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BEYOND CHILD CENTRIC:
A STUDY OF INCLUSIVE PLAYGROUND DESIGN FROM A MULTI-
STAKEHOLDERS PERSPECTIVE

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School of Design

Beyond Child Centric:

A Study of Inclusive Playground Design from A Multi-Stakeholders Perspective

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A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

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CERTIFICATE OF ORIGINALITY

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YANG ZI (Name of student)

My last tribute is to those who know I am not perfect but still love me.

Abstract

Playgrounds are unique urban public spaces, yet their current designs often prioritize children's needs, neglecting other stakeholders such as parents, caregivers, community residents, and playground staff. These overlooked groups significantly influence children's experiences and collectively impact playground design, use, and management. With rising awareness of the diverse roles of public spaces, inclusive design has gained attention. Inclusive design goes beyond accessibility, aiming to meet the needs of all users and ensuring no group is excluded – especially in children's playgrounds.

This study redefines playgrounds as dynamic public spaces encompassing social interaction, participation, and daily life, rather than static physical sites. By analysing their historical, spatial, and relational attributes, the study argues that playgrounds are not exclusively for children. It re-examines their functions and design goals, focusing on how inclusive design can balance children's needs with those of other stakeholders, transforming playgrounds into multifunctional public spaces.

Key research questions include: Are current inclusive playgrounds in Hong Kong truly achieving their child-centric design goals? Who are the main stakeholders in public playgrounds aside from children? Do the existing inclusive public playgrounds meet these stakeholders' needs? This study develops design strategies to optimize playgrounds' multifunctionality and enhance their role as inclusive public spaces.

Grounded in the principle of countering design exclusion, the study proposes the R-I-N-G (Reviewing-Identifying-Narrowing-Generating) framework to match diverse user needs. A mixed-methods approach was adopted, including qualitative research, surveys, informal interviews, and unobtrusive observations. Data were collected over a year from three representative inclusive playgrounds in Kowloon, New Territories, and Hong Kong Island. Initial investigations across 40 playgrounds in Hong Kong provided foundational data through an inclusive quality checklist and caregiver feedback. Informal interviews with caregivers and

staff revealed barriers to inclusivity, while SOPARC and BMAT tools captured behaviour patterns and spatial usage among stakeholders.

Findings reveal that while Hong Kong's inclusive playgrounds partly achieve child-centric principles, they fail to fully celebrate inclusivity, often excluding other user groups. Parents, caregivers, community members, and staff significantly shape children's play experiences and the overall playground experience.

Based on a behaviour-need analysis, six major activity clusters were identified, and their corresponding demands were mapped. Five core design principles for inclusive playground design were derived: multifunctionality, inclusivity, flexibility, safety, and comfort. Spatial layout refinements integrate behavioural and spatial analyses, enabling diverse user groups to interact without interference. Optimized design strategies target five key zones: the core playground zone, open space, periphery and sheltered area, pathway, and entry. Each area's emphasis aligns with specific user activities and needs. These design strategies are further integrated into a systemic macro-meso-micro framework, enabling policy-level, community-level, and interface-level inclusive design interventions.

These strategies enhance playgrounds as inclusive, multifunctional spaces, serving not only children but also providing a safe and comfortable environment for all city users. This fosters social inclusion, improves the quality of life, and reimagines playgrounds as urban oases for diverse stakeholders. While grounded in the context of Hong Kong, the study highlights the need to expand future research through cross-cultural comparisons and broader stakeholder inclusion to test and refine its propositions.

Key Words: Inclusive Design, Public Playground, Multiple Stakeholders, Behaviour Clustering, Need Analysis

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Chapter 1 Introduction

1.1 ‘Sorry, I know I should leave.’

‘It [the playground] is close to home ... I just want to find a place to sit for a while and let myself go ... But after staying for a long time, I get a bit squirmy...’ One morning in early 2023, I met Mr. A in Kowloon Park. He was sitting cross-legged in a corner of the children’s playground, looking absorbed, as if he was thinking about something (see Figure 1.1). I was curious: why did he not sit on the bench not far away? There were very few people in the playground at that time, and there were still many empty seats.



FIG.1.1 A man is sitting in a corner of the children’s playground in Kowloon Park

I couldn’t resist going up and asking him. Smiling, with a tinge of embarrassment, he said, ‘As an adult, I don’t think I should stay here. After all, playgrounds are designed for children. If I just sit or stand like this, watching the children play, it always feels somewhat out of place. It is like I shouldn’t be here, invading their territory.’

Although Mr. A is not a child caregiver and was not among the interviewees for our GRF project's research on inclusive children's play spaces, his response piqued my curiosity. He explained, 'Yeah, it always feels like I don't belong in this place ... It's like, my presence might make other parents or caregivers feel weird. 'What is this adult doing here?' I don't want to be the **centre** of attention, make people feel uneasy, or even suspect that I'm weird or have some bad motives ... In the morning or at noon, if I'm lucky and there are fewer people, there will be more adults like me. That way, I wouldn't seem so out of place or make other people feel uncomfortable. I just want to find a place to be quiet for a while ... But when there are a lot of people, I feel awkward, and I always feel like an uninvited guest. Then I thought, hey, better go, it's time to leave.'

Why does Mr. A want to stay in the playground but feel that he shouldn't be there? Why does he feel that he doesn't belong in this space? Why does an adult feel so uncomfortable sitting in a children's playground? Mr. A's ambivalence reflects a question: **Can public playgrounds only be exclusive areas for children, or can they be a place of rest for all urban users?** Especially in a city like Hong Kong, where land is scarce, do adults looking for a moment of peace in their fast-paced lives have the right to stay in the playground without feeling like 'outsiders'?

These questions reveal the problem of inclusive design of urban public spaces in the context of rapid urbanization and increasingly fierce competition for space. As 'child-centred' public spaces, do playgrounds really only need to meet the needs of all children? Perhaps, when we revisit the playground, we will find that it is not just a space for children. In addition to children, there are parents, domestic assistants and professional nannies who accompany them; community residents living near the playground; and even adults who accidentally break in and look for a place to rest. These different user groups are also using this public space. I want to ask some questions: **How can a more inclusive design make the playground a place that all can share?** How can we make it a place where other groups can find a place for themselves without preventing children from playing? In this sense, can playgrounds become 'urban oases' that every city user can enjoy?

These questions made me reflect upon how playgrounds can be designed inclusively—so they cease to be merely a place for children and instead become a public place where people can rest. It's not only about the health and well-being of children; it relates to the quality of life and well-being of the whole city users. Therefore, **this study will reconstruct the role and function of the playground, explore its multiple roles as a multifunctional space, and how to meet the needs of more diverse users through more inclusive design strategies.** These reflections will help us understand how to make urban public spaces more inclusive and better serve people of different ages and roles in the city.

1.2 Something may be missing in playground design

The concept of playground seems to be closely associated with 'children', but is it really designed only for children?

Public playgrounds in Hong Kong were first established to prevent juvenile delinquency in immigrant communities and to maintain social order (see Figure 1.2). Early playgrounds were not intended to promote children's creativity, but to keep poor children busy, prevent them from disrupting society, and devote their energy to socially recognized activities (Fan, 2021). In the 1950s, with Hong Kong's population boom and housing shortage, the government began to build public housing on a large scale. These projects were usually equipped with simple community play spaces, mainly traditional play equipment such as swings and seesaws (Fan, 2021).

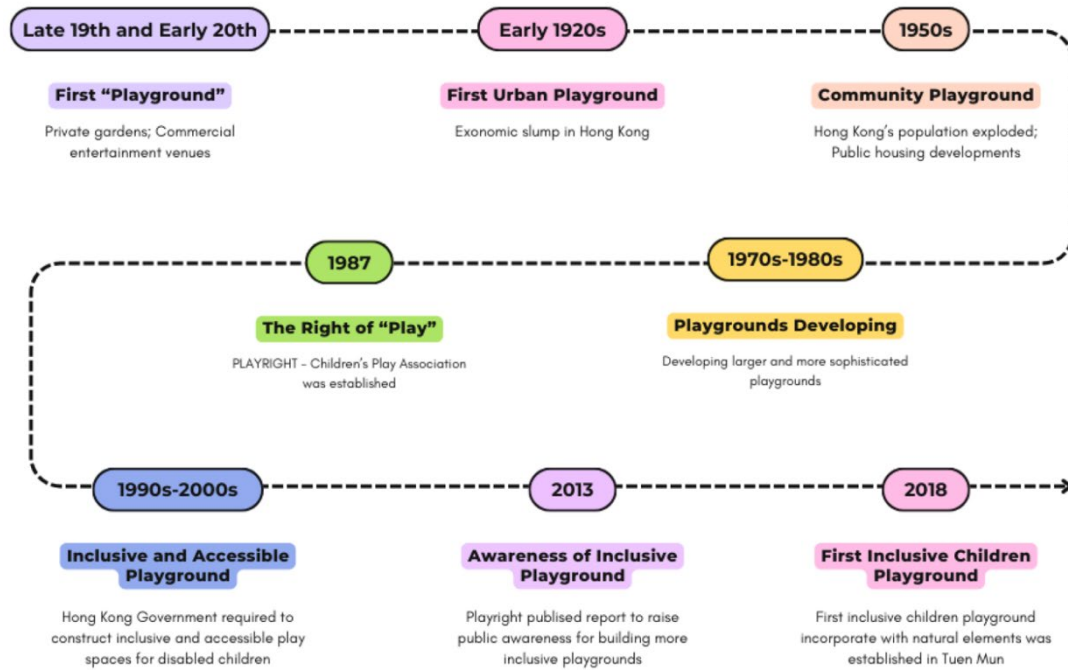


FIG.1.2 Timeline of children's playgrounds in Hong Kong

By the 1970s, with the introduction of larger playgrounds offering various facilities and activities, the government also began investing more systematically in public play infrastructure. During this period, public playground design gradually shifted to meet the different developmental needs of children. As society increasingly recognised children's rights in the 1980s, a new foundation was laid for promoting appropriate play. The establishment of the Playright Children's Play Association in 1987 marked an important milestone in advocating for age-appropriate play and children's participation.

From the early 1990s to the 2000s, public playgrounds began increasingly addressing the needs of children with disabilities, as the government channelled resources into creating more accessible and inclusive environments. In 2013, Playright released the report *Better Inclusive Play Space for Children with Disabilities*, which successfully brought inclusive playgrounds to public attention. In 2018, the first truly inclusive playground opened in Hong Kong, incorporating natural elements such as water and sand to create a harmonious play environment suitable for children of different ages and abilities (Leisure and Cultural Services Department, n.d.).

Unlike the Webster's dictionary's definition of **playground** – 'a piece of ground for and usually having special features for recreation, especially by children' (Gove, 1961, p.1737) – the history of Hong Kong's public playgrounds shows that their original purpose was not simply for children's entertainment, but to address social issues in densely populated immigrant communities.

Similarly, as public spaces, Carr et al. (1992) mentioned in *Public Space* that playgrounds are 'located in neighbourhoods... sometimes include amenities for adults' (Carr et al., 1992, p.81). Also, The *Hong Kong Planning Standards and Guidelines* (2021) further explain that playgrounds are a form of open space within landscape architecture and are part of the broader public space system. These statements indicate that playgrounds, as public spaces, are not exclusively for children but serve wider social functions.

Although the current designs of public playgrounds in Hong Kong are primarily child-centred, they mainly provide different play facilities for children aged 2-5 and 5-12. The notice boards in playgrounds often state that 'adult supervision is recommended' (see Figure 1.3), implying that playgrounds not only recognize the relationship between children and their caregivers, but also reflect the impact of this relationship on playground use, i.e. determining when, where, how and even whether children can access the playground. Refshauge et al. (2012) pointed out that public playgrounds are an important social space for families, suggesting that playgrounds are not limited to children, but also include their caregivers and families.



FIG.1.3 Notice board of inclusive playgrounds in Hong Kong

Public playgrounds have significant public meaning in urban environments from three dimensions: historical, spatial, and social relations (see Figure 1.4). Playgrounds not only play a key role in cultivating children’s problem-solving skills and emotional intelligence (Brett et al., 1993), but also play an important role in promoting intergenerational interaction and enhancing community connections (Pitsikali & Parnell, 2020). Since children often need to be accompanied by their parents, family members, or caregivers to enter the playground, and most public playgrounds are located near the community, **the ‘child-centred’ design paradigm is insufficient**. International research, particularly in Western contexts, has predominantly emphasized child-centred approaches focusing on accessibility for children and the promotion of independent play. However, these approaches often overlook the complex dynamic involving other stakeholders, such as caregivers, families, and community members, who significantly influence the usage and functionality of playground spaces (Shadkam & Moos, 2021; Woolley, 2008; Moore & Lynch, 2015).

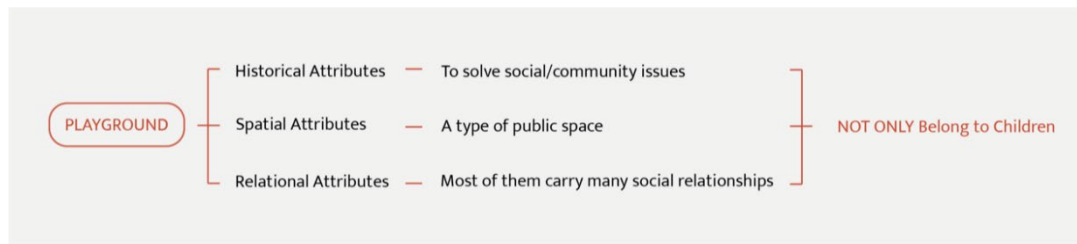


FIG.1.4 Playgrounds are not only for children

This study, therefore, addresses this critical gap by explicitly shifting the focus from a purely child-centric view towards a multi-stakeholder inclusive perspective. It aims to reconstruct and redefine playgrounds to expand the scope of inclusive design and include more groups by exploring the needs of other stakeholders. Given that designers are not the end-users or managers of public playgrounds, this study will optimize the existing participatory design to obtain more objective research methods and data.

To achieve this, the study first proposes a novel systemic user research framework, termed **the R-I-N-G framework**, which integrate Reviewing, Identifying, Narrowing, and Generating to systematically identify and analyse stakeholder requirements. Based on this framework, empirical research is conducted through a survey, informal interviews, and unobtrusive observation at selected inclusive playgrounds provided by the Leisure and Cultural Services Department (LCSD) and the Planning Department (PD) of the Hong Kong Special Administrative Region Government. The collected data is analysed to identify behavioural patterns, organized into activity clusters, which are further examined to understand the specific user needs associated with each cluster. These identified needs are then mapped onto corresponding spatial zones within playgrounds, highlighting critical design considerations. Ultimately, the findings are synthesized into design principles and differentiated strategies, structured within a macro-meso-micro systemic design framework. This systematic and holistic approach explicitly addresses the shortcomings of current international practices, providing actionable insights and structured strategies to transform playgrounds into truly inclusive public spaces catering to diverse user groups.

1.3 Research question

By reviewing the development history of Hong Kong playgrounds, it can be found that the Hong Kong government has increasingly attached importance to the inclusive design of public playgrounds, with the goal of meeting the needs of children of different ages, abilities and developmental backgrounds. However, public playgrounds are used by more than just children, and the needs of other user groups – such as caregivers, domestic helpers, intergenerational companions, and staff - are often overlooked or insufficiently considered.

Therefore, the core question of this study is: **how can inclusive public playgrounds be designed not only to support children’s play but also to accommodate the spatial, behavioural, and relational needs of other urban users?**

Based on this, the study will further ask the following sub-questions:

- 1) Do the current inclusive playgrounds in Hong Kong truly meet the ‘child-centred’ design principle?
- 2) Who are the key stakeholders of public playgrounds other than children?
- 3) Do the existing inclusive playgrounds address the needs of these stakeholders?
- 4) If not, what are the expectations and visions of these stakeholders for future inclusive playgrounds?

In addressing these questions, the study does not reject the importance of child-focused design, but rather takes it as a foundational premise upon which broader inquiries into multi-stakeholder inclusion can be developed.

1.4 Research aims and objectives

Although this study recognises the foundational importance of designing playgrounds that accommodate the needs of children—including children with diverse abilities—the core

analytical focus is not limited to child users. Instead, it builds upon the spatial and policy baseline provided by the ‘Design for All Children’ framework to investigate how other stakeholders—especially caregivers, domestic helpers, and community members—interact with, experience, and negotiate spatial inclusion within public play environments.

By shifting beyond a child-centric paradigm, the study positions **public playgrounds as shared spaces of intergenerational and multi-role interaction**. The goal is to examine how the real-world experiences of non-child users influence the perceived and actual inclusiveness of such environments.

1.4.1 Research aims

This study will propose design strategies to optimise the existing ‘child-centred’ public playgrounds into a public space catering to **a broader range of stakeholders**. It aims to increase their inclusiveness by exploring stakeholders’ interactions, behaviours, and needs in-depth. This will help expand the purview of inclusive design beyond children and address the needs of other users, particularly in enhancing the experience of non-disabled stakeholders.

It is an important area of research because it ensures that future public playground design incorporates an inclusive framework of design and guiding principles to ensure playgrounds better serve diverse users of playgrounds.

