骑乘，厚度为15-35cm。 70、墙上可适当开孔洞，供儿童穿越和窥视产生游乐兴趣。 71、墙体顶部边沿应做成圆角，墙下铺软垫。 72、墙上绘制的图案应采用不易褪色的材料。	6-10岁
滑板场	73、滑板场为专用场地，要利用绿化种植，栏杆等与其它休闲区分隔开。 74、场地用硬质材料铺装，表面平整，并具有较好的摩擦力。 75、设置固定的滑板练习器具，铁管划架、曲面滑道和台阶总高度不宜超过60cm，并留出足够的滑跑安全距离。	10-15岁
迷宫	76、迷宫由灌木丛或石墙组成，墙高一般在0.9m-1.5m 之间，以能遮挡儿童视线为准，通道宽1.2m。 77、灌木从墙需进行修剪以免划伤儿童。	6-12岁
球场	78、球场应独立设置，并距离其它游戏场地和设施至少10 米左右的距离，距离住宅至少20 米距离。 79、球场尺寸至少5×10 米（宽×长），在场地有限的情况下，可尽量增加长度，以使儿童跑动距离增大。球场可下沉设置或四周有挡球的矮墙，下沉高度或墙高至少50cm，使孩子可以坐在边沿观看。 80、球场长向方向两侧应设置球门，或设较高的墙以代表球门。 81、地面宜为草地、土地、沙地或橡胶地面	6-12岁

Figure 3.4 Guidelines for the Design of Environmental Landscapes in Residential Areas

3.2.3 Overall Comparison of Children's Entertainment Facilities

Foreign children's entertainment facilities are more innovative in terms of form and function than domestic children's entertainment facilities, paying more attention to children's psychological and physiological needs and interactive design, bringing new vitality to children's entertainment life. Due to the late start of Chinese children's entertainment facilities, many related regulations have not yet been established. Therefore, in terms of innovation and interaction, the design of domestic children's entertainment facilities still has a large gap with foreign countries but on the other hand, it is still very clear to have great room for improvement.

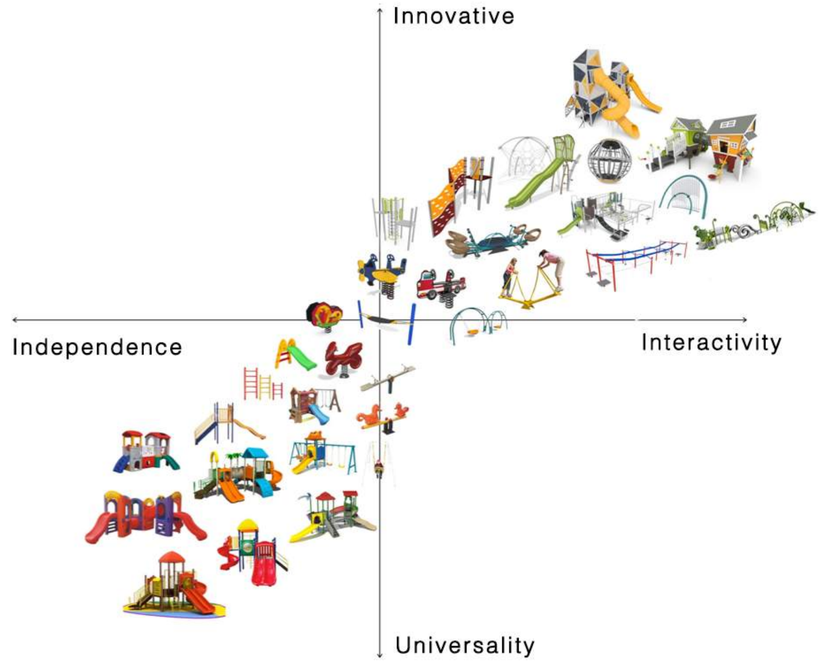


Figure 3.5 Overall comparison of children's entertainment facilities design at home and abroad

Chapter 4: Analysis of Children’s Entertainment Facilities in Shanghai Newly-built Communities

This chapter will conduct a field analysis of the existing children’s entertainment facilities in Shanghai newly built residential communities, summarize the development characteristics, make observation and investigation on the use and interactive behaviors of the target population so as to get a real understanding of the actual needs of children .

4.1.1 Development of Newly-built Residential Communities in Shanghai

The residential communities in Shanghai have already had a history of development of more than 60 years since the founding of the People's Republic of China. From the construction of the workers' new villages under the influence of the Soviet Union in the 1950s and 1960s to the large suburban residential communities that emerged during the new historical period in 1987 and to the advancement of commercial housing reform in 1998, all these have brought about a diversified and multi-variety situation in the development of residential communities. The emergence of "newly built residential communities" took place after the reform of the housing distribution monetization in 1998, namely the residential communities of commodity houses. Under the dual background of rapid economic development and marketization of residential communities, the construction of residential communities in Shanghai has entered a golden period of rapid development with a rate of millions of square meters per year. The area of residential buildings rapidly developed from 199.61 square meters in 1978 to 1.19074 million square meters of newly built residential buildings in 2017, and the per capita living area has grown from only 3.6 square meters in 1978 to 24.16 square meters per capita today. The goal of one person one room has been basically achieved. Since 1998, the number of newly built residential communities in Shanghai has reached 7,425, and Pudong New Area is a district with the largest number of newly built residential communities at present, which is 1,621, followed by Minhang District and Songjiang District, where there are 776 and 545 newly built residential communities, respectively.

The design of residential buildings in residential communities is also becoming more diverse, for example, 10-storey and above high-rise residential buildings, 6-storey and

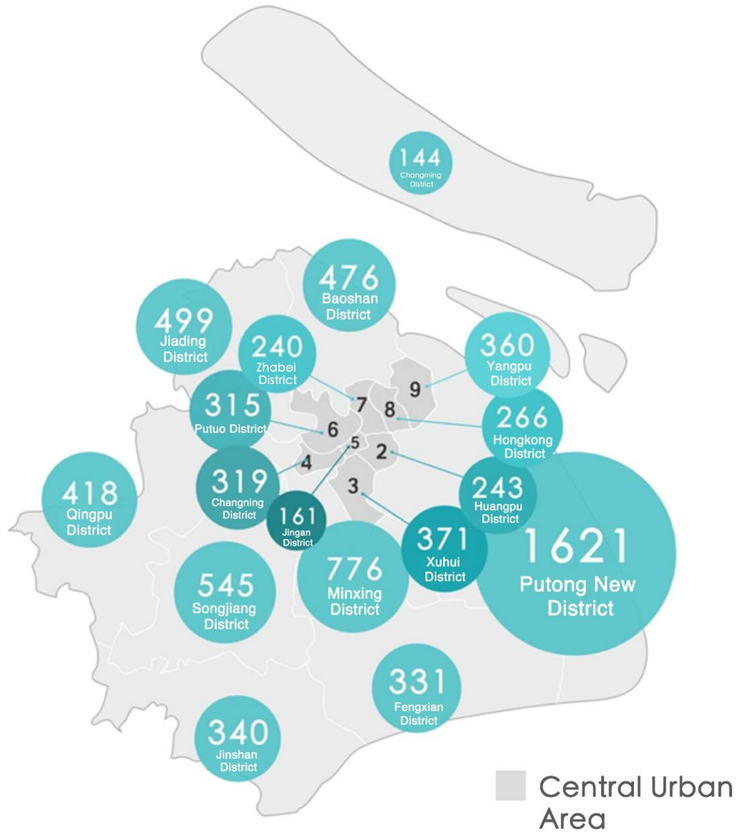


Figure 4.1 Number of new residential areas in various administrative districts in Shanghai

under multi-storey residential buildings or detached villa residential buildings. At the same time, however, the quality of different residential communities also reflects the emergence of social hierarchy. According to the selling prices of commodity houses, the residential communities are further divided into high-end residential communities, medium-to-high-end residential communities, low-income residential communities, and so on.

4.1.2 Distribution of Children's Entertainment Facilities &Space in Newly-built Residential Communities

The total number of children in Shanghai city takes a leading place in the whole country. As of the end of 2017, the number of permanent residents in Shanghai was 24,183,300, and the number of kids and teens aged 0~14 was 2,120,000, accounting for 8.8% of the total population. The huge number of children has also increased the demand of residents in residential communities for children's entertainment facilities and space. In order to meet this demand, more and more real estate developers began to plan and design children's entertainment space and facilities in order to seize the mind of consumers,such as Country Garden, Vanke, Greenland Group, Dongyuan, Jinmaofu, Zhongnan Group, etc.

As shown in the figure, we can know that the total number of children's entertainment venues in Shanghai newly built residential communities (measured by the number of children's entertainment venues) is about 6,943, and the district with most distribution is Pudong New Area, 1,650, followed by Minhang District, 758, Songjiang District, 520, Jiading District, 480, and Baoshan District, 329, etc., whereas the number of children's entertainment facilities is fewer due to the limited number of newly built residential communities in the central urban area.