1.4.2 Research objectives

The study will focus on the following three different areas:

(a) **Identification and analysis of significant stakeholders in public playgrounds:**

Apart from the children, other key stakeholder groups will be identified, and their needs and behavioural patterns examined, along with their specific use of playgrounds. From that process, understand different stakeholders’ roles in the space and their varied expectations of the design.

(b) **Determination of the effectiveness of the design in existing inclusive playgrounds:** Survey, informal interview, and unobtrusive observation will be carried out to assess how well the design of existing inclusive public playgrounds meets different stakeholders' needs. Analyse active experience with existing playgrounds, first-hand use, and the barriers and challenges these groups face to point out flaws and inadequacies in current design.

(c) **Propose new inclusive design strategies:** A new set of design principles is proposed based on the needs and behaviours of different stakeholders. These principles aim to better meet the needs of diverse users through a 'behaviour-needs' oriented approach, and enhance its inclusiveness by exploring the spatial layout and functional planning of playgrounds, making it a public space suitable for leisure and entertainment for everyone.

1.5 Significance of the study

This research is considered significant from three perspectives: broadening our definition of public space, expanding multi-stakeholder perspectives, and optimising research methods and design tools innovation.

First, **broaden the definition of public space.** Public space has traditionally been defined as physical places shared publicly. This study proposes that public space design should consider physical characteristics and social functions, that is, city users' daily life and social interaction in the public space, to create a 'hybrid space' that can meet public participation needs and daily interactions. So, playgrounds provide more than just recreational playtime for children; they're also vital hubs of social engagement and community life. It should satisfy public space needs among the children and accompaniment of family members, people in the neighbourhood, and other urban residents who intend to be served by the space.

Second, **expanding perspectives.** Existing playground research and design only focus on children, ignoring the existence and needs of other stakeholders. This study introduces a multi-stakeholder perspective to identify and analyse other user groups besides children, such as

parents, caregivers, community residents, playground staff, etc. It explores the impact of the needs and behaviours of these groups on playgrounds. This multidimensional perspective gives us a more comprehensive understanding of the functions of playgrounds, promotes the design paradigm shift from ‘child-centred’ to ‘multi-stakeholder inclusion’, and emphasizes the inclusiveness and diversity that playgrounds should have as urban public spaces.

Third, **optimise research methods and innovate design tools**. Although participatory design has become the mainstream method of inclusive design, its limitations lie in the dominant position of designers and the limited participation of users. This study proposes the R-I-N-G user needs research method framework. It is designed to retrieve and assess real stakeholder needs through reviewing, identifying, narrowing down, and generating with reduced subjective bias by designers while ensuring data collection objectivity and comprehensiveness. In addition, the study introduces the concept of ‘behaviour cluster’ to classify typical behaviours in playgrounds, and based on these behaviour clusters, the everyday needs of stakeholders are extracted to realize more accurate design interventions.

1.6 Structure of the thesis

The framework of this study is shown in Figure 1.5. The paper is divided into seven chapters.

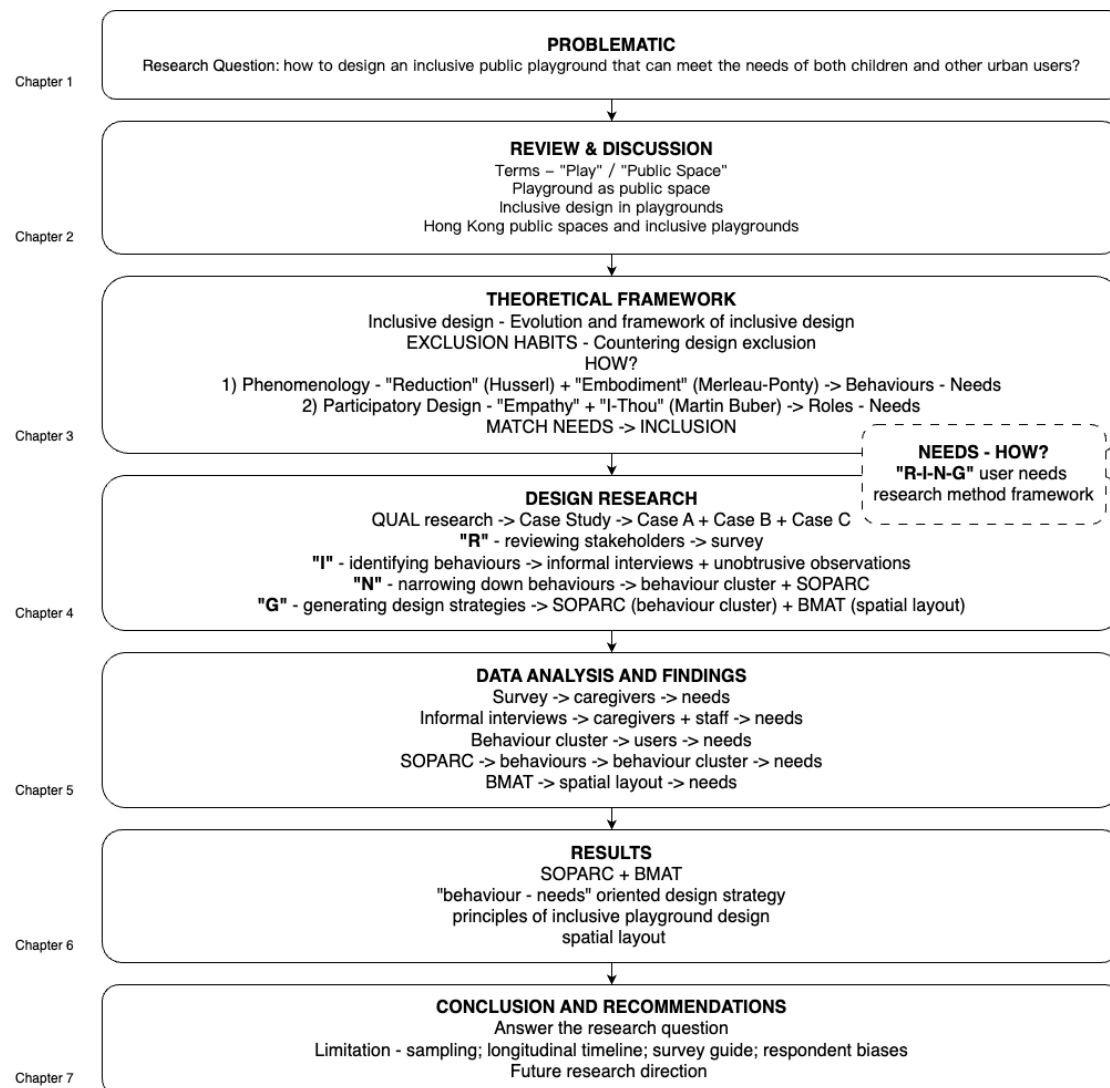


FIG.1.5 Framework of the study

Chapter 1 is the **introduction**. It first introduces the research background and motivation, proposes research questions based on the phenomena observed in playgrounds, explores the limitations of the ‘child-centred’ design paradigm of Hong Kong’s public playgrounds, and then proposes the research objectives, research significance and research questions. Through a critical analysis of the current public playground design, the core research goal is to meet the needs of more stakeholders in public playgrounds through more inclusive design strategies.

Chapter 2 is the **literature review**. It reviews the theories and concepts related to playground design, public space and inclusive design, covering the definition of ‘play’, the functions of public space, the historical evolution of playground design, and, in particular, the

current situation of public space and inclusive playgrounds in Hong Kong. Through this literature review, a theoretical foundation is laid for the subsequent research, the research gaps in the existing literature are analysed, and how this study will fill these gaps.

Chapter 3 provides the **theoretical framework** of inclusive design, including the historical evolution of inclusive design and its core concepts, focusing on the phenomenon of exclusion in design and its causes. This chapter also introduces phenomenology and participatory design methodology and analyses its application in inclusive playground design. Finally, based on the theory of ‘countering design exclusion’, it is proposed to achieve inclusive design by matching diverse needs and stakeholders. It proposes the ‘R-I-N-G’ user needs research method framework to cope with the design of complex needs.

Chapter 4 addresses **research methodology**. Adopting an implementation research paradigm and combining case studies and behavioural mapping ensures the scientific nature of this process, with specific methods including on-site surveys, informal interviews, behavioural observations, data analysis, and more informal means. This chapter describes how to use these methods to identify and evaluate stakeholders’ needs and behavioural characteristics, providing data support for design improvements.

Chapter 5 is the **data analysis**. Through the collation and analysis of the questionnaire survey, informal interviews and unobtrusive observation data, especially the evaluation of playground design by different stakeholders and their improvement needs, are discussed in depth. This chapter also proposes the concept of ‘behaviour cluster’ and summarizes the space use characteristics of different behavioural groups using the behaviour mapping method.

Chapter 6 presents **design recommendations and principles** based on the previous data analysis. This chapter proposes a ‘behaviour-needs’ oriented design strategy and summarizes five principles of inclusive playground design: multifunctionality, inclusiveness, flexibility, safety and comfort. Based on the behavioural set and spatial layout presented in Chapter 5, this chapter investigates ways of meeting diverse users’ needs more effectively while increasing inclusivity by optimizing the spatial layout and facility configuration.

Chapter 7 is the **conclusion and recommendation**, which summarizes the study's main findings, clearly answers the research questions, and discusses the study's limitations and future research directions.

Chapter 2 Literature review

2.1 Definitions of play

Since the 19th century, academic interest in play has continued to grow, but its definition has always been vague and difficult to standardise (Zosh et al., 2018). Play involves multiple disciplines, such as philosophy, psychology, and pedagogy, and each field has different discussions on the meaning and value of games. The diversity and complexity of play make a single, precise definition of it difficult. This study refers to the views of Sutton-Smith (1997) and extracts standard features from the evolution of game theory to understand play more comprehensively.

2.1.1 Functional view of classical play theories

Classical play theories primarily centre on the function of play, emphasizing its biological and psychological roles as a natural behaviour. Friedrich Schiller (1875) regarded play as ‘the aimless expenditure of exuberant energy’ (Verenikina et al., 2003). This view holds that play is a release of energy beyond the needs of survival. Following Schiller, Herbert Spencer (1873) expanded the surplus energy theory derived from evolutionary theory by suggesting that play manifests energy accumulation through natural selection. Moritz Lazarus (1883) noted play’s therapeutic and relaxation properties, noting how it could provide individuals with much-needed psychological relief from daily pressures and activities. Similarly, George Patrick (1916) saw the play as an activity to relieve mental fatigue.

From an evolutionary perspective, Karl Groose (1898, 1901) proposed that the purpose of play is to help organisms practice instinctive skills to improve their survival in adulthood. The play has an essential part to play when it comes to rehearsal and preparation for adult life; G. Stanley Hall (1920) further developed this view, believing the play was, at its core, an emotional catharsis providing safe channels for individuals’ social instincts.

As can be seen from these classic theories, early theories of play did not focus on the essential definition of play, but instead took a functional perspective, viewing play as a means to help individuals release energy, relax, practice skills, and engage in emotional catharsis.

2.1.2 Diversification of play theories in the late 20th century

In the mid-to-late 20th century, play theory gradually showed a diversified trend with the further development of psychological theory. Sigmund Freud pointed out in his psychoanalytic theory that play provides individuals with a safe space to express potential aggression and desires (Takhyar, 1988). He argued that children can achieve fantasy and wish fulfilment through play, and explore the relationship between the Self, the Ego, and the Superego in the process. Based on Freud's theory, Peller (1952) further proposed that play achieves 'wish fulfilment' through role-playing and imitation.

Erik Erikson believes play is essential for children to socialize and establish self-identity. Children can reduce anxiety while simultaneously improving social skills and self-cognition through playing different roles. Daniel Berlyne (1966) proposed the Arousal Theory which stresses that play serves to stimulate brain neural activity for better physical and mental health, creating new neural connections within our brains, thus improving physical and mental well-being simultaneously. This view regards play as an exploratory behaviour that helps improve individual cognitive and perceptual abilities.

Bateson (1955) believed that play is a form of 'meta-communication' from the perspective of communication theory, and that individuals create personal culture and identity through symbols and symbolic actions in play. Piaget (1951) and Vygotsky (1978) emphasized the importance of play for children's independent exploration, cooperative learning, and the development of language and thinking skills from a cognitive developmental and socio-cultural perspective, respectively. Piaget emphasized that children consolidate cognition by repeating known actions through play, while Vygotsky believed that play creates a zone of proximal development for children and promotes the development of higher-order thinking.

2.1.3 Play is not exclusive to children

Classical play theories and psychologists mostly explore play from the child development perspective, primarily emphasizing their role in children’s psychological and cognitive development. However, play is not limited to children; it is a form of behaviour that transcends age boundaries and is prevalent in human life. Article 31 of the United Nations Convention on the Rights of the Child clearly states that play is a fundamental right of children and is essential to their health and well-being (United Nations, 2013). However, this does not mean that play is an exclusive behaviour for children.

From an etymological perspective, the word ‘play’ comes from the Old English word ‘pleg(i)an’, which originally meant ‘to exercise’ or ‘brisk movement’ and does not limit its subject to children only (see Figure 2.1). Therefore, play should be understood as an activity without age restrictions, and its value and significance are reflected in different life stages and social situations.

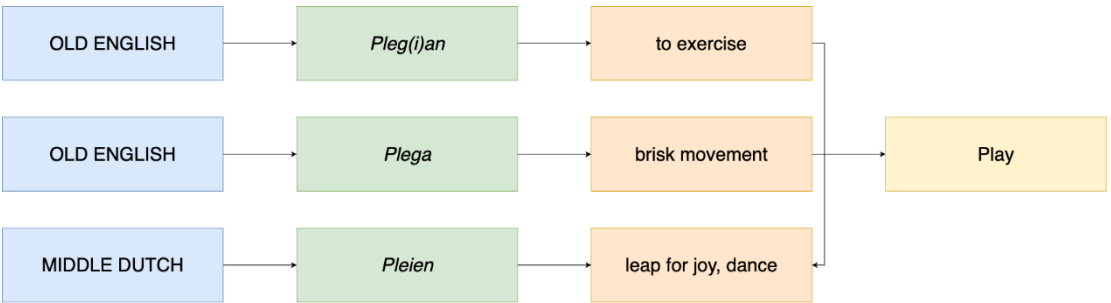


FIG.2.1 The origin of play

Source: Adapted from Oxford Dictionary

Table 2.1 summarizes the definitions or characteristics of play by many scholars. Although these definitions are diverse, they all show that play is a self-directed activity without strict goal orientation. They are not exclusive to children, but a universal form of behaviour that transcends age boundaries.

TABLE 2.1 Definitions of play

Play Theorists	Definition
Johan Huizinga	'...a free activity standing quite consciously outside 'ordinary' life as being 'not serious,' but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings which tend to surround themselves with secrecy and to stress their difference from the common world by disguise or other means.' (1950, p.13)
Jerome Bruner	'Play ... a means for acquiring information about and experience with the environment' (1972, p.699).
Jean Piaget	Play is a 'happy display of known actions' (1962, p.93).
Lev Vygotsky	'Play is an adaptive mechanism promoting cognitive growth. It creates the zone of proximal development.' (1978, p.102).
Kenneth Rubin	'...a behaviour that is (a) intrinsically motivated; (b) focused on means rather than ends; (c) distinct from exploratory behaviour; (d) nonliteral (involves pretence), (e) free from externally imposed rules; and (f) actively (not just passively) engaged in by the players.' (1983, p .693-744)
Peter Gray	Play is an activity that is '(1) self-chosen and self-directed; (2) intrinsically motivated; (3) guided by mental rules; (4) imaginative; and (5) conducted in an active, alert, but relatively non-stressed frame of mind.' (2009, 476-522)
Brian Sutton-Smith	'Play is a pleasure for its own sake, but its genetic gift is perhaps the sense that life, temporarily at least, is worth living' (2008, p.122).

Play is an attractive and valuable activity transcending 'play time' and specific places. As Sutton-Smith (2008) argued, the intrinsic charm of the play lies not only in the pleasure it brings, but also in the fleeting experience of meaning it gives to an individual's life. As a communal activity across ages and social classes, play can be a tool for children to learn and grow and an important way of social interaction and emotional expression for adults. Therefore, play should be regarded as a universal form of behaviour in which all individuals, regardless of age, identity or social status, have the right to participate in and enjoy the pleasures and benefits of play.

While the existing literature has not yet provided a unified and precise definition, the definition and function of play should not be limited to children, but should be extended to all age groups. Play is a universal behaviour that transcends time and space and is an important part of human society and culture. It not only promotes the healthy physical and mental development of the individual, but also constructs connections between people on a social level.

2.2 Public space: definitions and functions

2.2.1 Etymology and concept of public space

‘Public space’, the literal definition is a ‘space’ for ‘the public’. The term **public** originates from the Latin word phrase *pūblicus*, which means ‘of the people; of the state; done for the state.’ It was derived from the Old Latin *poplicus*, which meant ‘pertaining to the people,’ from *populus*, which in English means ‘the people’ (Online Etymology Dictionary, 2021). Public spaces embody three essential qualities that define them: openness, sharing and collectively (Vasquez & Maureen, 2001). *Synoiikismos* in Greek means ‘space for common life’, reflecting its collective character (Siu et al., 2020). Traditional Chinese culture sees public space as non-private areas that belong to all and emphasise collective interests and openness (Siu, 2001).