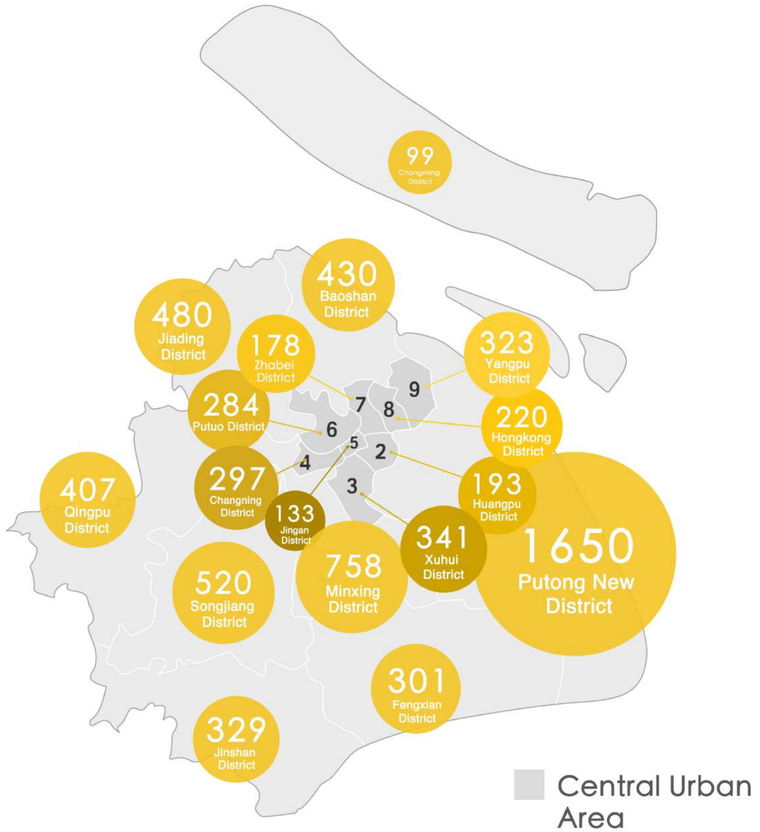


Figure 4.2 Number of children's entertainment space in various administrative districts of Shanghai

4.1.3 Characteristics of Children's Entertainment Facilities&Space in Newly-built Residential Communities

a.The number of newlybuilt residential communities is directly proportional to the number of children's entertainment facilities;

When the number of newly built residential communities in a region is relatively large, more households will live there, and the demand for building children's entertainment facilities is higher. Whereas the new demand will also lead to the construction of more complete children's entertainment facilities.

b.The homogenization of children's entertainment facilities among the newly built residential communities is serious ;

From the perspective of distribution of residential communities, the functional division of entertainment types is relatively simple and the homogenization is serious, the types and functions of entertainment facilities in almost every residential community are roughly the same, and only a few facilities are different in types and functions.

c.The materials selected for children's entertainment facilities in newly built residential communities are relatively simple;

Metals and plastics are the most used materials for children's entertainment facilities because of their robustness and durability, accounting for 53% of the total materials. The second most used materials are wood, cement and steel, and electric cables.

d.The quality of children's entertainment facilities is related to the quality of newly built residential communities;

The quality of children's entertainment facilities in the residential communities with a well-protected surrounding environment and infrastructures is generally good, and vice versa.While the most direct manifestation of the quality of a residential community is the selling price of houses in the residential community.

e.The quality of children's entertainment facilities is related to their regional distribution;

Pudong New Area, Minhang, Songjiang, Jiading and other districts, although they far from the city center, the area of the residential communities is relatively large, and these residential communities can also enjoy supporting services such as more complete children's entertainment facilities.

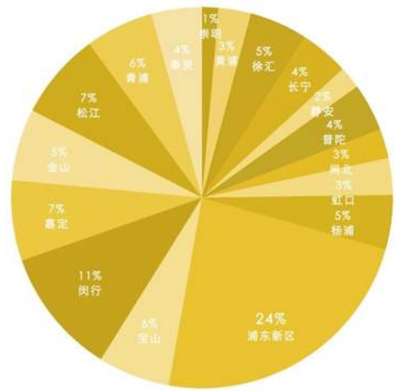


Figure 4.3 Proportion of children's entertainment facilities in various administrative districts of Shanghai

4.2 Interactivity Survey of Children's Entertainment Facilities and Space in Newly-built Residential Communities

4.2.1 Analysis Parents' Opinions

This survey is mainly carried out from two aspects: first, children's parents; the second is the children themselves, children's needs are understood through a combination of questioning interviews, painting and field observations. From January 2018 to March 2018, the author visited more than ten newly built residential communities in Shanghai, and distributed a total of 120 questionnaire sheets, as shown in the figure below:

Questionnaire	Questionnaire sheets issued (copies)	Questionnaire sheets collected (copies)	Recovery rate
Questionnaire sheet 1 (interviewees_parent)	120	112	93.3%
Questionnaire sheet 2 (interviewees_children)	120	87	72.5%

Table 4.4 Distribution of questionnaire sheets (plotted by the author)

Table 4.4 Distribution of questionnaire sheets (plotted by the author)

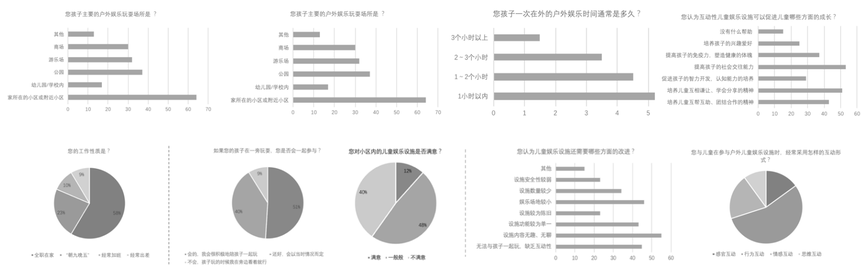


Figure 4.5 Survey results in parents' opinions

a.The space of a residential community is one of the main places for children's entertainment activities

From Table 4.4, we can see that most children's entertainment venues are mainly concentrated in residential communities or surrounding areas. Because the children interviewed are still in pre-school and early school age, they still maintain the appeal for "play", whereas the spaces of residential communities are one of the places where children can get highest-frequency contact with outdoor activities, not only giving children the necessary material basis, but also there are suitable venues for activities, happy playmates, safe residential environment, etc..

b.Children are the most active group in outdoor activities

As shown in Table 4.6 and Table 4.7, we can see that the number of outdoor entertainments of majority of children is mainly concentrated in 1~3 times and 4~6 times a week, and most of the outdoor entertainment time is controlled within 1~3 hours. It can be seen that children in cities have a lot of outdoor entertainment activities and plenty of time. And most parents realize the importance of outdoor activities for children's growth and expect children to spend some time outdoors to participate in entertainment activities.

c.Time for parents to participate in children's entertainment activities is limited

When asked if they were involved in entertainment activities together with children, although 51% of parents said they would actively participate, still 49% of parents said they would not necessarily participate. We can see that

nearly half of the parents believe that children's entertainment does not necessarily require their participation, and children can engage in entertainment activities voluntarily. The main reason for this is that the work of many children's parents is busy. Among them, 23% of the parents work in a "9-to-5" mode, and 19% of the parents even need to work overtime and travel frequently. It can be seen that due to the parents' work reasons, the time for accompanying their children to play is limited, which naturally leads to a decrease in the participation of children's entertainment activities.

d.Parents' satisfaction with children's entertainment facilities is relatively low

48% of parents expressed that their evaluation of existing children's facilities is average, while 40% of parents clearly expressed dissatisfaction with children's entertainment facilities in existing residential communities. The main reason lies in many aspects, among them, the reasons such as the entertainment facilities are boring, no interactivity, the venue is small and its functions are single, etc. are most prominent. It can be seen that most parents have a lower evaluation of existing children's entertainment facilities.

e.The interaction between parents and children is mainly through behavior

In the user survey process, more than 50% of the parents believe that they and their children mainly participate in entertainment activities by way of behavior interaction, that is, they interact with the facilities and others through various behaviors of the users to obtain a good entertainment experience.However, most parents are not aware of the relationship between behavioral interaction and the other three factors, nor the importance of emotional interaction, sensory interaction and thinking interaction in children's entertainment.

f.Parents have different understandings of interactive children's facilities

From the viewpoint of physiological function, nearly 30 parents believe that interactive children's entertainment facilities should be the similar to the facilities that provide parent-child activities and collective activities, whereas about 20 parents focus on facilities themselves, emphasizing that facilities themselves also need to have characteristics of diversity, funniness, ease of operation and safety. A small number of parents are more daring, they think that children's facilities may also have relatively novel interactive sensing means such as sound, light, and electricity to attract children, and let children consume their excess energy in entertainment activities so as to promote their growth and development.

While from the perspective of psychological function, 20 parents believe that the key to interactive entertainment facilities is to promote interpersonal communication, to make children enjoy a happy and entertaining experience and to stimulate children's spontaneity, and a small number of parents believe that interactive entertainment facilities need to have a certain significance of education and enlightenment, so that children can learn more knowledge in the process of entertainment, and truly achieve the purpose of learning through play. And more than 50% of parents believe that the existing facilities do not have interactive features, and there is still a big gap from their goals.

It can be seen that most parents' understanding of interactive entertainment facilities is mainly focused on emphasizing physiological functions, they lack of thinking about the children's entertainment facilities at psychological level. The reason is first due to the lag of existing entertainment facilities; second, due to the inadequacy of parents' understanding of children's growth education, which lead to the long-term neglect of children's psychological education.

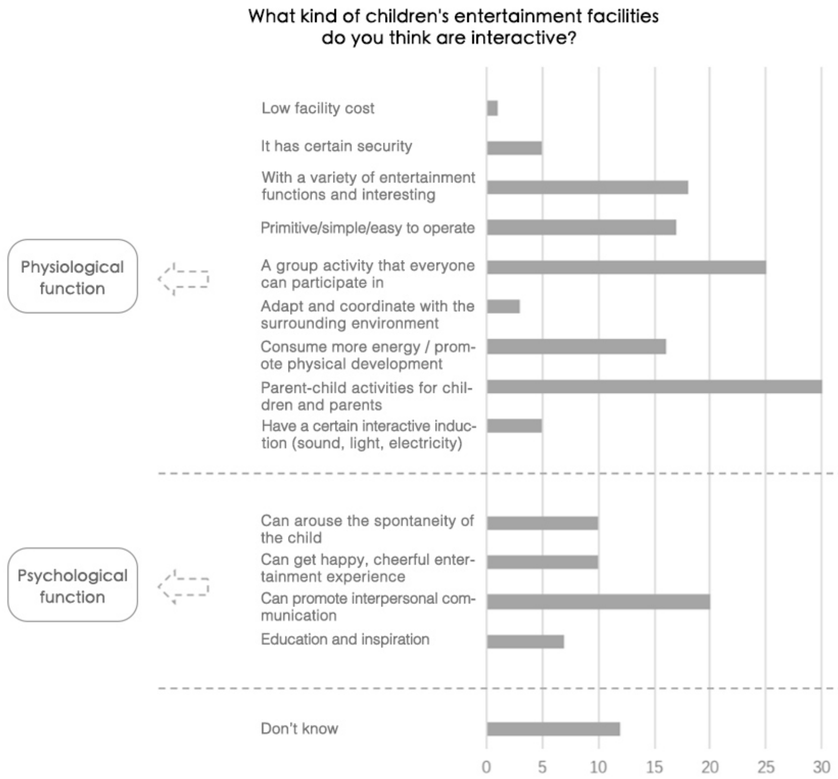


Figure 4.6 Parents' different understanding of interactive children's facilities

4.2.2 Analysis Children’s Opinions

Children are the main users of entertainment facilities and are the main players in entertainment activities. Knowing the real needs of children can better explore design pain points of entertainment facilities so as to propose advices on improvements of entertainment facilities. However, due to the limitations of children’s understanding ability, we understand children’s ideas about entertainment facilities in the forms of a combination of briefly asking children questions through questionnaire, interviews, and paintings and get the following information:

a. Children have a higher demand for entertainment facilities

80% of children especially like children’s entertainment facilities, the main reason is playful and funny, and that they can play with other children. Whereas the rank of children’s favorite entertainment facilities is sequentially sliding, rocking and climbing facilities. It can be seen that children’s attitude towards entertainment facilities is completely opposite to that of their parents, reflecting children’s unconditional love for entertainment facilities, and it can be seen that children’s entertainment facilities have become the most indispensable part of their lives.

b. The entertainment facilities and venues that children expect are colorful and diverse.

In children’s expressions of entertainment facilities and venues, they will use their fairy tales and albums that they have seen and heard as the source of inspiration to describe their imagination of children’s entertainment facilities and venues, that is, the pattern formed by their early knowledge and understanding of this new object. For example, in their descriptions, some children think that the entertainment facility will be a ship, and they are a crew member who is adventurous and swims in the sea; some children think that the entertainment facility should be a castle and imagine that they are the master of the castle; some children think that the entertainment venue should be a piece of nature, with lots of flowers and plants and many small animals, etc.

As children gradually become self-aware during their growth, they will vent their emotions in their own way and express their understanding and thoughts about the things around them. Although in the eyes of adults, children’s expressions are like groundless “nonsense”, and are whimsical “doodling”. But it is through the children’s tender and exaggerated expressions and paintings that we seem to have seen another world, and have seen their innocence and love in their deep mind. It is the most rare childlike revelation, the most primitive creative activity, and also what many adults can’t have. Children’s cognition of entertainment facilities and venues is full of unrestrained imagination, which forms a sharp contrast with the forms and functions of existing entertainment facilities. It also reflects the characteristics of symbolic and exercise games in the pre-school computing period. In the growth period of children, there should be more colorful entertainment facilities, and thereshould be more enjoyable and funny entertainment activities to inspire children’s cognition and imagination so as to promote their healthy growth. This is also the significance of urgently improving the interactivity of children’s entertainment facilities.

Figure 4.7 Children's description about dreamed entertainment facilities and space

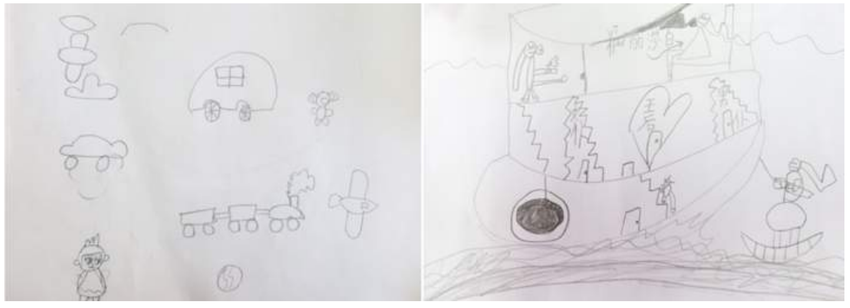


Figure 4.8 Children's hand-drawn entertainment facilities and space

4.2.3 Observations on Behavior of Target Users

To obtain a deeper understanding of the use of entertainment facilities by users, the author visited the children's entertainment venues and facilities in 19 newly built residential communities in Shanghai from January 2018 to March 2018 (see Table 4.17). Selected six residential communities from them according to the proportion of newly built residential communities in various administrative districts in Shanghai to focally analyze and observe the behavioral characteristics of children and their parents (see Table 4.18), and recorded and obtained the rules by sorting out so as to propose a scheme for interactivity design.

a. Investigation of basic information on residential communities

名称	建设时间/地点	建设规模	场地面积	设施情况	图片	名称	建设时间/地点	建设规模	场地面积	设施情况	图片
当代清水园	2003年 浦东新区	占地面积6万m^2 992户 居住组团	约120平方米	一处综合式设施、 一个秋千、 两个摇摇椅、 一个转球、 塑胶铺地		万科城花新园	2005年 闵行区	占地面积26万m^2 1559户 居住小区	约150平方米	一处综合式设施、 两个摇摇椅、 一个跷跷板、 塑胶铺地	
仁恒河滨城 三期（一）	2005年 浦东新区	占地面积31.6万m^2 4000户 居住小区	约200平方米 （第一处）	一处大型综合式设施、 一个秋千、 两个摇摇椅、 一个跷跷板、 沙坑		九城湖滨国际	2007年 松江区	占地面积20万m^2 3076户 居住小区	约160平方米	一个综合式设施、 两个摇摇椅、 一个转盘、 一个跷跷板、 塑胶铺地	
仁恒河滨城 三期（二）	2005年 浦东新区	占地面积31.6万m^2 4000户 居住小区	约200平方米 （第二处）	一处小型综合式设施、 一个秋千、 四个摇摇椅、 一个跷跷板、 沙坑		达安花园一期 （一）	2001年 静安区	占地面积10万m^2 2947户 居住小区	约40平方米 （第一处）	一个综合式设施、 两个秋千、 一个转盘、 无铺地	
仁恒河滨城 三期（三）	2005年 浦东新区	占地面积31.6万m^2 4000户 居住小区	约800平方米 （第二处）	一处大型综合式设施、 两处小型综合式设施、 一个秋千、四个摇摇椅、 一个攀爬设施、 塑胶铺地		达安花园一期 （二）	2001年 静安区	占地面积10万m^2 2947户 居住小区	约73平方米 （第二处）	两个综合式设施、 一个秋千、 塑胶铺地	
天安花园	2000年 浦东新区	占地面积5.4万m^2 4000户 居住组团	约192平方米	一个综合式设施、 两个秋千、 两个摇摇椅、 一个跷跷板、 塑胶铺地		联洋年华 （一）	2002年 浦东新区	占地面积7万m^2 1604户 居住组团	约160平方米 （第一处）	一处大型综合式设施、 塑胶铺地	
联洋年华 （二）	2002年 浦东新区	占地面积7万m^2 1604户 居住组团	约210平方米 （第二处）	两处秋千、 一个摇摇椅、 两个秋千、 沙坑与塑胶铺地		龙湖郦城 （二）	2011年 嘉定区	占地面积17.8 万m^2 1907户 居住小区	约160平方米 （第二处）	一处小型综合式设施、 一个摇摇椅、 草地铺地	

Table 4.9 Basic information table of survey on residential communities
(plotted by the author)

联洋花园（一）	2002年 浦东新区	占地面积13.6万m^2 717户 居住小区	约167平方米 （第一处）	一处综合式设施、 一个秋千、 塑胶铺地		大华颐和华城	2004年 普陀区	占地面积4.78万m^2 3338户 居住组团	约60平方米	一处综合式设施、 无铺地	
联洋花园（二）	2002年 浦东新区	占地面积13.6万m^2 717户 居住小区	约78平方米 （第二处）	一个综合式设施、 三个摇摇椅 攀爬设施、 塑胶铺地		阳城书院	2005年 闸北区	占地面积3.3万m^2 404户 居住组团	约30平方米	一个综合式设施、 两个摇摇椅、 塑胶铺地	
联洋新苑	2001年 浦东新区	占地面积3.26万m^2 204户 居住组团	约100平方米	一个综合式设施、 塑胶铺地		丰景湾名邸	2007年 虹口区	占地面积8万m^2 1387户 居住小区	约60平方米	一个综合式设施、 塑胶铺地	
华元豪庭	2004年 杨浦区	占地面4.6万m^2 352户 居住组团	约30平方米	一处综合式设施、 两个摇摇椅、 一个跷跷板、 塑胶铺地		华滨家园	2010年 徐汇区	占地面6.19万m^2 1987户 居住组团	约70平方米	一处综合式设施、 塑胶铺地	
东方名园	2003年 杨浦区	占地面10.9万m^2 461户 居住小区	约60平方米	一处综合式设施、 一个秋千、 无铺地		汇龙新城	2002年 黄埔区	占地面10万m^2 1148户 居住小区	约60平方米	一处综合式设施、 一个摇摇椅、 一个转球、 塑胶铺地	
龙湖郦城（一）	2011年 嘉定区	占地面积17.8万m^2 1907户 居住小区	约160平方米 （第一处）	一处综合式设施、 一个摇摇椅、 塑胶铺地		慧华东苑	2011年 宝山区	占地面9万m^2 693户 居住组团	约60平方米	一处综合式设施、 塑胶铺地	