Public space is more than a physical presence; it is an important part of human social life. As Altman and Zube (2012) pointed out, space can only be transformed into a ‘place’ with social and cultural value when it is used, transformed and endowed with symbolic meaning by humans. This process demonstrates the socially constructed nature of public space, which derives its meaning from the physical environment and the interaction between people and space. Therefore, public space is essentially an open social field, where people interact, express and share, and it is socially inclusive and collective.

2.2.2 Multidisciplinary definitions of public space

Public space can be defined from various perspectives across disciplines; there is no singular definition. Instead, each discipline’s understanding and demand of what constitutes a ‘public’ space varies significantly based on social context and focus.

Sociologists and historians typically view public space as the focal point for social interaction and engagement. Hartley (1992) believes that public space can be traced back to the ancient Greek marketplace, which served as a place for citizens to present themselves, communicate

and trade, and had important social and political functions. Madanipour (1999) pointed out that public space is a physical place accessible to everyone in towns, cities and rural areas, emphasizing its openness and accessibility. Lofland (1998) further emphasized that the reason why public space is 'public' is that the general public recognizes it and is relatively easy to access. Its core characteristics are accessibility and social inclusiveness.

Political theorists are more concerned about the role of public space in democratic participation and social life. Arendt regards public space as a 'common world'. She emphasizes that public space provides a platform for individuals to participate in public affairs, allowing people to transcend the realm of private life (Goodsell, 2003; Hansen, 2013; d'Entrèves, 2002). Habermas proposed the 'public sphere' theory, arguing that public space should have universal access and equality, and everyone should have equal access rights and be able to participate in public affairs (Habermas, 2020). Carr et al. (1992) also confirmed this point. They defined public space as 'democratic spaces', which are not only open to all groups, but also should 'protect the rights of user groups' to ensure that people enjoy freedom of action, highlighting the close connection between public space and democratic participation.

In architecture and urban design, the study of public space focuses on how the physical environment affects social behaviour and interaction patterns (Goodsell, 1988). Edelman (1996) studied the design of symbolic buildings, such as the White House and the Pentagon, and pointed out that these buildings convey authority and state power through specific spatial layouts and structures, which shows the role of public space design in consolidating political authority. The physical design of public space not only affects the public's perception of space, but also shapes the social interaction and power relations within the space (Hénaff & Strong, 2001; Miller, 2007).

From the perspective of design, the study of public space focuses more on how physical design affects people's social and behavioural patterns. Carr et al. (1992) proposed that a successful public space should be 'responsive, democratic and meaningful' and provide the public with a platform to meet the 'basic human needs' of social interaction and public life. Oldenburg (1991) further pointed out in the 'third space' theory that public space should provide people with a

social place that is neither a workplace nor a home, promoting social interaction in daily life. This theory provides an insight the role of public space in daily social interaction and emphasizes its unique value in modern urban life.

2.2.3 Static and dynamic balance in public space design

While the design field is more mature in its physical definition of public space, existing research overlooks the dynamic connection between public space and daily life. Existing studies tend to emphasize accessibility and inclusiveness aspects of public spaces while neglecting its role as vibrant social interaction fields; public space is not simply static physical existence but an evolving social and cultural process that should not be taken for granted.

Setha M. Low, in her book *Why Public Space Matters*, pointed out that when designing public space, designers need to consider not only the physical manifestation of the space, but also understand the interaction between the environment and the behaviour in the space. This means that public space design is not only about shaping the material level, but also about supporting the dynamic activities and interactions in the space. Miller (2007) also clearly stated: 'Public spaces do not exist as static physical entities but are constellations of ideas, actions, and environments.' This view breaks the traditional static understanding and emphasizes the social processes in space.

Successful public space design should balance static physical characteristics and dynamic social interactions. In *How to Turn a Place Around: A Handbook for Creating Successful Public Spaces*, the non-profit organization Project for Public Spaces (PPS) pointed out through a study of 'more than 1,000 public spaces around the world' that the success of public space design lies in its ability to engage people and make it an integral part of social life (Project for Public Spaces, 2000). This requires designers to focus not only on the physical form of the space, but also on how to support and enhance social interaction through the design of the space, so that the space can become a true catalyst for social life.

Based on the above analysis, the definition of public space proposed in this study attempts to break through the limitations of a single discipline and combine the dual attributes of physical space and social function. From the design perspective, public space is not only a physical place for people to socialize and relax, but also a dynamic field for social interaction, public participation and daily life. When shaping public space, designers must balance the physical characteristics of the space with its social functions to create a 'hybrid space' that meets the daily needs of the public and promotes social connections and interactions.

2.3 Playground as public spaces

2.3.1 Origins and development of playgrounds

The origins of playgrounds can be traced back to the late 16th century in Europe, where outdoor recreational spaces were designed primarily for the upper classes. These early spaces integrated ornamental gardens and open-air activity facilities, serving social and leisure purposes rather than being intended specifically for children (Carr, 1992).

A significant shift occurred in the 19th century amid rapid urbanisation and the deterioration of urban living conditions brought about by the Industrial Revolution. Public playgrounds began to emerge as part of broader efforts to improve the urban environment. The development of educational theories further reinforced this shift. Friedrich Froebel, who founded the world's first kindergarten in 1837, advocated for the role of play in children's physical and mental development. The term '*kindergarten*,' derived from the German '*kinder*' (child) and '*garten*' (garden), encapsulated a vision of natural and nurturing environments tailored for young children.

In 1848, American education reformer Henry Barnard was among the first to use the term 'playground' in his writings, linking recreational space with developmental and educational benefits for children (Brett et al., 1993). As urban population density increased in the late 19th and early 20th centuries—particularly in cities such as New York and Boston—there was a

growing recognition of the need to create safe and structured outdoor environments for urban children.

The establishment of the first public playground in Boston in 1885 marked a pivotal moment. In response to overcrowded living conditions and limited access to open spaces, especially in immigrant and working-class neighbourhoods, playgrounds were integrated into settlement house initiatives. These spaces not only offered vital play opportunities for children but also contributed to the broader social reform agenda by enhancing urban quality of life (Cranz, 1982). Consequently, the playground evolved from a privilege of the elite into a fundamental component of inclusive urban planning, serving diverse community needs.

2.3.2 Playgrounds as multifunctional public spaces

With the progress of society and urbanisation, the function of playgrounds has gradually expanded from a single children's playground to a multi-functional public space, which has become an important platform for interaction between family and community members. Carr et al. (1992) pointed out that playgrounds should not only serve children, but also consider the needs of users of different ages, especially the adults accompanying children. The needs and experiences of adult companions in playgrounds are also worthy of attention, which requires designers to fully consider the needs of diverse users when planning playgrounds to ensure that the function of playgrounds is not limited to children's entertainment but can also become a communication space for families and communities.

In *General Comment 17* (GC17), the United Nations Children's Fund (UNICEF) emphasises that playgrounds are important public spaces for meeting children's play and developmental needs, but some researchers argue that playgrounds are not limited to serving children (Williams & Green, 2001; Siu et al., 2017). Indeed, playgrounds are also important platforms for facilitating community interactions. Adults, carers and other community members can also use these spaces for socialising and leisure activities. The versatility and inclusiveness of playgrounds make it no longer just an exclusive space for children, but a resource that serves the entire community.

Playgrounds provide important spaces for community members to meet each other through physical amenities and social functions. Lynch et al. (2018) noted that playgrounds are often located in the centre of a community or a neighbouring area, making them easily accessible to all residents by walking, cycling or driving. Playgrounds provide not only space for children to play in, but they can also act as an important hub of community cohesion, encouraging different groups from within a neighbourhood to interact in one space. Finney and Atkinson (2020) further pointed out that the integration of the physical design of playgrounds with the social environment promotes a place where both children and adults can interact and communicate. The social function of playgrounds depends not only on the facilities but also on the attitudes, rules, cognition, and experiences of the space users (Woolley & Lowe, 2013). Their intergenerational and cross-cultural aspect makes playgrounds a vital place to foster community cohesion.

2.3.3 Playgrounds and social inclusion

As an important part of public space, the design of playgrounds should not only be limited to meeting children's play needs but should become a key field to promote social inclusion. Through their openness and diversity, playgrounds provide an opportunity for people of different backgrounds, ages and abilities to participate together, making them platforms for social interaction and cultural exchange. Moore et al. (2022) pointed out that playgrounds should be designed to promote equal interaction between different groups through inclusive means, ensuring that all users - regardless of their age, ability or background - are able to enjoy play.

The inclusiveness of playgrounds is currently reflected mainly in the design of physical facilities. For example, children's play equipment such as swings, slides and climbing frames is typically tailored to meet the needs of different ages and ability levels of children; benches and awnings offer space for adults to rest or observe activities; furthermore, modern playgrounds increasingly use barrier-free designs so children with disabilities can fully engage in activities (Moore & Lynch 2018).

Inclusive design means playgrounds not only offer children a safe space to play in, but they also promote interaction across generations and cultures through openness and sharing - not only strengthening bonds among neighbours but also contributing to social harmony and inclusion (Finney & Atkinson 2020). Therefore, playgrounds serve not just as recreational facilities, but as hubs of community interaction and cultural exchange (Finney & Atkinson 2020).

Overall, playgrounds serve not only as play spaces for children but also serve as public platforms that facilitate social inclusion and cultural exchange. Playgrounds have gradually evolved throughout history from garden spaces exclusively for upper class families into urban public facilities that meet the needs of various users. Currently, playgrounds provide opportunities for children of different ages, abilities and backgrounds to recreate and socialise through inclusive design, but it is undeniable that playgrounds can also play an important role in enhancing community cohesion and inclusiveness. Future playground design should continue to focus on how to meet the diverse needs of multiple types of users and ensure that all people can enjoy this public space equally.

2.4 Inclusive design in playgrounds

2.4.1 Evolution of inclusive playgrounds

Inclusive playgrounds originated in the United States in the 1960s and 1970s. At that time, as society paid more and more attention to the civil rights of people with disabilities, people gradually realized that these individuals must have equal opportunities to take part in social life (Mace, 1985; Landscape Structures, 2010). The rise of the disability rights movement promoted the discussion of inclusive design in public facilities and laid the foundation for the emergence of inclusive playgrounds (Kim et al., 2018). The original intent of inclusive playgrounds was to ensure that all children, regardless of ability, could participate equally in play in the same space by removing physical barriers, particularly by allowing children with and without disabilities to play together (Metro Recreation, 2020).

In 1975, New York City launched 'A Playground for All Children', the world's first public playground to explicitly provide equal play opportunities for children with and without disabilities (Kim et al., 2018; Landscape Structures, 2010). Its design goal was to create a play environment which catered to both types of abilities rather than creating separate areas solely for disabled kids (Kim et al. 2018). This marked a key transition in inclusive playground design from 'special design' towards an 'undifferentiated play experience.'

In 1990, the United States passed the *Americans with Disabilities Act of 1990 (ADA)*, which gave further impetus to inclusive design. The Act requires that all public playgrounds must have barrier-free access and equipment to ensure that all children have equal access to play (ADA, 1990). Since then, the concept of inclusive playground design has gradually expanded to other countries and regions, and many countries have begun to formulate relevant regulations to incorporate accessible design into the construction of public spaces. For example, the *Disability Discrimination Act* in the UK also promotes inclusive design to guarantee all children equal play rights.

2.4.2 Inclusive design in playgrounds design

The primary goal of inclusive playground is to provide equal play opportunities for all children, regardless of their ability or background. Inclusive playgrounds aim to break down physical and social barriers through design to ensure that all children feel included in play and enjoy playing together (Wenger et al., 2023). Therefore, inclusive design not only focuses on physical accessibility, but also includes promoting interactions between children to ensure that they can cooperate and communicate with each other in the same space (Moore et al., 2023; Sah & Sadri, 2017; Olsen, 2015; Brown et al., 2021).

In terms of physical design, inclusive playgrounds ensure that children of different abilities can freely access and use the various facilities through the accessibility of the facilities (Moore et al., 2023). For example, a variety of types and levels of difficulty of play equipment are installed to accommodate different children's abilities and needs; soft materials are used as surfaces to reduce injury risks during fall; and sensory play areas, such as tactile experience walls and

sound installations, are installed to help children with special needs to participate (Olsen, 2015; Brown et al., 2021; Wenger et al., 2023; Sah & Sadri, 2017).

Inclusive design does not end at physical accessibility. Instead, it focuses on ways to foster social interactions and emotional bonds among children through play environments (Wenger et al. 2023). For example, providing game facilities suitable for teamwork can promote cooperation, communication and trust building among children, and such interaction is essential for promoting social inclusion. By designing play activities that stimulate cooperation and sharing, inclusive playgrounds create opportunities for children of different backgrounds and abilities to participate together, reducing barriers and prejudices between them (Alsarawi, 2020; Kim et al., 2018).

Despite significant progress in the physical and social accessibility of inclusive playgrounds, current international designs, particularly those developed in Western countries, remain largely child-centric, emphasising children's independent play and accessibility needs, while neglecting the broader needs of other critical stakeholders. Existing research and practice tend to overlook caregivers, playground staff, and community members who significantly shape playground experiences and usage. Such omissions limit the comprehensive inclusivity of playground environments and reduce the potential for playgrounds to function effectively as inclusive public spaces for all community members (Shadkam & Moos, 2021; Woolley, 2008; Moore & Lynch, 2015).

Therefore, this study extends the existing international inclusive playground paradigm by explicitly focusing on the needs of previously neglected stakeholder groups. Through a systematic approach, it includes caregivers and other stakeholders in the analysis and design process. By applying the proposed systemic **R-I-N-G framework** — which integrates Reviewing, Identifying, Narrowing, and Generating dimensions—this research systematically analyses the diverse requirements of multiple stakeholder groups. The findings from this comprehensive analysis inform the development of differentiated design strategies, ensuring playgrounds can become genuinely inclusive spaces accommodating diverse users beyond children alone.

2.5 Hong Kong public spaces and inclusive playgrounds

2.5.1 Definition of public space in Hong Kong

In Hong Kong, the definition of public space has always been characterised by complexity and diversity, closely related to its unique social, political and geographical context. As a city with scarce land and extremely high population density, Hong Kong's public space is both an important part of citizens' daily lives and an important source of urban vitality and social cohesion. According to the definition of The Hong Kong Public Space Initiative (HKPSI, 2015), public space can be understood from two aspects: 'public' and 'space'. Specifically, 'space' refers to a tangible and specific place, while 'public' is more complicated. It can refer to 'anything that excludes government or commercial interests.' The definition of 'public' is 'each individual', 'the whole population', or 'the majority'. Therefore, HKPSI suggests that the nature of public space can be better understood by comparing it with related concepts such as 'private space' and 'open space'.

According to Section 4(17)(i) of the *Summary Offences Ordinance (Cap. 228 of Laws of Hong Kong)* issued by the Social Welfare Department (SWD, 2018), public places refer to all place to which the public have uninterrupted or regular access, whether the government or private individuals own them. These places include piers, passages, streets, roads, lanes, alleys, courtyards, arcades, waterways, passages, paths, roads, etc. (SWD, 2018). This definition focuses on the physical accessibility of public spaces and does not address their social functions.

The Hong Kong Town Planning Board equates public space with open space, defining it as 'any land with the minimum of the building structure which has been reserved for either passive or active recreation and provides major or minor recreational facilities, which may be of local or district significance, which is for the use and enjoyment of the general public' (Town Planning Board, 2015). This definition encompasses parks, playgrounds and recreational areas among others for public use.

Nonetheless, the *Hong Kong Planning Standards and Guidelines (HKPSG)* does not clearly define ‘public space’; instead, it includes it in the category of streets and recreational spaces. Recreational spaces are considered a statutory land use area to provide open space and recreational facilities for public enjoyment (Planning Department, 2024). The HKPSI further divides space into public space, private space, recreational space, social space, semi-public space and open space (HKPSI, 2015) to make a clearer distinction between the different types of space.

The definition of public space in Hong Kong is somewhat ambiguous, especially in the common phenomenon of mixing public space and open space in documents of different departments. For example, in 1981, the fourth chapter of the *Hong Kong Planning Standards and Guidelines (HKPSG)* approved by the Land Development Policy Committee (LDPC) ‘Recreation, Open Space, and Greening’ divided public space into eight categories, including public recreation space, conservational zones, active recreation space, passive recreation space, etc. (Planning Department, 1990). In the updated version in 2022, these classifications were further clarified, and categories such as open space, green space, and passive open space were added. The HKPSI believes that rather than further clarifying the definition of public space, it is better to understand the nature of public space by comparing it with other related concepts. However, the term ‘open space’ is often confused with ‘public space’ in government documents, which has caused some confusion in practice. Although public space should be open and inclusive, its social function and spatial quality are often not sufficiently emphasised in actual planning (Lai, 2017; Lam et al., 2005).