Table 4.9 Basic information table of survey on residential communities
(plotted by the author)

b.Record form for observation of users' behavior_1

According to the proportion of newly built residential communities in Shanghai, the author selected six residential communities from the basic information table of the above residential communities as the key observation objects. These six residential communities are Dangdai Qingshui Park, one place in Renheng Hebin City, one place in Tian'an Garden, Vanke City Garden, Jiucheng Hubin International Residential Community and one place in Da'an Garden. Each residential community is allocated for one day, starting from 9am to 6pm, recording and observing the use of children's entertainment facilities in each residential community. In order to record their use behaviors faster, all behaviors will be expressed in the form of phonetic codes, as shown in the figure below:

名称	建设时间/地点	建设规模	场地面积	设施情况	图片
当代清水园	2003年 浦东新区	占地面积67万m^2 992户 居住小区	约120平方米	一处综合式设施、 一个秋千、 两个摇摇椅、 一个转球、 塑胶铺地	
仁恒河滨城三期	2005年 浦东新区	占地面积31.67万m^2 4000户 居住小区	约200平方米	一处综合式设施、 一个秋千、 两个摇摇椅、 一个跷跷板、 沙坑	
天安花园	2000年 浦东新区	占地面积5.4万m^2 4000户 居住组团	约192平方米	一个综合式设施、 两个秋千、 两个摇摇椅、 一个跷跷板、 塑胶铺地	
万科城花新园	2005年 闵行区	占地面积26万m^2 1559户 居住小区	约150平方米	一处综合式设施、 两个摇摇椅、 一个跷跷板、 塑胶铺地	
九城湖滨国际	2007年 松江区	占地面积20万m^2 3076户 居住小区	约160平方米	一个综合式设施、 两个摇摇椅、 一个转盘、 一个跷跷板、 塑胶铺地	
达安花园一期	2001年 静安区	占地面积10万m^2 2947户 居住组团	约40平方米	一个综合式设施、 两个秋千、 一个转盘、 无铺地	

Table 4.10 Six selected residential communities
(plotted by the author)

c.Record form for observation of users' behaviors_2

The author conducted an all-day real-time survey of children's entertainment facilities in above-mentioned six residential communities. Each residential community was allocated for one day. From 9:00am to 6:00pm, the author observed and recorded the use of children's entertainment facilities in each residential community, and the use behaviors will be recorded in the form of phonetic codes, as shown in the figure below:

Use behaviors (the marker symbols begin with the initials of Chinese Pinyin, for example: sit = Z1, stand = Z2, chat = LT):
Table 4.20 Table of user's behavior codes (plotted by the author)

4.2.4 Analysis of Survey Results

Through a week of user's behavior observation and recording, the author found the characteristics which many of his behaviors have. In order to more intuitively reflect user's behavior habits, the author sets the children and parents (companions) as a group unit, and collected a total of about 42 sets of use behavior data for statistics, and summarized and arranged the data and drew the data into tables so as to more accurately reflect the characteristics of user's behaviors.

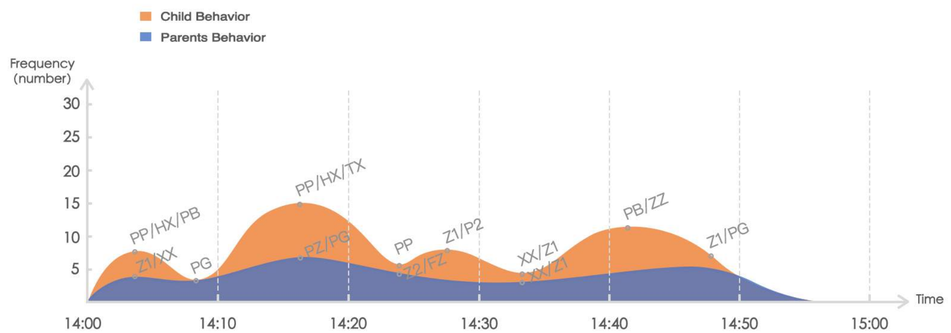


Table 4.11 Single-group user behavior data display for a certain period of time - contemporary Qingshui Park

Time Information		Residential Information	
Data：	March 14, 2018	Name：	Contemporary clear water garden
Weather：	Sunny day, breeze	Facilities：	A comprehensive facility, a swing, two rocking chairs, A ball, plastic floor
Observation Period：	9:10am~7:06pm	Space：	Plastic floor covering, an area of about 120m²

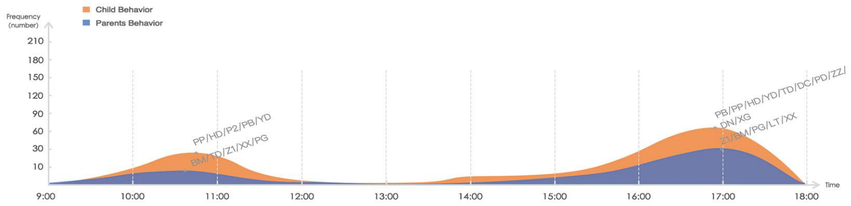
Serial number	Gender F/M	Age	Belongings	Companions	Duration of single behavior	Behaviors	Unexpected behavior	Location	Types of behavior
1	M	3	N o	grandson	T10 T10	PB、HX、PP、P2、HX、PP、HX、PB、 PP、P2、PG、TX、HX、PP、HX、PP、HX	Climb up the slide backwards from the bottom	Modular facility slide	Practical Game
2	F	60	a school bag	grandma	T10 T10	Z2、Z1、Z1、PG PG、PZ、XX	When drinking water, she accidentally poured the glass	A bench in front of a modular facility	View and emulate

Movements	Symbol	Movements	Symbol	Movements	Symbol	Movements	Symbol
坐 sit	Z1	钻入 drill	ZR	聊天 chat	LT	跑步 run	PB
站 stand	Z2	追逐 chase	ZZ	休息 rest	XX	散步 walk	SB
跳 jump	T1	打闹 hit	DN	旁观 Bystander	PG	悬挂 hang	XG
蹲 squat	D1	推动 push	TD	睡觉 nap	SJ	拍照take photos	PZ
趴 kneel	P2	停歇 stop	TX	看手机 watching cellphone	KSJ	排队 queue	PD
躺 lie down	T2	摇动 shake	YD	吃东西eat	CDX	攀爬 climb	PP
铲挖 shovel	CW	拉扯 pull	LC	扶着 Hold	FZ	转动 rotate	ZD
躲藏 hide	DC	滑动 slide	HD	帮忙 help	BM	发呆 in a daze	FD

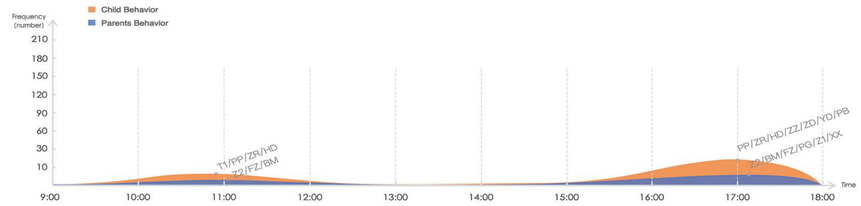
Less than 1 min	T1	1~10mins	T10	10~30mins	T30	30~60mins	T60	More than 1h	T1h

Table 4.12 Record table for observation of users' behaviors (plotted by the author)

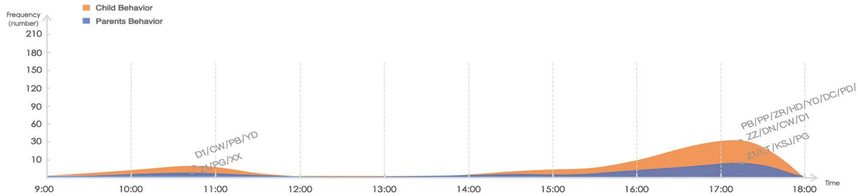
User behavior data of in “Contemporary Clear Water Garden”



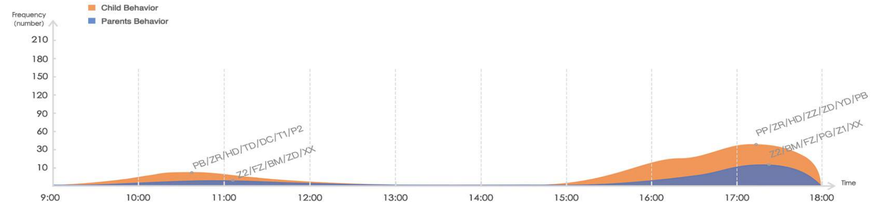
User behavior data of in “Wanke Garden”



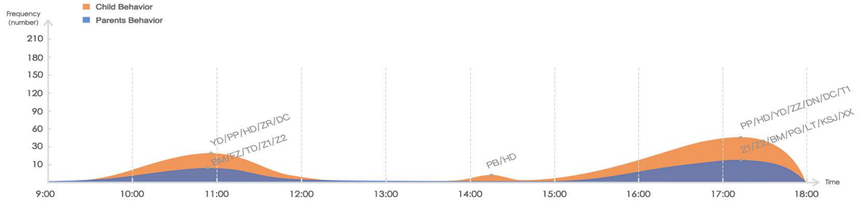
User behavior data of in “Ren Ganges Waterfront Community ”



User behavior data of in “JiuchengLlakeside Community”



User behavior data of in “Tian’ an Garden”



User behavior data of in “Daan Garden”

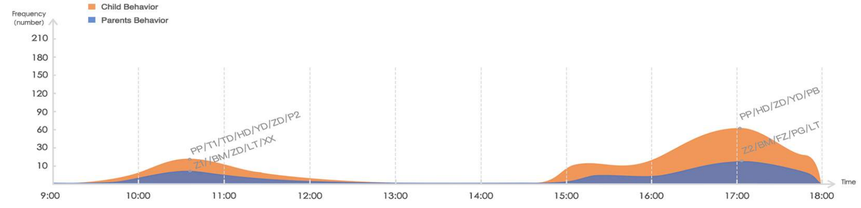


Table 4.13 User behavior data for six new residential recreation spaces

By summarizing the records of the behaviors of users in the six newly built residential communities, we can clearly find the time characteristics of the use of the facilities by the users and several more common behavioral characteristics, as summarized as follows:

a.Factors influencing entertainment time interval

From the entertainment time, we can conclude that the time period for children to use entertainment facilities is mainly concentrated in the time interval from 10:00am to 11:30am and from 16:30pm to 18:00pm. Whereas children who carry out entertainment activities in the morning are usually children of infancy and childhood, while pre-school and early-school-age children do intensively in the afternoon. Whereas the afternoon time interval is also the peak of the day and the longest entertainment time. One reason is that children are taken home from kindergartens and schools by their parents, children will play outdoors for a while before going home; the second reason is that when the weather turns hot (starting in March), the temperature in the afternoon time interval is more suitable for children's outdoor activities. Because different seasonal changes will also affect children's entertainment time. For example, in the winter, the range of children's outdoor entertainment will be reduced and the length of time will be different from usual. From this, the relationship between children's entertainment time and weather temperature can be derived.

b.Diversity and unpredictability of children's entertainment behavior

From the behavioral characteristics of children, it is found the games are mostly the exercise games, and the groups of behaviors occurring with higher frequency are climbing (PP)/jumping (T1)/running (PB)/sliding (HD)/-pushing (TD)/Shaking (YD)/Hiding (DC)/Entering (ZR)/Shoveling (CW)/Groveling (P2) and Queuing (PD). It is found through observation that climbing is the most frequent behavior of children. Children not only like to climb a variety of entertainment facilities such as climbing nets/climbing walls, but also like slide, whether it a spiral slide or a double-track slide, children especially like to climb up from the low end of the slide and grovel to slide down when they climb to the high end. Or they wait and see when they finally climb to the top of the slide, hoping to get the praising of their parents and companions, such type of behavior is also the most frequent occurrence of the unanticipated behavior. In addition to the regular sports behaviors, queuing is a relatively common behavior of children. Due to the small number of children's entertainment facilities and the small size of the venues, when a peak of entertainment appears, usually more than a dozen children and parents will gather on a venue of just over 100m2. Due to the limitations of entertainment facilities, there appears the phenomenon that many children will wait near the facility until other children finish playing.

c.Flexible and versatile entertainment content can bring more ways of interactive entertainment

In the above classification of children's entertainment games, in addition to often using 40% of the exercise games,

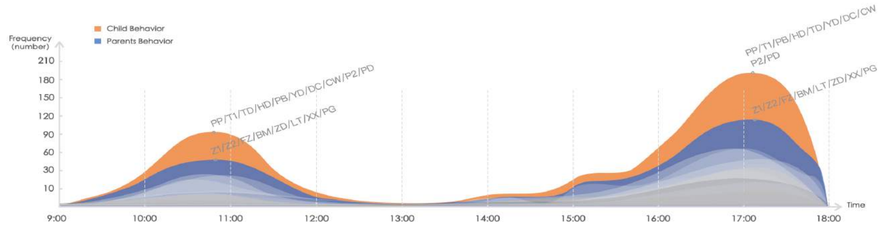


Table 4.14 Total user behavior data for six new residential units (42 groups)

Table 4.15 Analysis of Children's Entertainment Time Period
- Contemporary Clear Water Park

Table 4.16 Non-predictive behavior of children
(photographed by the author)

the proportion of symbolic games and constructive games accounted for 25% and 22% respectively. It can be seen that children are highly adaptable to try different entertainment content, and flexible and versatile entertainment toys are more likely to attract children's interest than the unchanging toys.

Sand is the most popular constructive entertainment material for children. From the survey on entertainment space in Renheng Hebin Residential Community, it can be found many children like to crouch and play sand in the sandbox. Loose sand can give children an uncertainty and flexibility. It can flow through the hands of children like water, giving children different sensory stimuli and exercising children's perception. It can be arbitrarily shaped into various forms like mud if mixed with water, inspiring children's creativity and imagination. In the process of shoveling (C), digging (W), stacking (TF) and pouring (DC1), it invisibly promotes the development of children's fine actions and improves children's limbs coordination ability. That is sand interacts with children's senses and behaviors, and interacts with children's thinking.

d.Children's private space

In the survey, we also found that children like to run around (PB) and also like to hide (DC). Because of the limitations of children's entertainment spaces in the residential communities, children usually like to run and chase around the entertainment facilities at periphery of the entertainment venue, and won't stop immediately until they find a space where they can hide, and enter into (ZR) that hidden space so that adults or little partners cannot find them, just as many children like to scrabble under the table or the facility, they delight in letting others unable to find them. This kind of intimate space not only can arouse children's curiosity, but also can offer children a sense of safety, just like the psychological rapport between them and the facilities, just like finally having their own space and not being disturbed by other persons. This is why some children's entertainment facilities have ducted slides and passages and semi-enclosed spaces, etc.

e. Interactive behaviors between parents and children in the entertainment activities

From the above picture, we can see that because children are still in an active and playful period, their sporting behavior frequency is much higher than parents. Whereas parents' behavioral characteristics are relatively quiet, which are mostly the behaviors of assisting or watching their children or talking with other parents, for example, sitting (Z1)/-standing (Z2)/holding (FZ)/helping (BM)/chatting (LT)/Guiding (ZD)/Rest (XX)/Bystand (PG) (as shown in Fig. 4.14). This is also because the parents accompanying their children are mainly elderly people such as grandparents.

Although parents' participation in children's entertainment facilities is relatively low, mostly the role of companionship and custody, they still have positive interactive behaviors. For example, a parent is helping a child to push a swing, an old person or a mother is helping a child climb an entertainment facility, or a group of grandmothers are guiding their children to pay attention to safety, etc. Although these behaviors are not directly involved in children's entertainment activities, they indirectly help children, enabling children to interact with adults in the ZPD area and

Table 4.17 Children's casino queuing and crowding
(photographed by the author)

Table 4.18 Children playing in the sand scene
(photographed by the author)

Table 4.19 Children's hidden space
(photographed by the author)

the proportion of symbolic games and constructive games accounted for 25% and 22% respectively. It can be seen that children are highly adaptable to try different entertainment content, and flexible and versatile entertainment toys are more likely to attract children's interest than the unchanging toys.

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f.Interaction forms of children's entertainment facilities

The interactive behavior mainly can be divided into: a. interaction between people, that is, interaction between children, interaction between children and their parents, and interaction between people can be further divided into interaction between individuals, interaction between individual and group, and interaction between groups; b. The interaction between people and facilities refers to that children obtain a different entertainment experience through interaction with entertainment facilities.

Based on the users' behaviors, the interactive behaviors can be divided into: a. cooperative behavior, that is, two or more people need to cooperate to complete the entertainment content, such as the turntable, the two-seat rocking chair, etc.; b. competitive behavior, that is, two or more people need to interact and cooperate to operate the facility, and balance the facility through the force competition of both sides during the use of the facility. c. Primary-secondary behaviors, that is, entertainment item that can be completed by one person or more persons, e.g., a swing, a person alone can play on it, and two persons also can play on the swing together.

Table 4.20 Parental behavior characteristics
(photographed by the author)

Table 4.21 Parent-child interaction behavior
(photographed by the author)

4.3 Design Method for Interactivity of Children's Entertainment Facilities in Newly Built Residential Communities

4.3.1 Design Factors

a.Functional factors

Through the previous field survey on the newly built residential communities in Shanghai, it is known that the average area of children's entertainment venues is about 170m2, therefore, the area of children's entertainment activities is limited. Therefore, most of the children's entertainment facilities are a complex that combines multiple functions. The types of entertainment facilities are relatively simple and their functional forms are relatively rigescent. In the user survey, most parents' understanding of interactive entertainment facilities is mainly emphasizing physiological functions, whereas the forms of actual interaction between children and the facilities and between others and parents are also mostly the behavioral interaction, lacking psychological thinking for children.

For this reason, in order to improve the purpose of interactivity of children's entertainment facilities and to increase parents' attention to children's psychological development, we can consider the manner of combining how to conduct sensory interaction, behavioral interaction, emotional interaction and interaction with children, and provide multifunction entertainment facilities for children of different ages.

b.Structural factors

The structural factors of children's entertainment facilities are the basis of functional factors and have an important impact on the design of entertainment facilities. It often plays a role of forming a connecting link between the preceding and the following as a design framework. The change of structure will first lead to the change of function. The realization of the function requires the support of structure. The two factors complement each other and are indispensable.