2.5.2 Government policies on public spaces in Hong Kong

The Hong Kong government manages and maintains public spaces through the cooperation of several departments. Among them, the Planning Department (PD), the Leisure and Cultural Services Department (LCSD) and the Housing Authority (HA) are the leading agencies for the formulation and implementation of public space policies. The Hong Kong Planning Standards and Guidelines (HKPSG) is an important guiding document that details open space’s types, uses, and quantity requirements to ensure the public’s quality of life (Planning Department,

2024). Unfortunately, however, these specifications cannot account for every factor which affects allocation and management decisions pertaining to public spaces; scarcity of resources as well as priority given to commercial development may all play a part.

Formulating and implementing public space policies in Hong Kong always presents a struggle between efficiency and social value. On the one hand, planning and design rely too much on quantitative indicators, focusing on rigid requirements such as the physical size of the physical size of spaces and types of facilities. For example, the HKPSG specifies in detail the type, number and size of facilities that public spaces should have (HKPSI, 2018). This data-driven planning model ignores the qualitative needs of public spaces to a certain extent, and fails to fully consider how to promote social interaction and inclusion through spatial design. Due to the lack of flexibility, many public spaces are difficult to meet the needs of different social groups, limiting the opportunities for users to enjoy and express themselves (Gehl, 1996).

On the other hand, many public spaces have been designed as multi-purpose places to increase land utilisation, but this practice sometimes sacrifices the social functions of public spaces. In addition, some public spaces have been transformed into quasi-public commercial plazas for commercial interests, which makes their openness and publicness questionable.

In 2018, the government revised the *General Guidelines on the Scope of Public Subscription Permits* to clarify the definition of public spaces further and impose stricter regulations on its use. According to section 2(1) of the regulation, public spaces refer to all areas to which the public has free access (SWD, 2018). In addition, the government has strengthened the control of noise and activities in public spaces by amending the Public General Rules (LCSD, 2020).

Despite the challenges, the Hong Kong government has also begun to emphasise the social value of public space in recent years and has taken a series of measures to enhance the inclusiveness of public spaces. For example, in *Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030*, the government proposed alleviating the pressure of a high-density urban environment by creating high-quality public spaces (Planning Department, 2016). In addition, the government has gradually relaxed restrictions on using some public spaces and encouraged

citizens to hold more community activities to enhance the social functions of public spaces and community cohesion.

2.5.3 Current status of inclusive playgrounds in Hong Kong

Although the construction of inclusive playgrounds in Hong Kong started late, it has progressed in recent years. The Leisure and Cultural Services Department (LCSD) and the Housing Authority (HA) are the departments mainly responsible for playground construction and management, with LCSD managing about 70 per cent of public playgrounds and HA taking charge of the rest, mainly located in public rental housing projects. Compared with the large public playgrounds managed by the LCSD, the playgrounds managed by the HA are smaller in scale and have relatively spartan facilities (Lai & Low, 2019).

Although the Hong Kong Government claims that many playgrounds are equipped with inclusive facilities, the quality and coverage of these facilities vary. According to a survey conducted by the Hong Kong Committee for UNICEF, while about 70 per cent of LCSD-managed playgrounds claim to have inclusive facilities, only 4.5 per cent of playgrounds are able to provide a fully accessible experience for all children (UNICEF Hong Kong, 2012). Currently, the design of facilities in most playgrounds is still largely based on international safety standards (i.e., ASTM F1487 and EN 1176-1), which focus on the safety of the facilities but fail to adequately consider the diversified needs and social interaction needs of children with disabilities (Wong, Lam & Siu, 2018).

In addition, Hong Kong's playground management model is orientated towards efficiency and affordability, and managers tend to opt for integrated play structures that are easy to maintain, ignoring the complexity of inclusive design. Many playgrounds have too many restrictive regulations, such as prohibiting eating, skateboarding, and playing with balls, further limiting children's free space (McCay & Lai, 2018). This management model not only inhibits the promotion of inclusive games but also restricts the public's use of playgrounds.

Promoting inclusive playgrounds in Hong Kong also faces the problem of insufficient public awareness. According to a survey, 75 per cent of parents of children with disabilities have never heard of ‘inclusive play’, and 80 per cent of children with disabilities have never had the experience of playing in an inclusive playground (UNICEF Hong Kong, 2012). This knowledge gap represents inadequate public education efforts that serve as a roadblock to developing inclusive playgrounds.

Despite the many challenges facing the construction of inclusive playgrounds in Hong Kong, in recent years, the government and society have gradually increased their attention to its importance. In 2015, the Leisure and Cultural Services Department (LCSD), the Architectural Services Department (ArchSD) and the Tuen Mun District Council (TMDC) jointly promoted the construction of Hong Kong’s first inclusive playground that integrates natural elements. This development marked an important breakthrough in the design of inclusive playgrounds in Hong Kong. While LCSD has identified 42 inclusive playgrounds in 18 districts across Hong Kong, whether these playgrounds can indeed provide appropriate inclusive facilities for children of different abilities and encourage inclusive interactions in the community remains to be further verified.

Therefore, this study will take the inclusive playgrounds listed by the Leisure and Cultural Services Department (LCSD) as the scope of the study, focusing on whether the design of these playgrounds has paid attention to the social interaction and the needs of children of different abilities. At the same time, the study will also examine whether the design of these playgrounds has provided appropriate facilities and services for child carers and other users. By revealing the real public demand for inclusive playgrounds, it is expected to provide more support for the future development of inclusive playgrounds in Hong Kong and promote their further promotion and application.

2.6 Conclusion

This chapter provides a theoretical foundation and contextual framework for the current status of public playground design in Hong Kong and its inclusive challenges by reviewing game

theory, public space and inclusive playground design. Firstly, in reviewing the diverse definitions of play, this study proposes that play is not limited to children's activities, but is a pervasive behaviour across all ages and social contexts. This perspective provides theoretical support for inclusive playground design; that is, playgrounds should serve different groups, including children, adults and people with disabilities.

Second, different definitions of public space from different disciplines provide a multi-dimensional viewpoint for playground design that emphasises openness and inclusion within public space. Public space development within urban environments provides a theoretical basis for designing playgrounds. As part of public space, playgrounds have evolved from private places for the elite to multifunctional spaces that can meet the diverse needs of the public. Especially in the context of inclusive design, playgrounds are not only children's activity spaces, but also important places to promote social interaction, accommodate multiculturalism, and meet the needs of different users. Therefore, this study regards playgrounds as an important part of public space, and advocates that the user group of playgrounds should not be limited to children, but should be extended to every individual who enters the space, and that all users should have equal rights to use its facilities.

Thirdly, this chapter examines how inclusive playgrounds meet the needs of children of various abilities through physical and social design. Inclusive playgrounds strive to eliminate physical and social barriers so all children, caregivers and community members alike can enjoy this public space together. While progress has been made towards this end goal of inclusive playground design, challenges such as design limitations, and policy constraints.

Finally, by analysing Hong Kong's public space policy and the current status of existing inclusive playgrounds, this study finds that the construction of inclusive playgrounds in Hong Kong is still at an early stage, facing problems such as limited land resources, a single design orientation, and insufficient public awareness of inclusive design. The current design standards cannot fully meet the needs of diverse users, especially the needs of carers and other community members. Future inclusive playground design should continue to meet the physical and social interaction needs of children, while paying more attention to the needs of users from different

backgrounds, especially carers and other stakeholders, to ensure that playgrounds are not only physically accessible, but also able to promote social interaction and integration among diverse groups.

In summary, this chapter has laid a solid theoretical foundation for the study of inclusive playground design, and clarified the key direction of subsequent research, that is, expanding the scope of playground users, paying attention to the diverse needs of caregivers and other stakeholders, and promoting the further application of inclusive design concepts in playgrounds.

Chapter 3 Theoretical framework

3.1 Evolution and framework of inclusive design

Inclusive design (ID) has evolved as part of society's ongoing search for diversity of user needs and fair design since the late 19th century. Since the late 19th century, inclusive design has evolved from focusing on the special needs of people with disabilities to encompassing a wider range of user groups, involving multi-dimensional differences in physiology, psychology and culture. During this process, design concepts and practices have also undergone important transformations and developments.

3.1.1 Origins and key milestones of inclusive design

The origins and key milestones of inclusive design can be traced back to the late 19th century, where its early practices closely paralleled disability design (see Figure 3.1). In 1794, George Hepplewhite designed the 'Gouty stool', one of the early attempts at customising furniture for people with disabilities (Kille-Speckter & Nickpour, 2022); in 1885 Andrew Gawley created an arm prosthesis featuring steel hand attachment that further supported assistive devices (Kille-Speckter & Nickpour, 2022); these early design practices laid the groundwork for accessible design (Clarkson & Coleman, 2015).

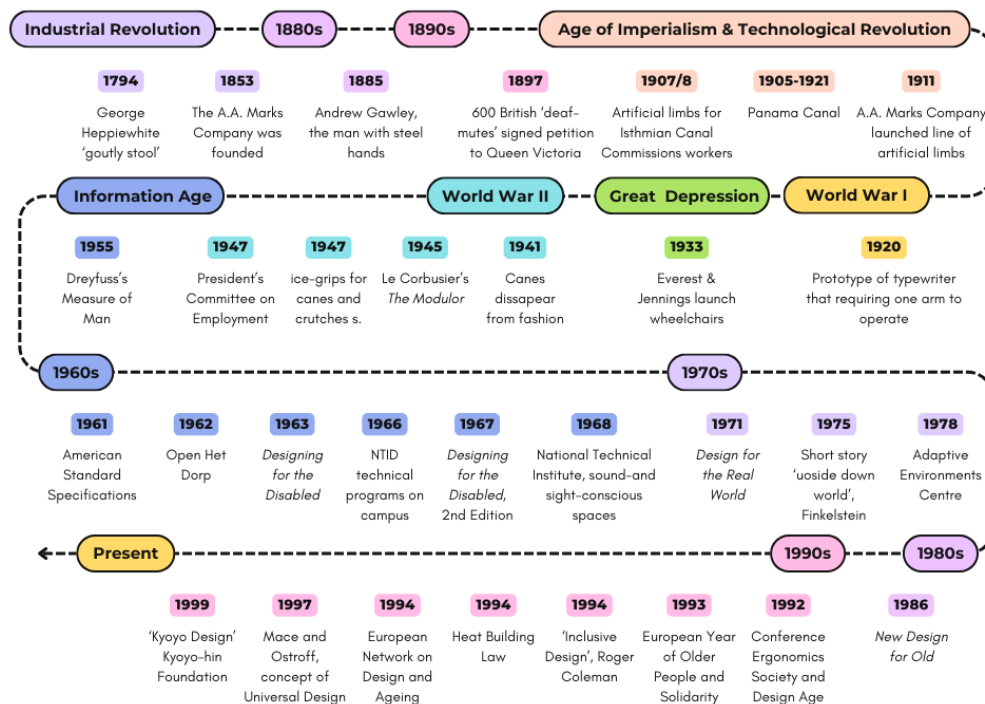


FIG.3.1 A milestone timeline of the evolution of inclusive design

Adapted from Kille-Speckter & Nickpour, 2022

With the progression of industrialisation and a growing social consciousness, the rights and needs of disabled groups began entering the public discourse. In 1897, a petition by deaf-mutes to Queen Victoria in the UK marked a key moment in demanding equal rights for people with disabilities (Kille-Speckter & Nickpour, 2022). This was followed in 1907 by the Irish Canal Commission's development of artificial limbs for workers, representing the expansion of barrier-free design into occupational applications.

The aftermaths of the First and Second World Wars further accelerated developments in assistive design. As the number of disabled veterans increased, society's attention shifted towards improving prosthetic technology and promoting accessibility. In 1911, A.A. Marks introduced a more advanced generation of artificial limbs, energising the evolution of functional and mass-manufacturable assistive products (Kille-Speckter & Nickpour, 2022).

The 1960s marked a turning point as the disability rights movement gained momentum, catalysing a paradigm shift from the ‘medical model’ to the ‘social model of disability’. This transformation emphasised the role of environmental and social barriers in creating exclusion, thereby framing design as a proactive tool for inclusion. The publication of *Designing for the Disabled* by Selwyn Goldsmith in 1963 exemplified this shift by expanding the design focus beyond physical access to social equity (Clarkson et al., 2003).

In 1984, Richard Hatch formally introduced the concept of ‘inclusive design’, emphasising everyday barriers experienced by disabled individuals. This early phase, later referred to as ‘Inclusive Design 1.0’, concentrated on physical elements such as ramps and handrails that facilitated access (Dong, 2020).

In the 1990s, Roger Coleman significantly advanced the discourse by offering a clear definition of inclusive design. He stressed that design should encompass users with diverse abilities, backgrounds, and needs (Coleman, 1994). This broadened the scope of inclusive design and sparked extensive academic and professional engagement.

Entering the 21st century, inclusive design has gradually become institutionalised and globally promoted. In 2003, John Clarkson and colleagues published *Inclusive Design: Design for the Whole Population*, which played a pivotal role in formalising inclusive design as a systematic approach (Clarkson & Coleman, 2015). Meanwhile, companies such as Microsoft extended the concept into digital products and services, stressing that inclusive design must respond to the full spectrum of human diversity. This transition—from ‘designing for minorities’ to ‘designing for the full population’—signifies that inclusive design now stands at the core of contemporary design thinking (Vinney, 2021).

By reviewing these historical developments, it becomes evident that inclusive design is not merely a technical pursuit but a sustained response to evolving societal values around fairness, diversity, and participation. The following section will explore the core principles of inclusive design and how they are translated into real-world design practices.

3.1.2 Concept and principles of inclusive design

Inclusive design is a key principle in global design practice and an essential strategy for meeting user needs from different groups. Its purpose is to maximize the inclusion of different people's needs through design, ensuring that products, services and environments are suitable for as wide a range of user groups as possible (Wu et al., 2024). Unlike other design approaches, design not only emphasizes accessibility, but also reduces exclusion through design, especially focusing on marginalized groups neglected in traditional design.

Different institutions and scholars have slightly different definitions and understandings of inclusive design:

- ⑩ **Microsoft** regards inclusive design as 'a methodology that enables and draws on the full range of human diversity.' (Vinney, 2021; Bigge, 2024). This definition emphasizes responding to user diversity through design so that the design can better meet the needs of different users.
- ⑩ The **Ontario College of Art & Design University (OCAD)** in Toronto proposes that inclusive design should 'consider the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference' (Inclusive Design Research Centre, n.d.), emphasizes that design should cover the vast differences of users.
- ⑩ The **UK government** believes that inclusive design is a strategic approach to 'products, services and environments that include the needs of the widest number of consumers' (Department of Trade and Industry, 2000). This definition combines the goals of social equality and innovation, emphasizing the importance of inclusive design in the business and innovation sectors.
- ⑩ The **British Standard on Managing Inclusive Design** provides the most widely circulated definition of inclusive design in 2005. They defined inclusive design as 'the design of mainstream products and/or services that are accessible to, and usable by, as

many people as reasonably possible...without the need for special adaptation or specialized design' (Keates, 2005).

Different institutions and scholars have slightly different definitions of inclusive design, but the core concept is the same, all emphasizing diversity and non-exclusion. The core concept of inclusive design is not only about adaptability at the functional level, but also about inclusiveness at the emotional, social and cultural levels. These concepts include the following points:

- ⑩ **Diversity and difference:** inclusive design recognizes and respects the diversity of users. Design should not only focus on physiological differences, such as age and physical capability. However, it should also consider differences on multiple levels, such as psychological, cultural, language, and socio-economic backgrounds, to avoid designing to serve only 'normal' users (Holmes, 2018).
- ⑩ **Human-centred:** Design must focus on users' behavioural, emotional and psychological needs. Through warm and friendly design elements and intuitive and easy-to-understand interfaces, design can help users become better integrated and enhance their engagement (Vinney, 2021).
- ⑩ **Flexibility and universal applicability:** Inclusive design seeks to provide flexible design solutions that adapt to meet the diverse needs of users, so they may easily use products and services according to their individual requirements (Wu et al., 2024).
- ⑩ **Social equity:** Inclusive design promotes social equity by decreasing exclusion. As such, it fosters understanding and mutual respect between groups with differing backgrounds (Holmes 2018). Designers should aim to reduce inequality caused by design during the design process as part of an initiative promoting inclusion.

Once we understand the fundamental concepts of inclusive design, the next step should be clear: How can these principles be implemented in actual design? Inclusive design emphasizes diversity and non-exclusivity, but exclusionary habits often become the largest hurdle towards

realizing this objective. In the next section, we will further examine this relationship by investigating design habits strategies and ways of countering exclusion design strategies.

3.1.3 Transition and Challenges in Inclusive Design

Inclusive design has transformed from specifically targeting minorities to accommodating an encompassing population. Countering design exclusion has gradually become one of the central issues in inclusive design as designers recognise its negative effects, such as reduced participation or worsening social inequality; hence, addressing it has become a cornerstone of inclusive design.

Exclusionary design in traditional design usually stems from the assumption of the ‘normal user’. This assumption focuses on non-disabled adults and ignores the special needs of groups such as children, older people, and people with disabilities (Kille-Speckter & Nickpour, 2022). This assumption only compounded their exclusion both functionally and psychologically, making it harder for them to use products or public spaces, further marginalises them in society. Design habits lead designers to fall back on established paradigms while disregarding users’ needs. Countering design exclusion is one strategy used to combat design habits; it aims to challenge traditional paradigms by breaking them.

By combining ergonomics, demographic data, simulations, and user research, designers can better understand the impact of different abilities on the usability of products and spaces, thereby identifying design opportunities to reduce exclusion (Clarkson et al., 2003). Not only will these approaches enable designers to meet diverse user needs more easily, but they will also encourage reflection on how complex social problems have influenced thinking formation - inclusion is evidence that design has failed in adapting itself adequately, and this, in turn, prompts us to re-examine designers’ ethical and social responsibilities more closely.

Countering design exclusion does not involve simply providing additional design solutions for marginalized groups; instead, it means reconsidering the design process and methodology in order to create an approach that is accessible to all. By identifying potential mechanisms of

exclusion in design habits, designers can take steps early in the design process to avoid seemingly minor but far-reaching exclusions (Holmes, 2018). For example, when designing entrances to public spaces, design habits may default to designing narrow passageways, ignoring the needs of people with mobility impairments; in user interface design, design habits may lead to overly complex designs, ignoring the needs of users with low cognitive loads (Buchanan, 1992).

The existence of design habits forces designers to reconsider any implicit biases they might harbour when making design choices, not only regarding technology or function selection but also regarding attitudes and understanding towards diverse user groups. By breaking design habits, designers can reposition their roles, becoming promoters of social equity and inclusion, not just being executors of technical solutions.

Inclusive design requires designers to constantly challenge existing assumptions, especially regarding which users the design should serve and how to respond to their diverse needs (Vinney, 2021). Design habits may cause designers to ignore groups not considered by traditional design specifications when facing social changes. For example, the design habits of public playgrounds often only focus on children's entertainment needs, while ignoring the experience and interaction needs of caregivers and other related groups. These habits not only exacerbate exclusion at its functional level but further marginalize these groups both functionally and psychologically marginalise these groups at both functional levels as well.

After understanding the connection between design habits and the rejection of designs, designers should adopt more comprehensive user research methods to pursue inclusive designs. What follows is an exploration of how to further promote the development of inclusive design through design strategies driven by diverse needs.

3.1.4 Diversity-driven inclusive design

The core challenge of inclusive design is how to integrate effectively diverse user needs into design practice. The traditional 'people-oriented' design model often focuses on meeting the

majority of users' needs, while ignoring the special needs of minority groups. However, with the further development of inclusive design, designers have gradually realised that a single design model cannot reflect the complex needs of diverse people in the real world. Therefore, inclusive design driven by diverse needs has gradually become a new design trend.

Inclusive design emphasises that designers should fully understand the diversity and differences of different user groups. Whether the traditional human-centred design paradigm can cover the needs of everyone has become an increasingly prominent issue. Designers usually design based on the '80/20 rule' (Box & Meyer, 1986). That is, the design should meet the needs of 80 per cent of users. However, this definition of '80 per cent' often ignores the complex needs of marginalised groups. Any individual may become a 'marginalised group' in a specific situation. Therefore, designers must abandon the traditional dichotomy of 'mainstream users' and 'special users' and recognise that the diversity of user needs is universal rather than exceptional.

Margaret Mead, a pioneer in anthropology, revealed through participant observation that users are the real experts (Mead, 1932). Designers should establish connections with users through in-depth observation of user behaviour to better understand their real needs (Mead, 1932). This in-depth understanding of user behaviour can be achieved through 'thick data'. Unlike the quantitative analysis of 'big data', thick data captures the complex contexts and motivations behind user behaviour through qualitative research methods (Geertz, 1973). Thick data not only reveals user behaviour in specific contexts, but also helps designers to identify potential exclusion in design, thus providing a deeper basis for inclusive design.

By analysing thick data, designers can gain an in-depth understanding of user needs and expand them across wider groups by building personas. However, traditional personas tend to simplify users into static groups without accounting for human complexity and diversity. Persona collection addresses complex design challenges more comprehensively by integrating multiple user portraits to systematically capture users' multidimensional needs in different contexts. For example, designing solutions for the visually impaired can serve this group and positively impact older users or those who temporarily face obstacles in specific contexts.

In public playground design, by observing and recording users' daily behaviours, designers can capture and classify the behaviours of children, children with disabilities and their caregivers in the same way as persona collection, gain insights into their diverse needs based on the categorised behaviours, and respond to these needs effectively in design. By meeting individual needs through design, while creating solutions that can serve multiple user groups, the wide applicability and inclusiveness of the design can be enhanced.

Diversity needs-driven inclusive design not only provides designers with new design strategies, but also inspires them to be sensitive to the dynamic needs of users in their designs. By redefining user needs and diversity, inclusive design will continue to drive the realisation of equity and social inclusion in design practice.

3.2 Phenomenology in spatial design

As a philosophical approach to exploring the nature of things through an in-depth understanding of human experience, phenomenology centres on the direct experience and understanding of phenomena (von Eckartsberg, 1998a; Pollio, Henley & Thompson, 1996). The phenomenological approach has been widely used in architectural design as an effective tool for designers to explore the relationship between space and human experience. Architectural phenomenology not only focuses on the physical function and form of buildings, but also emphasises the deep interaction and perceptual experience between architectural spaces and their users.

3.2.1 Architectural phenomenology: theory and practice

Architectural phenomenology is a philosophical approach based on phenomenology, which aims to explore the deep relationship between architecture and people by studying human perception and experience of architectural space (Seamon, 2018; VonderBrink, 2007). The theory not only focuses on the functionality and formal aesthetics of architecture, but also emphasises the interaction between architectural space and the user's perception, experience and emotion (Krell, 1982; Viljoen, 2010; Sadala & Adorno, 2002;). Architectural

phenomenology believes that the meaning of architecture is not only reflected in its physical functionality and aesthetic value, but also in how it can trigger users' identification and resonance with cultural, historical and social contexts through spatial experience.

Architectural phenomenology originated from the phenomenological thought of German philosopher Edmund Husserl, who, in his *Logische Untersuchungen* (1900-1901) advocated the study of the nature of phenomena through the method of 'back to the things themselves' (Pivcevic, 2013; Soltani, & Kirci, 2019; Smith, 2019). The concept of 'intentionality' proposed by Husserl, that is, all consciousness is directed towards a phenomenon, provides a theoretical basis for architectural phenomenology. The meaning of architecture should not only be reflected in its physical structure and function, but also in how individuals give unique meaning to architecture through perception and action (Gaál-Szabó, 2012; Seamon, 2000).

Based on Husserl's theory, Martin Heidegger further proposed the concept of 'dwelling', arguing that architecture is not only a material construct, but also a place of human existence, carrying human life experience and sense of belonging (Wang, 2015). This ontological perspective closely links architecture with human survival, providing a theoretical basis for designers to understand how architecture interacts with people emotionally and materialistically.

Maurice Merleau-Ponty expanded the application of architectural phenomenology through his theory of 'embodiment'. He emphasised that spatial experience is both visual and holistic, achieved through the multi-sensory interaction of the body with the environment. When considering space, designers must pay attention to the movement of the body in space, changes in posture, and the impact of sensory experiences on spatial perception (Poon, 2018; Wang, 2015). This theory offers designers new insight into understanding how spaces affect people across sensory and emotional dimensions.

Christian Norberg-Schulz advanced architectural phenomenology through his concept of 'Genius Loci'. He believed that the significance of architecture lies in the deep connection between the individual and the place through design, and that architecture should be a medium

for carrying history, culture and individual experience (Krell, 1982; Seamon, 2018). This concept reminds designers that when creating architectural spaces, they should pay full attention to the users' emotional experience and cultural identity to stimulate people's sense of belonging and resonance with the place.

3.2.2 Reduction in Husserl's phenomenology

Husserl's phenomenological reduction is the core of his theory, whereby presuppositions, judgements or preconceptions about objects are temporarily set aside through epoché to experience the phenomenon itself directly and purely (Petrović et al., 2018). This process helps individuals transcend subjective biases and external frameworks for experiencing phenomena directly, leading them to gain deeper insights into its nature and development.

The steps of phenomenological reduction include setting aside judgements about the external world, 'bracketing' all preconceptions, and freeing the individual from the preconceptions and prejudices of everyday experience. Secondly, reflecting on conscious activity reveals the basic structure of the individual's interaction with objects. Ultimately, the individual can understand phenomena through phenomenological reduction and dig out the 'pure experience' hidden behind complex phenomena (Dai, 2023).

In space design, phenomenological reduction allows designers to understand user needs. First, designers need to temporarily put aside the presuppositions of the established functionality or formal aesthetics of the space, and return to the user's subjective perception, focusing on how the user perceives the environment through the spatial experience. Secondly, phenomenological reduction can help designers go beyond the single focus on the surface function or visual form of the space, and explore the multi-sensory experience of the user in the space, such as visual, auditory, tactile, etc., to enhance the level of the experience of the space. Finally, phenomenological reduction reveals users' deep needs and emotional responses in any space, providing architects with a new way of designing architectural spaces.

This approach is especially effective for needs analysis in public space design. For example, in the design of public playgrounds, designers can understand the behaviour patterns, needs and perceptions of different user groups through phenomenological reduction. The perceived experience of children in a playground is different from the needs of caregivers, and designers need to put aside the definition of the traditional function of the playground and return to the direct experience of users in the space, to design a space that can meet the needs of different user groups.

3.2.3 Embodiment in Merleau-Ponty's phenomenology

Merleau-Ponty's theory of embodiment extends Husserl's phenomenological framework by considering the body as the core subject of perception. He believed that individuals perceive space through the body's interaction with the world, and that perception is not merely a result of vision or cognition, but a holistic experience composed of the multi-sensory interaction of the body in space (Krell, 1982). From this perspective, the experience of space is dynamic, and designers must pay attention to how the user's body moves, interacts, and perceives space when considering spatial design (VonderBrink, 2007).

The concept of body schema in embodiment theory refers to the ability of an individual to interact with the environment through the body, allowing people to move freely in space (DuFour, 2023). This theory explains how humans adapt to spaces without realising them, such as walking in the dark by touching a wall or adjusting their steps through changes on the ground (Gallagher, 2005). Merleau-Ponty pointed out that users' body movements and postures in a space directly affect the way they understand and use the space (Viljoen, 2010). Therefore, designers can study the body schema of users in space and analyse in depth how users interact with the environment through their bodies, to design a space that is more in line with users' behavioural patterns and ways of perceiving.

The embodiment theory particularly applies to the design of public spaces, such as playgrounds, where children are physically active through facilities such as slides and climbing frames, while caregivers perceive the space through observation and interaction. Therefore, design should

meet both children's activity needs as well as providing a comfortable interaction and observation experience for caregivers through design.

3.2.4 Phenomenology and participatory design

Phenomenology emphasizes an in-depth examination of individual experience and perception, providing the theoretical grounding for participatory design processes. Participatory design focuses on the active participation of users in the design process, while phenomenology helps designers better understand user needs and optimise the design by focusing on users' subjective experience, perception and behaviour (Frauenberger et al., 2010).

Firstly, phenomenology emphasises the importance of the user's direct experience and perception. In participatory design, designers obtain feedback through user interaction, and the phenomenological approach makes this process more in-depth. Through phenomenology, designers can capture the emotional responses, physical interactions and multi-sensory experiences of users in a specific situation, ensuring that design decisions are not only based on rational analysis, but also optimised by the user's actual experience.

Secondly, phenomenology focuses on the contextual nature of user experience, which is highly compatible with the concept of participatory design. Specific environments, cultural contexts and time factors often influence users' needs and behaviours. Phenomenology helps designers understand user needs and the cultural and historical context behind them by deeply analysing these contextual factors.

In addition, phenomenological approaches help to reveal the hidden needs of users. In participatory design, certain user groups (e.g., children, older people, or individuals with special needs) may have difficulty expressing their needs through language or hiding their real needs. Through phenomenological analysis, designers can identify the potential needs of users by observing their behaviours and perception patterns so that the design solution can be more in line with users' actual usage scenarios.

The combination of phenomenology and participatory design not only enhances the depth and flexibility of the design process, but also enables designers to better respond to the complex needs of users. In the design of public space, especially in the design of public playground, this combination is particularly crucial. Through phenomenological and participatory design methods, designers are able to fully understand the behaviour and experience of different user groups in the space, thereby creating more inclusive and diverse design solutions.

3.3 Principles and limitations of participatory design

Participatory design, as a user-centred approach, emphasises the active participation of users in the design process to better understand and respond to their needs (Bødker et al., 2022). However, participatory design also faces many challenges in practice, especially in accurately grasping the complex needs of users. Empathy plays an essential role here - helping designers establish deep connections with users that increase applicability and inclusiveness of design solutions.

3.3.1 Definition and role of empathy in design

The term 'empathy' is derived from the German word '*Empfindung*,' which means understanding another person's internal state by feeling their emotions and experiences (Ho, Ma, & Lee, 2011). Empathy means that designers should try to 'stand in another's shoes' to experience their world to more fully understand the user's needs and emotional state (Heylighen & Dong, 2019).

The role of empathy is not only limited to understanding the user's superficial needs, but also to deeply perceive the user's life experience and emotional motivation through the combination of emotion and cognition. Empathy allows designers to transcend limitations and prejudices in design by delving deeper into users' subjective experiences - thus making the design process more inclusive and humane (French & Teal, 2016). Through empathy, designers can better identify users' pain points and understand the user's behaviour patterns, social needs and cultural background in a given context (Wright & McCarthy, 2008), thus creating experiences in design that are more responsive to users' needs.

Empathy plays a particularly important role in diverse and cross-cultural design. By understanding the user's emotions and life background, designers can develop more inclusive and sensitive design solutions when facing complex social and cultural differences. In this process, empathy is not only a tool for designers to understand users, but also the core driving force throughout the entire design process.

3.3.2 Evolution of participatory design and empathy

The term '*participation*' in Chinese can be interpreted as 'taking part in, intervening in', i.e. the behaviour of an individual who is actively involved in the process of an activity (Zhang, 2010), or it can be understood as 'the involvement of all relevant people in something, including decision-making, planning, implementation, management, testing and evaluation' (Chen, 2003). Participatory design encompasses various techniques that aim to increase public involvement while emphasizing participant empowerment throughout the design process. At its heart, Participatory Design approach's advantage lies in not relying on external forces for design solutions; rather, participants make these decisions themselves and form an equal rights and cooperation-based design model. This design approach prioritises 'participation' over design itself, and empowers participants to change their behaviours and mentalities, thus achieving the process from passive participation to internal identity (Shen et al., 2018).

Participatory design first emerged in Scandinavia in the 1960s. Its background was formed in the social movement of workers fighting for more rights to speak in technology design (French & Teal, 2016). Participatory design during this period emphasised the right of workers to participate in the technical design process, so that design was no longer decided unilaterally by the designer but based on the collaboration and opinions of the users (Wu et al., 2024). This model was an early manifestation of empathy in design, where designers promoted human-centred design practices through user collaboration.

However, in the 1970s, the practice of participatory design was gradually criticised (Wu et al., 2024). Some scholars pointed out that early participation was often formalistic, with user participation more about fulfilling policy requirements than a genuine expression of needs

(Tang, 2018). This formalised ‘pseudo-participation’ (Reich et al., 1996) led to a lack of real emotional connection between designers and users, and the design outcomes were difficult to solve practical problems effectively. In this context, designers gradually realised that it was not enough to let users participate, and that designers must also deeply understand users’ actual experiences and needs. Empathy was gradually introduced in this process and became the core factor in promoting the further development of participatory design.

Since the 1980s, participatory design has expanded to encompass a wider range of areas, such as community building, public space, and product design (Wu et al., 2024; French & Teal, 2016). Designers have begun to pay more attention to users’ cultural backgrounds and life experiences, and endeavour to understand their needs and expectations in specific contexts. Empathy plays a vital role in this process, as designers develop a deep understanding of users through emotional connection, thus creating design solutions that are more relevant to their needs.

3.3.3 Empathy role and limitations in participatory design

Empathy plays an integral part of participatory design, helping designers gain a deep understanding of user emotions and usage scenarios, comprehend their needs more completely and respond in more humane ways (Wright & McCarthy 2008). However, while empathy provides designers with invaluable information regarding users, it has some limitations in the design process itself.

First, although designers’ empathy can help them experience users’ emotions and usage situations, this experience is often one-sided (Barnes & Du Preez, 2015). The complexity and uniqueness of user experience means that even if designers gain certain perceptions through simulation and observation, this experience is still one-sided (Van Dugteren, 2014). Each user has a different background, social status, culture, and physical condition, and even if designers can capture part of the experience through user interviews, role-playing, and situational simulations, they will not be able to encompass all of the emotions and everyday details.

Second, the subjectivity of designers also limits the effective use of empathy (Heyligen & Dong, 2019). Empathy requires designers to transcend their own biases, but designers' life experiences, cultural backgrounds, and values may affect their understanding of user needs, which in turn brings about potential biases. To a certain extent, this subjectivity may cause designers to misunderstand user needs, resulting in design solutions that cannot truly solve users' problems. Furthermore, power inequality between designers and users often inhibits effective empathy - with designers typically possessing greater expertise and decision-making power while their voices may go unheard or ignored or marginalised altogether.

To combat these limitations, designers need to adopt a multidimensional approach to user research to more fully understand user needs. For example, through various approaches such as user interviews, scenario simulations and observational studies, designers can understand users' actual needs and emotional states to a greater extent (Devecchi & Guerrini, 2017; Björling & Rose, 2019). In addition, designers need to constantly reflect on their biases and limitations and work from the user's perspective to avoid design bias due to subjectivity (Lee, 2008).