Due to the limited space of children's entertainment venues in Shanghai newly built residential communities, they cannot accommodate larger entertainment facilities, thus placing higher requirements for the delicate structural design of children's entertainment facilities. How to maximize the functional and structural advantages of entertainment facilities in a limited space? This requires the use of various spaces in the venue in practice. For example, in a limited space, the entertainment facility can be developed to a higher level, which can reduce the footprint of the facility; for example, we can design the structure of the entertainment facility by combining it with the surrounding environment and by means of the advantages of walls, corners or undulating grounds, etc., thereby reducing unnecessary space waste. And in group activities, we should consider how to make the structural design more ingenious, so that it can meet the situation of multi-person participation and interaction. At the same time, we also need to strengthen the scientificness and rationality of structure design.

c.Form constituent factors

The forms of children's entertainment facilities in Shanghai newly built residential communities are very simple and their homogenization is serious, lacking creativity and diversity. Furthermore, most parents are less satisfied with the existing entertainment facilities. One of the main reasons is that the facilities are boring, and their boring appearance can easily lead to aesthetic fatigue. Therefore, inspired by foreign facilities being more novel and having a strong story background, the form of children's entertainment facilities can start with its content. Rich and colorful content can enhance the innovation of the fa-

cility form. For example, we can take inspiration from nature to turn it into a forest adventure hut. We can also find clues from fairy tales to turn it into a castle for storing treasures. However, no matter how the children's entertainment facilities change, the most important thing is that entertainment facilities can't do without users' demands for "beauty", that is to say, children's entertainment facilities must always meet the children's psychological and physiological needs and the grasp of the external "beauty" of the form.

d.Material and process factors

In the selection of materials for outdoor children's entertainment facilities, we should fully consider the physiological characteristics of the users. Since the user subject of the children's entertainment facilities is children, and the object is parents, whereas most of the parents are mainly the elderly. The children's visual and tactile sensibility is just in open state and its sensitivity is relatively high. Whereas the sensory perception of the elderly is declining, and their perception of the surface temperature of the material is relatively slow. Because the materials of outdoor children's entertainment facilities in residential communities in Shanghai are mostly made of metals, they are affected by the weather greatly. On rainy days, metal facilities will be more slippery; in the sun, metal facilities will be hotter; and in winter, metal facilities will become colder. These conditions are very inconvenient for children and the elderly.

For this reason, in the design, we can replace a part of the metal materials in contact with the skin with relatively natural and soft materials, such as wood or plastic, so as to weaken the sense of alienation brought by the metal texture. Or we can change the way of processing, hide or weaken the corners of the harder metal parts to reduce the sense of hardness of the material appearance. At the same time, due to the safety of the facility, the anti-corrosion and moisture-proof treatment of the wood material can enhance the robustness of the material and ensure the safety of children.

e.Color factors

According to research reports, children aged 2~4 months have already had a perception of colors, and by 4 months they have shown a preference for a certain color 52. Whereas children's perception of color is inseparable from the environment of growth. Different colors can stimulate children's visual sense, and even affect children's personality shaping and internal emotional changes. For example, the use of too direct and sharp contrasting color effects can easily cause children's anxiety and discomfort, producing boredom. Whereas brighter colors with visual impact can also pose a negative impact on children's visual perception and inner emotions. And too much dull color is not conducive to the growth of children.

Therefore, in order to better understand children's preferences for color, the author conducted a survey on color matching of 23 children's entertainment venues and facilities in 19 residential communities, not only including the main colors of the facilities, but also the colors of the pavement and the colors of the surrounding environment, as shown in Fig. 5.1. All entertainment venues are surrounded by plants, among them, 7 children's entertainment facilities use red, yellow and blue, which are the most used color combinations, and the rest 4 entertainment facilities use a darker color combination. One of the color schemes (in black circles) most loved by children is the combination of red, yellow, blue and green, combination of red, green and yellow, and combination of red, green, yellow and brown. These color combinations are all the colors with high brightness, high purity and warmer tone, which not only help the balance of color matching, but also give children a comfortable and bright feeling. The color selection of interactive children's entertainment facilities should be based on the

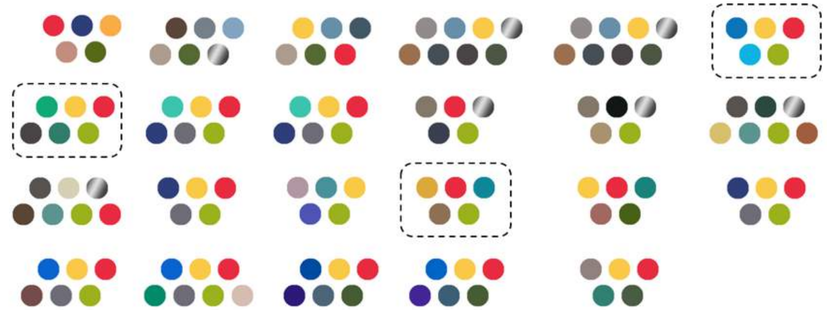

Table 4.22 Color matching of children's entertainment facilities in Shanghai newly built residential areas
The second row is the color of the site and the color of the surrounding vegetation.

visual characteristics and personalities of children of different ages, guide children's personality shaping and inner emotions through colors so as to provoke children's interactive use behaviors and achieve the goal of enhancing the interactivity of entertainment facilities.

4.3.2 Design Features

a.Funniness

Play is children's nature. Children can develop their social interaction and cognitive ability in the process of playing, discovering the ego and cultivate their own hobbies and more flexible thinking skills so as to shape their creative spirit. As the carrier of children's play, the most prominent premise of entertainment facilities is whether they can attract children, that is, the funniness of entertainment facilities. The funny children's entertainment facilities can maximize the vigor of children in entertainment, stimulate children's entertainment interest through humorous and vivid stories, colorful content, vivid and interesting forms, etc., making the quiet entertainment venues more lively and infectious, letting children always maintain the pursuit of play.

b.Diversity

According to research reports, children aged 2~4 months have already had a perception of colors, and by 4 months they Interactive children's entertainment facilities also need to have diverse characteristics, the diversity of the facilities is mainly reflected in functions, forms, materials, structures and colors of children's entertainment facilities. Due to the restlessness and curiosity that children are born with, the fixed combination type children's entertainment facilities can easily cause boredom among children who like richness and variability. And because of the great differences in children's activity, range of activities and activity habits at different periods, their demand for entertainment facilities is not the same. Therefore, in terms of the diversity of entertainment facilities, we need to provide a variety of entertainment methods according to the psychological and physiological needs of children and in combination with the characteristics of children's use behaviors.

c.Challenging

The design of interactive children's entertainment facilities also needs to focus on the challenges of their entertainment activities, so that children can get the chance to adventure and meet challenges in the process of entertainment, so as to stimulate children's enthusiasm for participation in entertainment activities, and improve their physical coordination ability and ability to overcome difficulties. Even babies often need to test the limitations of their abilities through play, and they can practice some skills repeatedly until they are able to master them. In the period of personality formation, children in the growing period need to learn to overcome difficulties and meet challenges in their entertainment activities to learn how to deal with risks. This is the essence of growth.

Therefore, the design of challenging children's entertainment facilities can not only arouse children's curiosity, exploration desire and the spirit of self-challenge, children also exercise coordination ability of their limbs when passing through the entertainment facilities with certain difficulty, also can get praise and encouragement from their parents and companions to enhance children's self-confidence and pride and satisfy children's sense of self-worth. The satisfaction of this emotion will also help to shape children's perseverant and persistent character.

d.Safety

Ensuring the safety of children's entertainment activities is also an important design feature of their interactive facilities and a basis for challenging feature of their facilities. For example, in the choice of materials, the use of durable and non-toxic materials can not only extend the life of the facilities and enhance children's use safety. Laying (artificial) turf, mats, plastic, fine sand and coarse sand on a solid ground can help children to reduce injury by ground impacts. In the appearance structure of the facilities, it should be stable and robust smooth curved surface and connection method. The protruding parts of metal and wood materials need to be rounded by grinding, and the metal edges should be rolled up or equipped with round caps, pay attention to the metal edges of the slide along the slideway facilities and the end of the slideway, avoid sharp pointed objects, corners or edges, and the protrusions of the facilities, which may cut and pierce the children's skin, posing a hazard to children's safety. And the fixtures of all facilities should be placed below the ground level or under the pavement. Setting the ground and facilities to different colors helps to visually distinguish them clearly and prevent children from falling on the exposed base and suffering damage. At the same time, pay attention to the rotating parts of the facilities, eliminating any hazard that may cause crushing or shearing of children's limbs, and avoiding the possibility of children's limbs getting stuck in the use of entertainment facilities.

e.Naturalness

With the rapid development of newly built residential communities, the living environment of children in cities is gradually surrounded by reinforced concrete, and growing up in the natural environment has become a luxury for both parents and their children. However, the role of the natural environment in the growth of children is indispensable. Children can truly release themselves in the natural environment and enjoy the pleasure of freedom. Only when they are truly free and happy can children's spontaneity be triggered.

In the process of exploring nature, children will use natural sand, soil, stones, branches, etc. as toys and re-create with them. This process also helps stimulate children's curiosity, creativity and exploration desire. Yet, the abundant natural environment can also give children sensory stimulation, such as sight, touch and smell, which is helpful to improving children's cognitive and sensory ability. For example, water, sand, etc., these uncertain toys have the characteristics that are not available in entertainment facilities and give children a different sensory experience. They can flow softly and gently through children's fingers, and can also be combined with natural soft sand granules to be shaped into various forms arbitrarily to inspire children's creativity and imagination. Just as Emerson said: "The best way to cultivate a good person is to let him grow in nature."

f.Coordination

The design of venues for interactive children's entertainment facilities also needs to be configured reasonably in combination with the environment in the residential communities, and they can also highlight the locality of the venue itself while they are integrated into the surrounding environment. Therefore, in the site selection of children's entertainment space, it is necessary to choose a place with a large area, convenient transportation and convenient access for residents and children in the residential communities. It can be set in the central area of the residential community, where children can arrive at the entertainment venue on foot or by bicycle. And keep a certain distance from the driveway to prevent children from entering the middle of the road when they are playing, reducing their safety risk and dispelling parents' concerns about traffic safety when children are playing outside. At the same time, it is necessary to avoid the venue to be too close to the residential buildings to prevent the noise caused by children playing from affecting the lives of nearby residents. Secondly, the children's entertainment spaces and other leisure areas also need to have certain connectivity. These spaces can be the spaces for children's entertainment and also the places for parents' relaxation and leisure. They create a pleasant atmosphere of public spaces for the residents of the residential communities and strengthen interaction and communication between the residents of the residential communities. In addition, in the choice of site, we should also choose the orientation that avoids strong sunlight, because most of the facility materials are made of plastic, metal, etc. If the direct sunshine is too long, it will cause deterioration of the facility materials. Therefore, we should choose a place with good ventilation and wind shelter to protect the facilities from damage.

e.Interactivity

Interactivity is the most critical feature of children's entertainment facilities and also the key for children to obtain a good entertainment experience. However, the design of existing children's entertainment facilities in Shanghai often overlooks the exploration of children's inner world, it only focuses on the growth of children's physiological aspects, leading to the imbalance and lack of children's growth. Therefore, by improving the interactivity of children's entertainment facilities, children not only can exercise their coordination ability of limbs, promote the healthy development of their bodies, but also foster their awareness of getting along with others to promote the interactions between children and the facilities, between children and their parents and between children and other children so as to enhance emotional communication between the two sides, improve children's social communication ability. So interactivity plays a key role in shaping children's healthy personality and health psychology.