Empathy in participatory design is an evolving capability that requires designers to remain sensitive and open-minded throughout the design process and truly listen to users' voices. Although there are many challenges in practice, through continuous research and improvement, empathy can help designers overcome limitations in design and create design solutions that are closer to user needs and promote social equity and inclusiveness.

3.3.4 Martin Buber's philosophy from 'us and them' to 'I-Thou'

In participatory design, the relationship between designers and users often manifests itself as a binary opposition model of 'us and them' (Ehrlich & Ornstein, 2010). This divides designers and users into separate groups; leading designers to often overlook users' real needs when making design decisions; with designers acting more like information gatherers than decision-makers while treating users like objects for design decisions - often leading to exclusionary designs.

The philosophy of 'I-Thou' proposed by Martin Buber in his book *Inch und Du* (1921) provides a more humane model of the relationship between designers and users. The 'I-Thou' relationship emphasises openness, sincerity and mutual respect between individuals, transcending purely instrumental and utilitarian interactions (Cipolla, 2009). Designers should approach users as individuals with individual personalities and intrinsic values who require deep understanding through equal dialogue and interaction with them.

In the traditional 'us and them' relationship, designers often regard users as passive research objects, and this attitude can easily lead to misunderstanding of user needs in complex design contexts. For example, in a cross-cultural design context, due to the differences in culture and social status between designers and users, it is difficult for designers to accurately understand user needs, which not only affects the applicability of the design, but may also exacerbate social inequality (Van Dugteren, 2014). In contrast, Buber's 'I-Thou' relationship emphasises that designers should establish relationships with users based on equality and mutual trust, and treat users as partners in design rather than objects. This relationship can encourage designers to put aside preconceived ideas and truly understand their needs and expectations from the user's perspective.

In design practice, Buber's 'I-Thou' philosophy provides designers with new perspectives to help them better understand the complex needs of users. Firstly, designers should go beyond a simple focus on functional needs to understand the context of users' lives, socio-cultural and emotional needs through in-depth dialogue and interaction (Norman, 2013). Secondly, designers need to view users as co-creators of the design rather than simply demand providers, which means that users should have a voice in the design process and substantially influence the design through their interactions (Sanders & Stappers, 2008). Through this egalitarian interaction, designers can better capture users' underlying needs and ensure that the design solution not only meets their functional requirements, but also responds to their emotional and social needs.

Although Buber's 'I-Thou' philosophy provides profound theoretical guidance for designers to understand users, it also faces many challenges in practical application. First, the power

imbalance between designers and users is often difficult to eliminate, with designers having more design resources and decision-making power, while users' voices may be ignored due to a lack of expertise (Kensing & Blomberg, 1998). Second, commercial design environments often pose time and resource restrictions that impede designers from forging deep relationships with users to obtain a comprehensive understanding of their needs. In addition, cultural and language differences may deepen the gap between designers and users, especially in a global design environment, where designers and users come from different cultural backgrounds, and the difficulty of understanding and communication is further increased.

In conclusion, Buber's 'I-Thou' philosophy provides a new theoretical framework and practical guidance for the designer-user relationship in participatory design. By considering users as co-creators of designs, designers can introduce multi-user perspectives, understand users more thoroughly, go beyond simple functional considerations and produce more humane and inclusive designs solutions. However, to truly realise this relationship in actual design, designers need to constantly reflect and improve on their design methods and attitudes to overcome power inequalities and resource constraints in design practice and achieve equality and co-creation in design.

3.4 Theoretical and methodological framework for user needs research

As a special public space, the design of public playgrounds should not only meet the needs of direct users such as children and their parents, but also consider the preferences and needs of indirect stakeholders such as managers and community members. Therefore, this study adopts a human-centred design method to analyse the behavioural patterns of different stakeholders in public playgrounds and reveal their diversity and inclusive needs in playground design.

3.4.1 Evolution and classification of human-centred design methods

The Human-Centred Design (HCD) approach has evolved from a purely functional focus on human-computer interaction to a broader socially inclusive design (see Figure 3.2). Auernhammer et al. (2022) proposed that the evolution of human-centred design can be

divided into four categories: (1) design experimental psychology, (2) medicine and rehabilitation in design, (3) communal practices in design, and (4) social psychology in design. The evolution of each type of method represents the transformation of design thinking from functionality to sociality and from individuality to publicness. These transformations reflect the diverse attempts and profound changes in design when facing complex social problems.

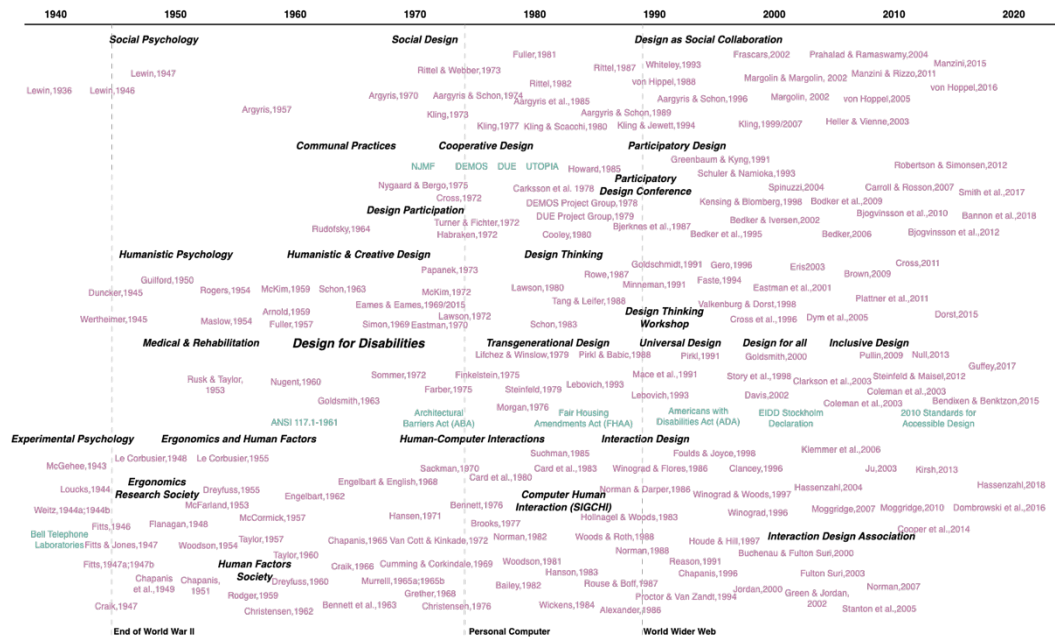


FIG.3.2 Several diverse evolutions of human-centred design

Adapted from Auernhammer et al., 2022

- ⑩ **Design experimental psychology:** This category has shifted from traditional approaches to ensuring that people adapt to the use of technology to designing technology systems that better meet human needs (Auernhammer et al., 2022).
- ⑩ **Medicine and rehabilitation in design:** It focuses on developments in medicine and rehabilitation, working to meet the needs of people with different needs (Rusk & Taylor, 1953).
- ⑩ **Communal practices in design:** It emphasises collective participation and democratisation in the design process to obtain design inspiration (Rudofsky, 1964).

- ⑩ **Social psychology in design:** This category uses social practice to address social tensions that arise in the interaction between humans and artificial, cultural, and natural environments (Lewin, 1946, 1947).

The various human-centred design approaches have different characteristics in terms of their application scenarios and practices. Table 3.1 describes these four types of design approaches in detail.

TABLE 3.1 Four categories of human-centred design approaches

A. Design experimental psychology	
A1. Ergonomics and human factors	Aims to improve the efficiency, safety and comfort of the system through design, involving multidisciplinary research such as physiological and cognitive abilities (Bennett et al., 1963; Van Cott & Kinkade, 1972).
A2. Human-computer interaction	The focus of research has shifted from analogue systems to interactive digital systems to enhance human cognitive abilities and complex problem-solving through technology (Engelbart, 1962; Card et al., 1983).
A3. Interaction design	Emphasis on the interactive experience of people and technology systems, focusing on user behaviour patterns and incorporating emotional and experiential design (Buchenau & Fulton Suri, 2000).
B. Medicine and rehabilitation in design	
B1. Design for people with disabilities	They are redesigning accessibility for people with different types of disabilities (Goldsmith. 1963; Steinfeld, 1979). Design approaches in this field cover all aspects, from physical to sensory barriers and seek to enhance the universal applicability of design.
B2. Transgenerational design	Consider the needs of various age groups, such as children and the elderly. This approach emphasizes that design should address a broad spectrum of users without creating disadvantages for specific groups (Pirkl & Babic, 1988).
B3. Universal design	Advocate for the consideration of all people's needs in design and the reduction of disparities in use and discrimination has become a guiding principle in the design community (Mace et al., 1991).
B4. Design for all	Promote the design concept of human diversity and equality, with particular emphasis on incorporating the needs of all individuals in society during the design process (Bendixen & Benktzon, 2015).
B5. Inclusive design	Focus on designing solutions for individuals with diverse needs, emphasising the use of design to improve everyone's equal experience. It not only focuses on disabled people, but also on the needs of different groups, such as the elderly and children (Clarkson et al., 2003; Coleman et al., 2007).
C. Social psychology in design	
C1. Social design	Explores the conflicts between individuals and designed organisational systems, especially in architecture and urban planning (Argyris, 1957; Rittel & Webber, 1973). It emphasises the use of design to address social tensions and multicultural contexts.

C2. Design as social collaboration	Considers design as a social practice that is co-created by multiple subjects. It emphasises innovation through open, shared approaches to social and political change (Von Hippel, 1988; Heller & Vienne, 2003).
D. Communal practices in design	
D1. Design participation	The idea was that the practical knowledge of untrained builders and urban dwellers could inspire design. In the 1960s, this approach was developed in the Netherlands as the concept of ‘support and infill’ and introduced at the Design Research Association conference in 1971 (Cross, 1972).
D2. Cooperative design	Emphasises collaboration between designers and non-designers in developing tools and systems in the workplace. It worked with trade unions to influence design practice in the workplace (Ehn & Kyng, 1987). This led to the term ‘human-centred design’ (Cooley, 1980).
D3. Participatory design	It involved non-design professionals in the design process through collaborative and democratised approaches. The international participatory design research community established this approach at the first participatory design conference in 1990 (Robertson & Simonsen, 2012).

By reviewing the development of human-centred design methods, it can be seen that design has transitioned away from prioritizing individual needs toward practices which prioritize social equity and inclusiveness. Designers should adapt these design methods according to different situations or target populations to best serve users from diverse user groups.

3.4.2 Limitations and critiques of human-centred design

While human-centred design has significantly enhanced user experience and social inclusion, its limitations must not be ignored.

First, there is an ‘*information gap*’ between designers and users. Designers’ life experiences and professional knowledge may differ drastically from users, especially when designing for different cultural backgrounds and social groups, thus rendering it difficult for designers to truly represent users when making design decisions. This gap often results in unmet user needs (Rapoport, 1970; Derrick Sewell, 1971).

Second, designers’ subjective biases can also have a detrimental effect on the design process. Designers inevitably bring their personal values and cultural backgrounds into design discussions, which impacts how they interpret user needs. Unfortunately, this subjectivity may

cause certain user voices—particularly those from disadvantaged or marginalised groups—to be ignored or underrepresented (Porteous, 1971).

To cope with these issues, designers need to adopt more diverse user research methods, especially those that provide a deeper understanding of users' subjective experiences—such as phenomenological research—to help overcome both the information gap and subjective bias. This would allow for a more comprehensive understanding of users' diverse and context-dependent needs.

3.4.3 Application of phenomenological methods in user needs research

Phenomenology is a research method that reveals the essence of human subjective experience and behavioural patterns through in-depth investigation. The application of phenomenology in user needs research can help designers better understand the diverse needs of users and reveal hidden needs that are often overlooked in design.

Phenomenology comprises three main methods:

- ⑩ **First-person phenomenological research:** This method involves reflecting upon phenomena through one's subjective experience (Chaffin, 1989). This allows researchers to gain a greater awareness of biases they might possess while providing a reference for understanding user experience.
- ⑩ **Existential-phenomenological research:** A systematic research process that extracts common patterns from the descriptive experiences of respondents. The research steps include identifying the phenomenon of interest, collecting descriptive experiences, analysing the narratives, looking for commonalities, and presenting the findings to the respondents and other researchers (Von Eckartsberg, 1998b).
- ⑩ **Hermeneutic-phenomenological research:** It focuses on the relationship between human beings and the physical environment, and understands the deeper meanings of the interaction between human beings and the environment through the in-depth analysis of

human experience (Seamon, 2000). This method has great application value in environmental behaviour research by helping designers capture and comprehend motivations behind user behaviour in complex social contexts.

Phenomenological methods allow designers to capture the multisensory experiences of users within specific contexts, and to understand their embodied interaction with space. This approach is especially important in the design of public spaces and socially embedded products. By returning to the direct experience of users, phenomenology supports the creation of more inclusive, empathetic, and socially responsive environments.

3.4.4 ‘R-I-N-G’ framework for user needs research

Based on the previous theoretical analysis, this study proposes two complementary strategies for achieving inclusive goals by countering exclusionary design habits: understanding diverse needs through phenomenological research, and addressing the roles and needs of diverse stakeholders through participatory design (see Figure 3.3). These strategies work together to advance inclusive design.

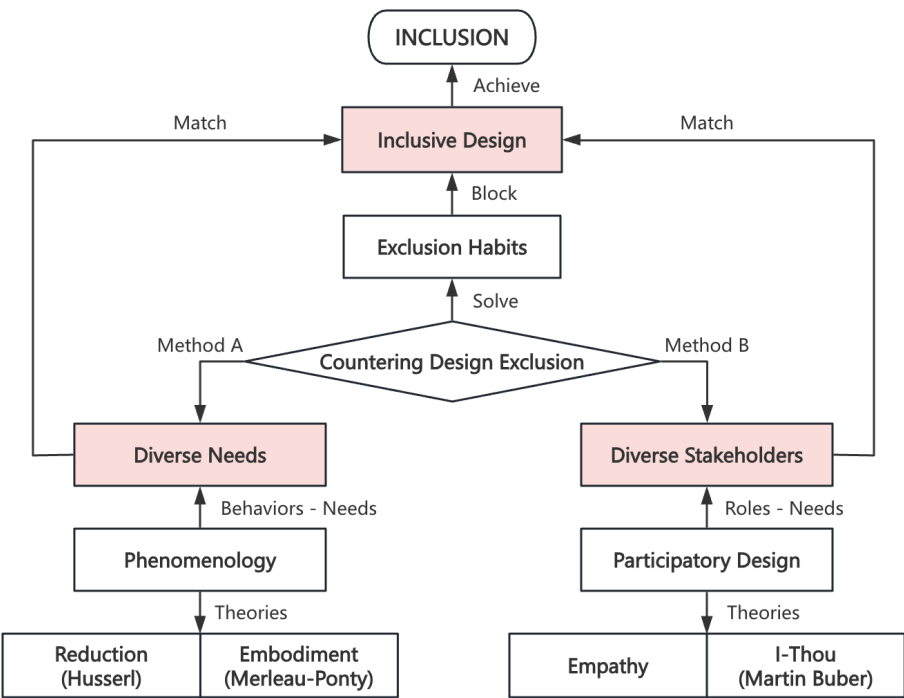


FIG.3.3 Two strategies to achieve inclusive goals

Under this conceptual framework, the study adopts an observation-based method, supplemented by surveys and interviews, to analyse users' everyday behaviours in public playgrounds. This aims to explore their needs, preferences, and behavioural patterns in relation to the built environment. Compared with subjective methods such as questionnaires and interviews, behavioural observation more accurately reflects people's actual usage patterns (Lawson, 2005). Environmental behaviour research identifies variations across social groups, provides empirical data for design interventions, and helps designers balance competing spatial needs (Hofmann et al., 2012). The data obtained from observation informs evidence-based design decisions and improves the scientific and targeted nature of spatial interventions (Goličnik & Thompson, 2010).

Current international methods for user needs research often lack a coherent and repeatable structure that integrates behaviour analysis across multiple stakeholder types. To address this gap, this study develops the '**R-I-N-G**' framework, a systematic tool for guiding empirical research and stakeholder-centred design in complex public environments (see Figure 3.4). This framework consists of four interrelated steps—**Reviewing**, **Identifying**, **Narrowing**, and **Generating**—designed to help designers progressively explore, analyse, and translate user behaviours and needs into actionable design strategies.

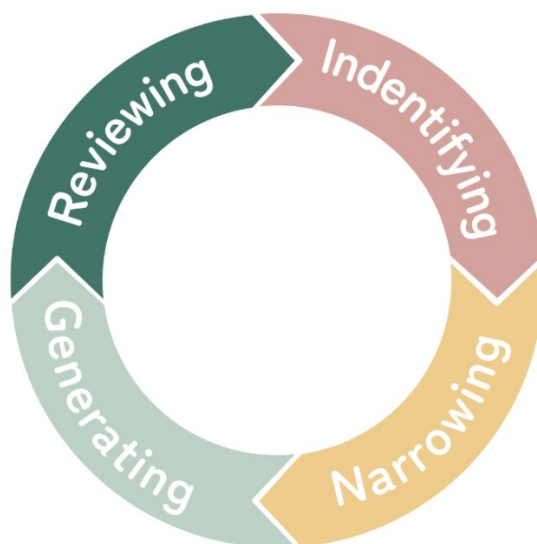


FIG.3.4 'R-I-N-G' user needs research framework

- ⑩ **Reviewing:** Identify all potential stakeholders—both direct and indirect users—in the target space. This helps define the research scope and lays the foundation for behavioural data collection and user segmentation.
- ⑩ **Identifying:** Observe and analyse physical and social behavioural patterns across different user groups. This step reveals how stakeholders interact with space and highlights design opportunities and constraints.
- ⑩ **Narrowing:** Cluster the identified behaviours and focus on those representing marginalised or underserved users. This step uncovers design exclusion risks and clarifies priority needs requiring targeted responses.
- ⑩ **Generating:** Develop differentiated and evidence-based design strategies rooted in the behavioural and perceptual insights from the earlier stages. This ensures design responses accommodate multiple user types while reducing design bias and habitual exclusion.

The **‘R-I-N-G’ framework** serves not only as a design process guide but also represents our pursuit of diversity and inclusion through design. Its emphasis on the rigorous collection and analysis of behavioural data distinguishes it from general inclusive design frameworks, making it particularly suitable for comprehensively capturing complex user interactions and stakeholder dynamics within public playground contexts. An optimized and systematic design process gives designers tools for making more thoughtful design decisions when faced with complex user needs, ultimately creating truly inclusive public spaces.

3.5 Conclusion

This chapter comprehensively analyses the theoretical development, core concepts, and challenges associated with inclusive design. Tracing its evolution from its origins in disability-focused practices in the late 19th century to its current emphasis on socially inclusive design for wider user groups, it highlights how inclusive design has developed not only through technological advances but as a sustained response to the values of fairness, diversity, and social inclusion.

Inclusive design has transitioned from a narrow focus on physical accessibility to a broader engagement with emotional and social inclusiveness. Designers have increasingly recognised that addressing only functional limitations is insufficient; inclusive design must also foster dignity and belonging, particularly for marginalised groups often overlooked in conventional practices.

This chapter also introduces phenomenological theories, such as Husserl's phenomenological reduction and Merleau-Ponty's theory of embodiment, which emphasise the user's direct perception and multi-sensory interaction with space. These theories encourage designers to look beyond formal and functional dimensions and focus on the emotional and bodily experiences of users, deepening the understanding of how space is inhabited and given meaning.

In parallel, participatory design is presented as a practical strategy to reduce design exclusion by involving users as active contributors to the design process. This method enhances inclusiveness by allowing users to co-create design outcomes. Furthermore, Martin Buber's 'I-Thou' philosophy supports a more ethical relationship between designers and users—encouraging equal, sincere, and dialogic interaction instead of the hierarchical 'us and them' model. This ethical stance fosters empathy, leading to more responsive and humane design outcomes.

To operationalise these principles in practice, this chapter proposes the 'R-I-N-G' user needs research framework, which consists of four iterative steps—Reviewing, Identifying, Narrowing, and Generating. This framework provides a systematic and evidence-based method for analysing behavioural data, especially in complex settings such as public playgrounds. It enables designers to address the diverse and often competing needs of stakeholders and to avoid exclusionary outcomes caused by habitual or biased design approaches (Lawson, 2005; Goličnik & Thompson, 2010).

In summary, this chapter synthesises diverse theoretical and methodological resources—from the history and principles of inclusive design to the application of phenomenology and

participatory ethics—to lay the groundwork for inclusive, equitable, and empirically grounded design practices. It calls on designers to critically reflect on their assumptions and methods, and to engage deeply with the real and diverse needs of users. The following chapters will apply the ‘R-I-N-G’ framework to analyse behavioural patterns and stakeholder needs in Hong Kong’s public playgrounds, offering both theoretical insight and practical strategies for inclusive design in urban contexts.

Chapter 4 Methodology

4.1 Research design

It is important to choose an appropriate research method in research. The research method not only determine how effectively data will be collected and analyses, but also it has a profound effect on its credibility and practical applicability value of research findings. This chapter will detail the research methods utilised in this study, from research design to implementation steps, to systematically reveal behaviour and needs patterns of different stakeholders in inclusive playgrounds.

This research adopts a triangulated, multi-method approach based on the R-I-N-G user needs research framework, aiming to address methodological gaps in current international playground studies that often lack comprehensive stakeholder analysis.

4.1.1 Qualitative research paradigm

The choice of research design must maintain a balance between the research purpose and the method to ensure the validity and reliability of the research (Cook et al., 1979). This study aims to explore how to design an inclusive playground that meets the needs of children and other urban users, focusing on understanding the behaviours, interaction patterns and actual needs of various stakeholders in this space. Accordingly, a qualitative research paradigm is adopted, as it allows deep engagement with participants lived experiences in natural contexts—something conventional quantitative approaches in international playground studies often fail to capture.

Qualitative research can explore human behaviour and social interactions in a natural context. Its methodology emphasises that researchers capture the motivations and meanings behind the behaviour of research subjects through daily interactions with them (Marshall & Rossman, 2014). Quantitative research can often appear ‘lifeless’ when exploring human behaviour’s

social context and psychological motivations, lacking an in-depth understanding of dynamic social relationships or subjective experiences (Chaturvedi, 2019). In contrast to the instrumentally driven, child-centric focus of many Western inclusive design studies, quantitative approaches often fall short in representing the subjective and inter-relational experiences of multiple user groups, especially caregivers and support staff in public spaces. Another important advantage of qualitative research is its in-depth understanding of individual behaviour and emotions, especially when exploring behaviours involving complex social relationships and cultural backgrounds (Heylighen & Dong, 2019). Compared to the numerical analysis of quantitative research, qualitative research can more delicately portray the contextuality and complexity of individual behaviour in a specific situation (Firestone, 1987; Guba & Lincoln, 1988; McCracken, 1988; Creswell, 2000). Through participate in research process, designers can identify and understand the experiences and social motivations of various stakeholders in playgrounds, enabling designers to gain invaluable insights, optimize design strategies, and make the design process more inclusive and humane.

Therefore, the qualitative paradigm is not only appropriate but essential to this study's aim of expanding the inclusivity lens to overlooked stakeholder groups. By embedding inquiry within their everyday contexts, this approach provides the depth needed to understand inclusive playgrounds as dynamic, co-constructed public spaces.

4.1.2 Case study strategy

Based on the qualitative research paradigm, this study further selected a case study strategy to conduct an in-depth analysis in combination with specific situations. Putt and Springer (1989) pointed out that urban research usually covers three purposes: exploration, description, and explanation. As this research intends to investigate usage patterns and behavioural logic of stakeholders using inclusive public playgrounds through multi-perspective analysis; case studies provide an effective means for accomplishing its goals.

Case study is a research methodology that enables an in-depth analysis of the behavioural patterns of a particular individual, group or community in a specific context (Merriam-Webster,

2022). Yin (2009) argues that the case study strategy is particularly appropriate when the object of study involves a complex social phenomenon and requires multi-dimensional data collection under specific spatiotemporal conditions. Flyvbjerg (2011) further pointed out that case studies are more suitable for in-depth exploration of complex social phenomena, especially when examining the dynamic relationship between the case and its environment; they can provide more insightful analysis. This method is flexible, allowing for a combination of diverse research perspectives, data collection tools, and interpretive techniques (Marshall & Rossman, 2014), and allows researchers to employ a variety of methods (including means of generating quantitative data) for data collection (Stake, 2005).

The advantage of case studies is their flexibility and ability to integrate multiple methods, which can help researchers fully understand complex social interactions and behavioural logic (Merriam, 1988; Andranovich & Riposa, 1993). When applied to playground design elements for inclusion design purposes, case studies provide insights into stakeholder experiences by describing behavioural responses in specific situations. Researchers can observe behaviours from various groups within a venue to assess effectiveness or shortcomings of current designs in meeting users' needs as well as providing suggestions for design.

Based on the list of inclusive playgrounds provided by the Leisure and Cultural Services Department (LCSD) of Hong Kong in the case selection process, and considering the data from the preliminary research, this study has selected three typical inclusive playgrounds in Kowloon, the New Territories and the Hong Kong Island as the case studies, to ensure that the selected cases are representative and scientific. By conducting in-depth research on these specific cases, researchers can gain insight into behavioural patterns and spatial usage characteristics of different playground stakeholders - providing an empirical basis for inclusive design strategies.

The application of case study strategy not only supports the in-depth exploration of inclusive public playgrounds, but also provides designers with a specific basis for optimisation strategies through multi-dimensional data collection and analysis.

4.1.3 Research path

Guided by the qualitative research paradigm and a case study strategy, and informed by the R-I-N-G user needs research framework, this study adopts a staged and integrated research path to ensure methodological rigour and thematic coherence (see Figure 4.1). The path consists of four interlinked phases: Initial Investigation, Case Selection & Data Collection, Date Analysis, and Findings & Discussion. Each phase responds to specific questions (sub-RQs) and builds on the outcomes of the previous phase, forming a cumulative and triangulated research process.

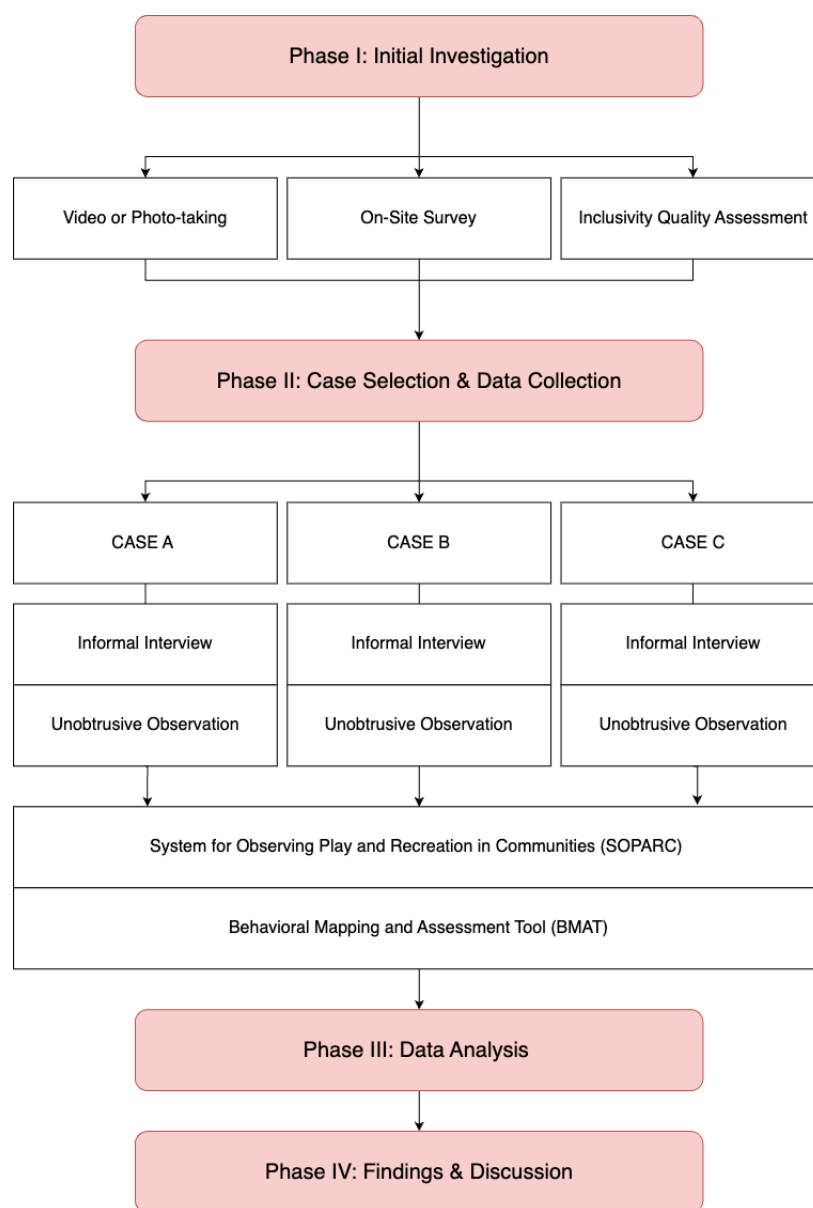


FIG.4.1 Research path

Phase I: Initial investigation

This phase explores whether Hong Kong's current inclusive playgrounds truly fulfil 'child-centred' design goals (sub-RQ1). It employs video/photo documentation, on-site surveys, and an inclusivity quality assessment checklist. The checklist—adapted from both international standards and local regulatory criteria—assesses spatial accessibility, facility diversity, and user adaptability. Visual documentation records spatial configurations and user flows, while structured surveys capture real-time feedback from caregivers and other stakeholders.

This phase corresponds to the 'Reviewing' step in the R-I-N-G framework, mapping stakeholder groups and revealing formal inclusivity gaps.

Phase II: Case Selection and Data Collection

Based on the data collected in Phase I, three representative playgrounds from Kowloon, the New Territories, and Hong Kong Island were chosen as case studies. The selection was guided not only by the inclusivity rating but also by site characteristics, user diversity, and frequency of usage.

This phase addresses research question (including sub-RQ2, sub-RQ3, and sub-RQ4) by employing a two-pronged data collection approach: informal interviews and unobtrusive behavioural observation. First, findings from the on-site survey helped identify a 'core circle' of adult stakeholders who are regularly present in playgrounds (e.g., parents, grandparents, domestic helpers, cleaning and security staff). These stakeholders were subsequently invited to participate in semi-structured informal interviews to articulate their spatial experiences, challenges, and latent needs (sub-RQ2 & sub-RQ3).

Second, systematic observations were conducted across all three case sites using the SOPARC (System for Observing Play and Recreation in Communities) and BMAT (Behavioural Mapping and Assessment Tool) protocols. These observations recorded actual spatial behaviours and interactions of all adult users present on site, providing embodied evidence to verify or contrast with interview narratives (sub-RQ4). This methodological triangulation ensured that subjective

accounts could be corroborated with behavioural realities, and potential dissonances could be critically analysed.

This phase corresponds to the 'Identifying' and partially the 'Narrowing' steps of the R-I-N-G framework, providing both subjective and embodied data for triangulated analysis.

Phase III: Data Analysis

This phase involves systematic processing of the multi-source data collected in the previous stages. Quantitative data from the surveys were analysed to identify general trends and user satisfaction levels. Qualitative interview transcripts were coded thematically to extract recurring needs, design frictions, and spatial tactics employed by adult stakeholders. Observational data, including time-location movement charts and interaction mapping, were used to reveal usage intensity, behavioural clustering, and affordance engagement.

By cross analysing these different datasets, the researcher was able to derive comprehensive insights into how stakeholder needs are both expressed and enacted in playground settings. This process not only helped validate earlier assumptions but also revealed previously overlooked spatial-experiential mismatches.

This aligns with the 'Narrowing' step of R-I-N-G, filtering behavioural patterns into needs clusters that inform inclusive design insights.

Phase IV: Findings and Discussion

In the final phase, the study synthesises findings to draw broader implications for inclusive playground design. By integrating insights from subjective perception (survey and interviews) and objective behaviour (observation), the study formulates evidence-based design principles that respond to both explicit and implicit needs of diverse stakeholders. This discussion serves to bridge the gap between current policy-defined inclusivity standards and the lived spatial experiences of multi-generational users.

Through this progressive and interconnected path, the research gradually shifts from surface-level evaluations of playground infrastructure to deeper investigations of everyday practices and unmet needs. By combining checklist, surveys, interviews, and behaviour mapping, the study ensures both horizontal breadth and vertical depth, allowing for a nuanced understanding of how inclusive playgrounds function beyond their design intentions.

This phase realises the ‘Generating’ step of the R-I-N-G framework, ensuring that inclusive strategies emerge from grounded, context-sensitive evidence.

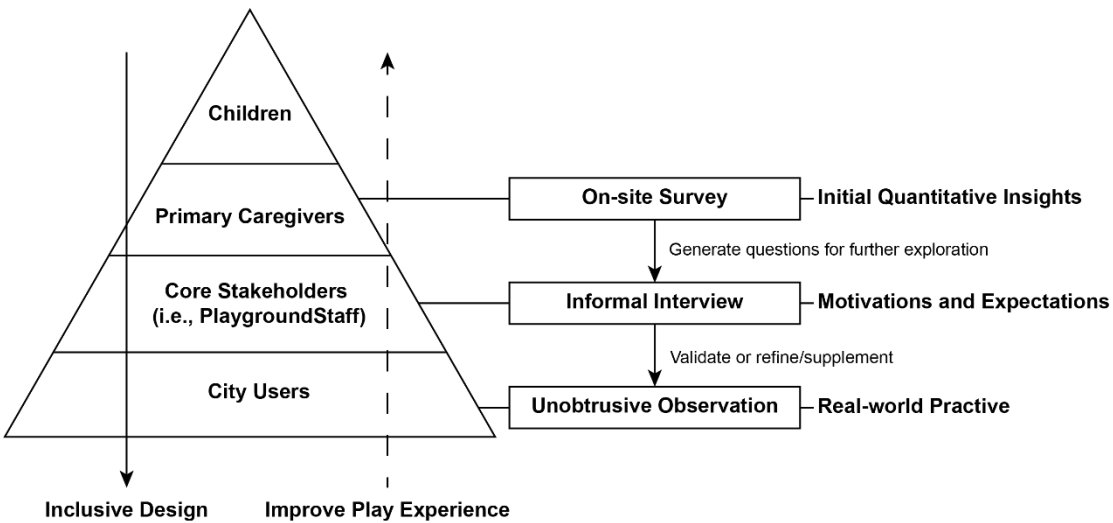


FIG.4.2 Triangulated Methodological Flow of Stakeholder Research

To complement the phased structure, Figure 4.2 visualises the interplay among the three main data sources. Rather than isolated techniques, these methods interact in a logic of progressive deepening—surveys shape interview prompts, interviews surface experiential meanings, and observations validate or refine perceptions through visible behaviours. This multi-layered approach mirrors the iterative structure of the R-I-N-G framework, enhancing both analytical depth and empirical validity.