Interactivity can be divided into human-machine interaction and human-human interaction. Human-machine interaction is the interaction behavior between children and entertainment facilities. Changing the shape, material, function, structure and color of entertainment facilities can greatly promote children's interactive communication, for example, using more attractive shape and appearance, more intimate facility materials to create more hidden spaces that children generally like, more entertainment items suitable for group playing and more lively and happy facility colors, etc. The interactivity is mainly reflected in behavioral interaction, sensory interaction and thinking interaction. Whereas human-to-human interaction refers to the interaction between children and between children and their parents, for example, using the characteristics of cooperative and competitive behavior to provide children's entertainment facilities that can be used by many people or adults together and have certain challenges to increase the opportunity for children to interact with others so as to improve their communication and thinking skills. The interactivity is mainly reflected in behavioral interaction, emotional interaction and thinking interaction.

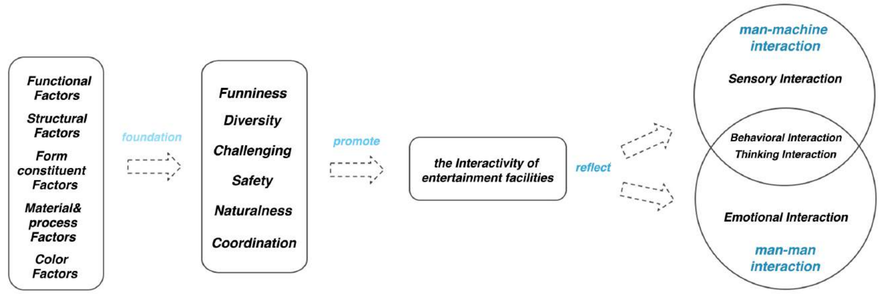

Table 4.23 Interactive entertainment facility&space design framework

Chapter 5 Interactive Design Practice of Children's Entertainment Facilities in Shanghai Newly-built Communities

In this chapter, we will select the representative Shanghai new residential community —Tian'an Garden, as the research practice location of this topic, and guided by the design policy of interactive children's entertainment facilities, combined with the characteristics of the practice area, to enhance the children's interactive experience.

5.1 Location Analysis

Tian 'an garden is a medium-sized residential group located in jinxiu road, pudong new district, Shanghai, covering a total area of about 54,000 square meters, a total construction area of about 140,000 square meters and a total of 4,000 households. The reasons for choosing Tianan Garden as the design practice goal of this subject are as follows:

Geographic location: Tian 'an garden is located in Pudong new area, the administrative region with the largest number of newly-built residential communities in Shanghai. With convenient transportation and high quality infrastructures, Tian 'an garden has the general characteristics of newly built residential areas.

The number of residents: There are many residents in residential community, and the flow of people is enormous. It is easy to observe the phenomenon that residents in residential areas use children's entertainment facilities during the peak period, and the preliminary research data provides support for the later practice.

Facilities and venues: the children's entertainment space in the residential community is about 192 square meters, belonging to the medium-sized entertainment venues, and the children's entertainment facilities are very common types of facilities in the general residential area, with integrated facilities as the center and other surrounding small facilities.

Environment: The central square of the residential area is close to the outdoor entertainment area, which is the central area for the leisure and entertainment of residents in the residential area, and also provides more extended activity space for children, which provides favorable conditions for the design practice.

Figure 5.1 children’s entertainment facilities and space in Tian’an Garden

Figure 5.2
children's
entertainment
facilities & space
in Tian'an Garden

5.2 Persona

The target population of this project is children aged 3-8 years, which is in the late pre-school and early school age. They still grow up in the stage of love playing and maintain the demand for "entertainment", but different from the younger children who are only satisfied with simple recreational activities. They need more psychological and physical needs. In order to get better understanding of the behavior characteristics of target users, this project will build two personas based on the previous research and analysis of the children's entertainment facilities and space in Shanghai newly built residential areas so as to provide direction for the later design practice. In this paper, two types of persona users, children and parents, are selected as the primary objects.

Name: Tongtong
Age: 5
Status: kindergarten
Place of Residence: Shanghai, China
Family Status: Live wth parents
Hobby: Cartoon, paint, sing, dance

- Tong tong is 5 years old. She is active, loving playing around and always curious about surroundings. Every day, before her mother picks up the child from the kindergarten to go back home, she will take her to the outdoor children's entertainment space for a while.
- The most favorite entertainment facilities for Tong Tong are slides and rocking horses. Most of the time she is just playing alone.
- The average playing time for her is controlled within one hour. If tshe play together with other friends, they will even play for more than 2 hours.
- She doesn't like to wait for other children to finish the facilities.
- She really hopes her mother can join and play with her.

" I like to slide, whoih it makes me feel happy to slide down from the top....."
" I don't know other children, most of time I just play alone. ....."

Figure 5.3 Persona_child

Name: Ms. Wang
Age: 36
Status: Office worker
Place of Residence: Shanghai, China
Family Status: Live wth kid, husband
Hobby: Yoga,swim,sing,movie

- Ms. Wang is very busy with her work. She gets up early to go to work every day, picks up her children after work and leads a regular life.
- Ms. Wang usually picks up the child before going home, will take the child to the residential casino to play for a while; When it comes to weekends, Ms. Wang is more inclined to take her daughter to play in shopping malls and parks.
- Ms. Wang limited her children's play time to an hour each time, while she rested and chatted with other parents.
- She doesn't want to see that her child gets hurt while playing

Figure 5.4 Persona_parent

" The child is still growing up, she needs to play outside more to promote her better growth....."

" Sometimes when I watch her playing, I will feel happy too".....

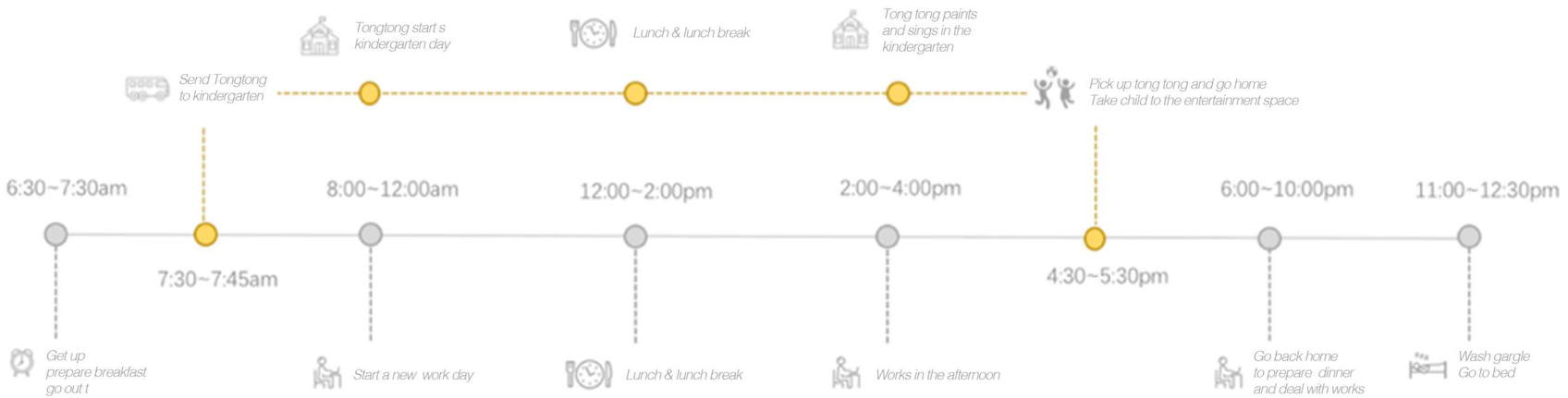

Figure 5.5 One day schedule

From the above analysis, it can be found that Tongtong is in the growth and development stage of children, her energy is more exuberant, but also maintain the pursuit of entertainment and play, through play to vent their "excess energy" and lively personality, rely on their parents, have a strong sense of self. Every morning, Tongtong will go to kindergarten together with their mother. After school, she will go to the residential children's entertainment center to play for one hour before going back home. The outdoor entertainment time is mainly around 5 PM.

Although Ms. Wang is usually busy with work, she still encourages children to go out for activities and ensures that children have more time for entertainment and play every day, emphasizing the importance of outdoor entertainment for children's physical development and physical and mental health. Every time Ms. Wang picks up children from school after work. She will let them play in the amusement park for a while, while Ms. Wang herself will take care of or make friends with more parents of children. The entertainment venue is also one of Ms. Wang's places for recreation and socialization.

5.3 Design Solution

Through the exploration of the practice location and the analysis of the target users, the practice has a particular direction. As the life of children living in urban residential areas is always surrounded by steel and cement, the activity space is gradually compressed and away from the comfort and freedom brought to children by the natural environment.

Therefore, in order to give back children a "green space", this topic proposed the concept

of "back to nature", combines the outdoor entertainment venues of Tianjin Garden with natural elements, introduces design schemes to extract several types of features that are more common in nature, crop, caves, green land, water, and sand. And to create a real green world for children in the city and encourage children to get more physical and mental development during play as well as promote the interactivity of children and facilities, children and parents, children and other children from the four aspects of behavior, emotion, senses, and thinking.

The Tian'an Garden residential community has a high greening rate and various types of plants, which is one of the characteristics of its residential area. Because the natural green belt surrounds the children's entertainment space, children can feel the livable ecology. In order to adapt the space to the surrounding environment of the residential area, the scheme also takes the turf as the main ground paving material of the site, which can cushion children's falls and give children a warm and intimate feeling. In the color matching, the children's favorite "red, green and yellow" color system is adopted, which makes the atmosphere of the whole entertainment space more lively and energetic, and the distance between children and facilities is invisibly narrowed.

To enhance the fun, diversity, natural, challenging and interactive characteristics of children's entertainment facilities, in the design proposal, the entertainment space is divided into a variety of entertainment areas, and each entertainment area has its characteristics. For example, children's climbing, and sliding facilities entertainment area, sound transmission interaction area, shaking type facility interaction area, "wheat field" interaction area and "hole wall" interaction area.

Figure 5.6 Inspiration

Figure 5.7
new concept
of children's
entertainment
facilities & space
in Tian'an Garden

Figure 5.8
new concept
of children's
entertainment
facilities & space
during the daytime_1

Figure 5.9
new concept
of children's
entertainment
facilities & space
at night

Figure 5.10
new concept
of children's
entertainment
facilities & space
during the daytime_2

Figure 5.11
new concept
of children's
entertainment
facilities &
space in the
daytime_2

"Nature" is the central concept in this space, combining with various natural elements to provide children with leisure and relaxation entertainment in the residential community. The materials for the turf can bring affinity, and the entertainment facilities are developed better than before to get significantly improved space for children to interact with facilities and others.

In the concept analysis, scheme 1 mainly shows the "wheat field" scene. A yellow-white rod made of synthetic resin stands in the center of the bunker with LED lights at the top to receive solar energy. Whenever it falls, LED The light will gradually light up and engage children shuttle to touch the pole, the LED light will appear more visible. This facility attracts children and enhances their curiosity by stimulating children's visual and tactile sensory interactions.

The inspiration for scheme 2 comes from the way of drilling wells. Children need to cooperate with another person to increase the water pressure and extract the water by stepping on the form. The strength of the force is also the factor that affects the amount of water. If the amount of

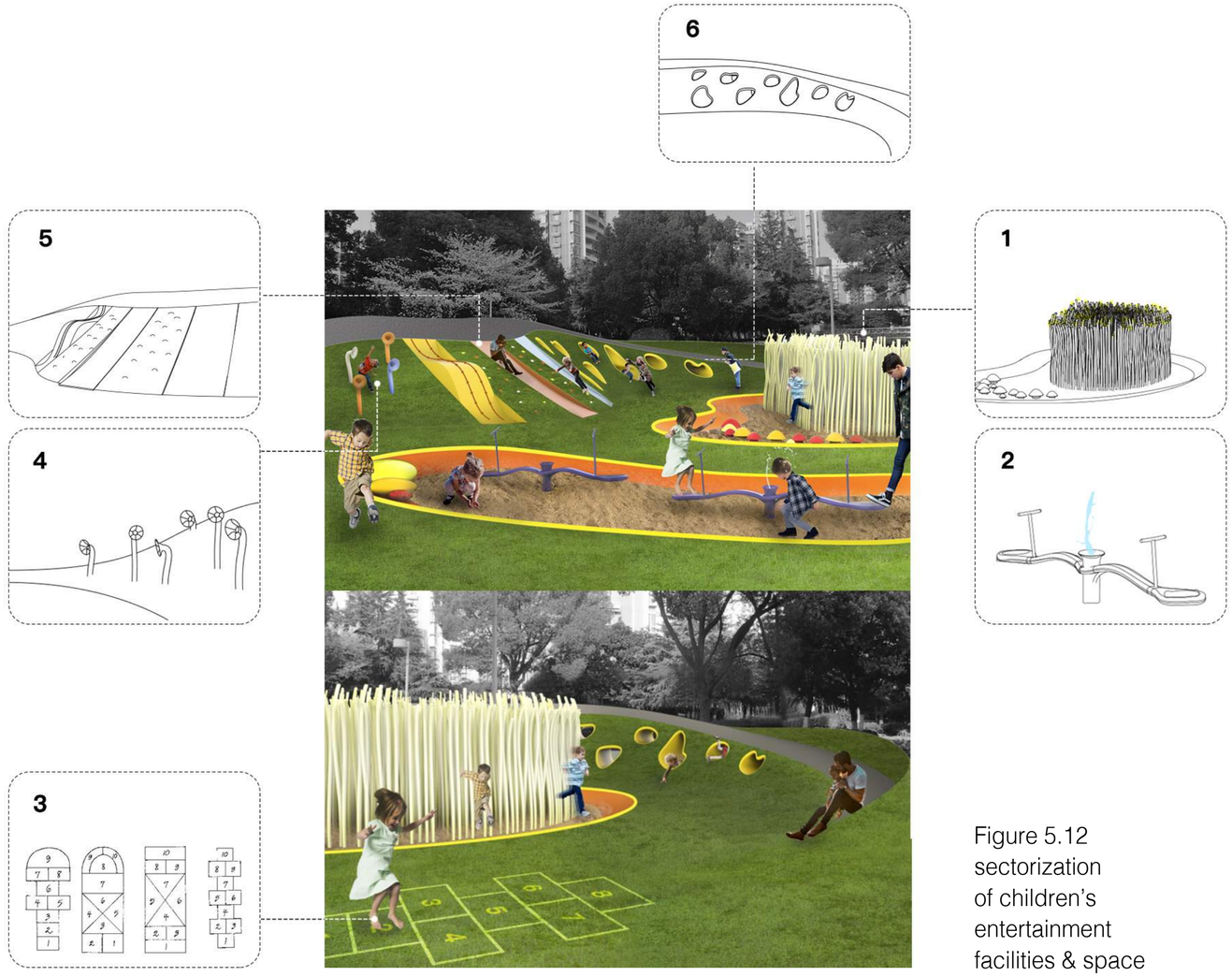

Figure 5.12
sectorization
of children's
entertainment
facilities & space

water is small, it means It takes more effort and needs more people. The purpose of this facility is not only to exercise the child's physical coordination ability but also to increase the child's interaction with others.

Scheme 3 is derived from the game of hopscotch that children used to play in the past. The cost of hopscotch is very meager. Only nine grids need to be drawn on the ground, but traditional games still have high value until today, which can exercise the flexibility of children's body, coordination, promote the development of its large muscle move-ments to cultivate tact, certain will quality and thinking ability and is very suitable for young and old to play with.

Scheme 4 shows a sound transmission tube. Children can sound different cylinders, and their echoes will be transmitted from any transmission tube. The sound is sent to stimulate children's auditory senses, and the interaction between children and facilities and others is enhanced.

Scheme 5 is the combination of climbing and sliding facilities. According to the previous research, many children like to climb up from the bottom of the slide and enjoy it. For this reason, combined with the behavior of children, it provides a variety of climbing methods to exercise the development of children's large muscle movements. At the same time, the size of the slide is larger than that of the traditional slide, providing a space for adults and children to play together.

Scheme 6 is the "cave wall" designed for children to enjoy the secret space. It is also a kind of labyrinth facility, in which children can drill into and play hide and seek with others to cultivate children's curiosity, flexibility and exploration desire. At the same time consume the excess energy of children

5.4 User Feedback

Through the analysis of the conceptual scheme of the outdoor children's entertainment facilities in the above-mentioned residential community, the author asked some residents and parents of the settlements to feedback their opinions in the form of scoring. The feedback information is as shown in the following figure:

We can see that the design scheme has good evaluation results in terms of function from the user feedback, shape and color elements, and interaction, nature, coordination, fun, and diversity are also aspects that users are more satisfied with, reflecting the feasibility of this design in interactive entertainment experience ascension, but also need improvement in the structure, material and challenging the step.

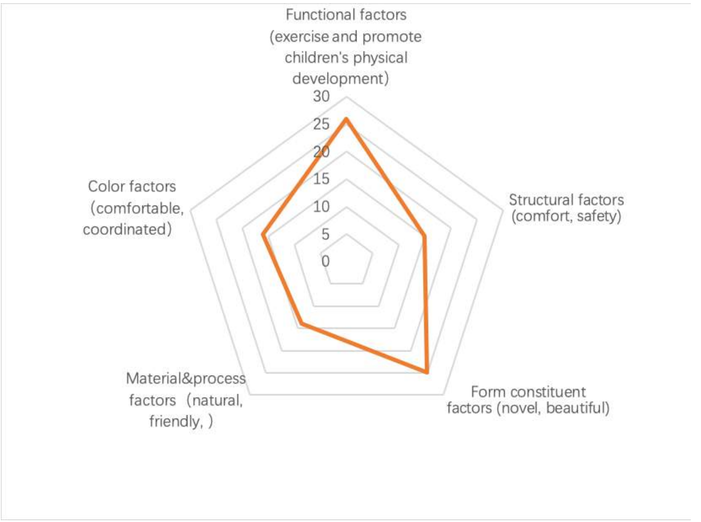

Table 5.13 User feedback for concept design of residential children's entertainment facilities &space

5.5 Summary

Based on the previous research, research and analysis results, this chapter takes the Tian'an Garden, a new residential area in Shanghai, as the target area, analyzes the situation of its residential area, constructs a character model, proposes its concept of “returning to nature”, and introduces various forms. The way of entertainment enhances the interactive, fun, coordinated, and natural nature of children's entertainment facilities, and enhances the interactive entertainment experience of children and facilities, children and others.

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