4.2 Pilot study and case selection

4.2.1 Instrument generation

Building upon the Hong Kong Leisure and Cultural Services Department (LCSD)'s official list of inclusive playgrounds, the research team conducted a pilot study covering 42 playgrounds across all 18 administrative districts of Hong Kong (see Appendix I). The aim was to assess each site's spatial features, design elements, and user behaviours using a combination of video documentation, photography, and field notes. This baseline survey was conducted by two trained researchers to ensure consistency and data reliability.

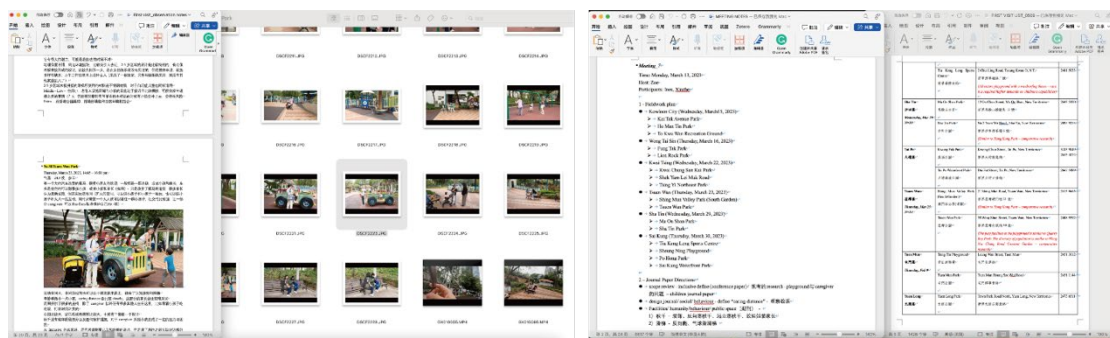


FIG.4.3 Research Field Notes, Visual Records, and Meeting Notes – Case of Tsuen Wan Park

To complement spatial observations with user perspectives, a structured questionnaire was conducted on-site at all 42 playgrounds (see Appendix II). The questionnaire gathered both demographic and attitudinal data from caregivers—including parents, grandparents, domestic helpers, and other accompanying adults. Four thematic modules were designed:

1. **Demographic information:** Capturing basic background details of the respondents, including their relationship with the children, age, and gender.
2. **Opinions on the inclusiveness of playgrounds:** Exploring caregivers' motivations for visiting playgrounds and their perceptions of the intended users of play spaces.
3. **Perceptions of children's needs and preferences:** Eliciting caregivers' insights on children's preferred play types and whether existing facilities meet those needs.

4. **Present behaviours and future expectations:** Delving into caregivers' own playground practices, their willingness to engage in co-play, and gathering user visions for more inclusive design in public playgrounds.

Each questionnaire took approximately 10–30 minutes to complete. Several participants voluntarily offered detailed qualitative feedback, enriching the dataset with deeper experiential insights.

In parallel, a Playground Inclusive Quality Checklist (see Appendix III) was developed to provide a systematic, evidence-based assessment of spatial inclusivity. This checklist was collaboratively formulated by the lead author and two additional researchers, based on findings from the first round of fieldwork and cross-referenced with international best practices, standards, and policy documents related to inclusive design.

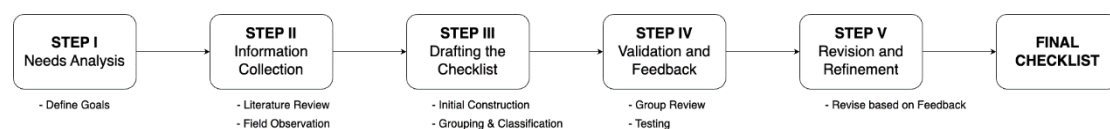


FIG.4.4 Checklist development process

The objective of the checklist was clarified as evaluating the quality of inclusive playgrounds in Hong Kong through on-site observation and experiential assessment. To achieve this, a comprehensive review of existing inclusive design standards, relevant local and international regulations, and best practices was undertaken. Structural analyses of existing checklists were conducted to extract key components and identify areas requiring improvement.

Combined with the initial phase of field research, observations and recordings were made regarding facility types, design elements, and user behaviours across various playgrounds. These empirical observations were further triangulated with preliminary survey results to gather authentic feedback on playground design performance.

Based on these data, a set of initial assessment items was developed—such as ‘barrier-free access’ and ‘diversified play equipment’—each accompanied by specific evaluation criteria. For

clarity and ease of application, the items were categorised into three main domains: ‘accessibility’, ‘safety’, and ‘recreation’. Logical interrelationships between the categories were ensured during the structuring process.

Following the completion of the draft checklist, the instrument was subjected to expert and peer review by the research team and two invited specialists. The review focused on the checklist’s practical utility and comprehensiveness. A small-scale pilot implementation was conducted to document practical challenges encountered during actual use. Based on user feedback, the wording, content, and structure of each item were refined to ensure clarity, readability, and usability.

Finally, the checklist was divided into six categories: (1) access (Wong et al., 2016; Waverley Council, 2020; Ross et al., 2017; Playground Centre, 2023; Yuill et al., 2007), (2) play experience (Aminpour et al., 2020; Caro et al., 2016; Hyndman & Lester, 2015), (3) equipment (Playworld, 2016; Leisure and Cultural Services Department, n.d.), (4) maintenance and safety (Caro et al., 2016; Hyndman & Telford, 2015; Waverley Council, 2020; Ross et al., 2017; Playground Centre, 2023), (5) supportive facility (Government of South Australia, 2022; Waverley Council, 2020), and (6) surroundings/environment (Aminpour et al., 2020; Caro et al., 2016; Hyndman & Lester, 2015; Moore, 1993; Ross et al., 2017; Waverley Council, 2020; Government of South Australia, 2022; Playground Centre, 2023).

This checklist contains 34 sub-items and uses a 0–2 scale for each (0 = not present, 1 = partially met, 2 = fully met), yielding a maximum score of 68. Playgrounds were then classified as: High Inclusivity (51–68), Moderate Inclusivity (34–50), and Low Inclusivity (below 34).

Importantly, all 40 playgrounds included in the study scored within the high inclusivity tier and were officially recognised as inclusive playgrounds under the LCSD’s Design for All Children framework. This policy alignment ensured that each selected site had already addressed the baseline needs of children—including those with physical, sensory, and developmental differences.

This foundational assurance allowed the research to shift its analytical focus beyond the traditional child-centric paradigm. Rather than evaluating whether these playgrounds provide basic child accessibility or developmentally appropriate play, the study critically examines how these same spaces function for non-child users—particularly caregivers and intergenerational companions. The checklist, therefore, serves a dual function: as a validation tool for child-focused inclusivity, and as a methodological platform from which broader questions of spatial equity and inclusive co-use can be investigated.

4.2.2 Selection criteria for playgrounds

To ensure methodological rigour and scoring reliability (Woodward & Franzen, 1948; Krippendorff, 2013), a multi-coder assessment process was employed in evaluating the inclusivity performance of the 40 playgrounds. In addition to the two researchers who conducted the fieldwork, two independent coders assessed each site using video and photographic records. This cross-validation approach enhanced the credibility of the observational scoring.

Observational consistency is a commonly used method of assessing reliability. However, for a long time, researchers have generally assumed that coders can occasionally agree on the presence or absence of themes. Researchers have developed various statistical methods to address this issue and explored the most effective measures under different conditions (Lombard et al., 2010). Themes can be considered as a binary existence (yes/no), a nominal variable with multiple attributes (such as gender, sexual orientation, etc.), an ordinal variable (such as emotional state) or an interval variable (such as age, income). The more variable attributes there are, the more difficult it is for coders to reach an agreement. Therefore, different measures of agreement should take this into account.

Researchers often use Cohen's Kappa (Cohen, 1960) when analysing nominal variables as a statistical indicator. Kappa measures the degree of agreement between a pair of coders on the presence or absence of binary (yes/no) themes in a text relative to a chance agreement. Kappa coefficients range from -1 to 1, with values close to 1 indicating a high degree of consistency,

values close to -1 indicating a high degree of inconsistency, and a coefficient of 0 indicating a degree of consistency indistinguishable from chance. The Kappa test not only helps researchers identify areas of the coding scheme that require further training or clarification, but also enhances the reliability of the coding scheme.

Landis and Koch (1977:165) developed a set of consistency benchmarks based on Kappa's empirical tests with the following recommendations:

- ⑩ ≤ 0.00 : Poor
- ⑩ 0.21-0.40: Slight
- ⑩ 0.41-0.60: Fair
- ⑩ 0.61-0.80: Substantial
- ⑩ 0.81-1.00: Almost perfect

Nowadays, most researchers consider a Kappa value of 0.80 or higher to indicate strong consistency or high reliability, and a Kappa value between 0.70 and 0.79 is considered sufficient, but these criteria are still evolving. In this study, based on the calculations, the final Kappa value of 0.85 indicates near perfection, and therefore the results are reliable.

With this reliability benchmark secured, the study proceeded to identify three representative case sites. These sites were selected based on a multi-dimensional screening process designed to ensure diversity in spatial typologies, social demographics, and urban contexts. The selection criteria comprised the following components:

(1) Evaluation Consistency and Inclusivity Tier

Only sites classified within the high inclusivity category—scoring 51 points or above on the Playground Inclusive Quality Checklist—were considered eligible for inclusion. This strategic decision ensured that each selected site had demonstrably met the institutional design

standards for inclusive child play, as defined under the LCSD’s ‘Design for All Children’ framework.

By limiting selection to high-performing sites, the study purposefully shifted focus away from basic infrastructural inadequacies and towards examining how inclusive design performs in real-life practice—especially for non-child users such as caregivers, older adults, and intergenerational companions. This distinction is methodologically significant: it prevents conflation between child-inclusion and overall inclusiveness, and instead highlights potential design-performance gaps for diverse stakeholder groups.

(2) Socio-Spatial Diversity

Data from the 2021 Hong Kong Population Census (Census and Statistics Department, 2021) were used to ensure variation across key demographic indicators, including:

- ⑩ Median monthly household income
- ⑩ Child population density (age under 12)
- ⑩ Administrative district typology

This socio-demographic triangulation allowed the selection to reflect the heterogeneity of Hong Kong’s urban landscape, accommodating different family structures, income groups, and neighbourhood compositions.

TABLE 4.1 Summary of District-Level Household Income and Child Population

Area	Median Monthly Domestic Household Income	Population	Children (aged under 18)	Usual Residents (1)
	HK\$	Number of Persons	Number of Persons	Number of Persons
Central and Western	45,040	235 953	28 412	232 894
Wan Chai (2)	45,000	166 695	19 821	164 396
Eastern (2)	32,000	529 603	61 681	523 161
Southern	32,440	263 278	32 732	260 353

Yau Tsim Mong	26,080	310 647	41 929	306 683
Sham Shui Po	21,490	431 090	58 626	426 531
Kowloon City	30,010	410 634	59 378	405 490
Wong Tai Sin	23,520	406 802	45 282	402 896
Kwun Tong	22,000	673 166	86 775	666 507
Kwai Tsing	23,740	495 798	61 121	491 275
Tsuen Wan	32,040	320 094	44 783	316 880
Tuen Mun	25,040	506 879	64 661	502 785
Yuen Long	27,560	668 080	92 083	661 721
North	23,580	309 631	41 101	306 115
Tai Po	30,000	316 470	40 494	313 504
Sha Tin	28,870	692 806	93 819	685 643
Sai Kung	37,840	489 037	66 580	483 912
Islands	28,960	185 282	28 285	182 781
Land	27,640	7 411 945	967 563	7 333 527

Note(s):

(1) Usual Residents refer to two categories of people: (1) Hong Kong Permanent Residents who had stayed in Hong Kong for at least 3 months during the 6 months before or for at least 3 months during the 6 months after the reference moment, regardless of whether they were in Hong Kong or not at the reference moment; and (2) Hong Kong Non-permanent Residents who were in Hong Kong at the reference moment.

(2) The boundaries of the Wan Chai district and Eastern district adopted in the 2016 Population By-census and the 2021 Population Census are not comparable with those adopted in the 2011 Population Census. Therefore, figures of the Wan Chai and Eastern districts for 2016 and 2021 are not strictly comparable with those for 2011.

Source: 2021 Population Census Office, Census and Statistics Department, The Government of the Hong Kong Special Administrative Region,
<https://www.censtatd.gov.hk/en/scode600.html>

(3) Spatial and Organisational Typologies

Consideration was given to variation in playground design formats, site management models, equipment configurations, and physical spatial layouts. This ensured analytical value across diverse built environments and enabled comparative behavioural observations.

As a result of applying these criteria, three final sites were selected as case studies for in-depth behavioural mapping: (1) **Kowloon Park Children's Playground** (Kowloon); (2) **Quarry Bay Park Children's Playground** (Hong Kong Island); and (3) **Tuen Mun Park Children's Playground** (New Territories).

These sites not only exemplify inclusive design for children in accordance with official standards, but also provide rich contrasts in terms of geography, facility type, and user

population. They thus offer a robust foundation for evaluating how inclusivity functions for multiple user groups within real-world playground settings.

4.2.3 Overview of selected playgrounds

Case A: Kowloon Park Children's Playground (KLNP), Tsim Sha Tsui, Kowloon

Kowloon Park is located in the bustling commercial district of Tsim Sha Tsui, Kowloon, adjacent to Canton Road, Austin Road, and several shopping malls and hotels (see Figure 4.5). The children's playground is in the northeast corner, close to 'Discovery Playground' and 'Kowloon Park Sports Centre'. It is equipped with barrier-free access and public toilets for easy access.

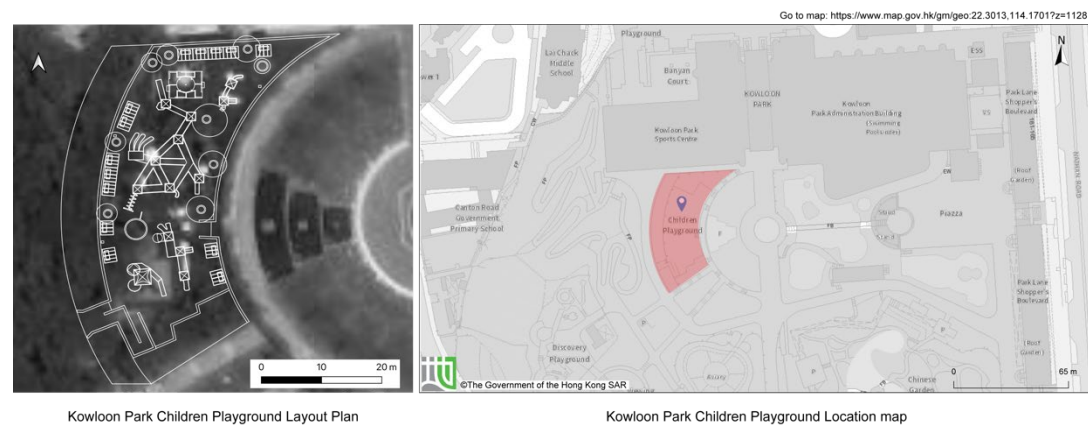


FIG.4.5 Kowloon Park Children Playground layout plan and location map

The playground is paved with non-slip safety mats and has various facilities, including ramps, play panels, rocking boats and barrier-free facilities. The venue is divided into two zones: the children's zone for 2 to 5 years old is equipped with small slides, sway boat and interactive play panels, and the children's area for 5 to 12 years old provides climbing frames and slides to promote the development of children's physical strength, coordination and social skills (see Figure 4.6).



FIG.4.6 Kowloon Park Children Playground play facilities

Case B: Quarry Bay Park Children's Playground (QUBP), Quarry Bay, Island

Quarry Bay Park is located in the Eastern District of Hong Kong, stretching along Victoria Harbour, with a prime location (see Figure 4.7). The children's playground is located on the east side of the park. It is designed for children aged 2 to 12, emphasising barrier-free use to ensure that all children can play together. Play facilities include climbing frames, rocking horses, swings and interactive play panels to meet the needs of children of different ages (see Figure 4.8). The venue is safe and has non-slip safety mats to ensure the safety of children when playing.

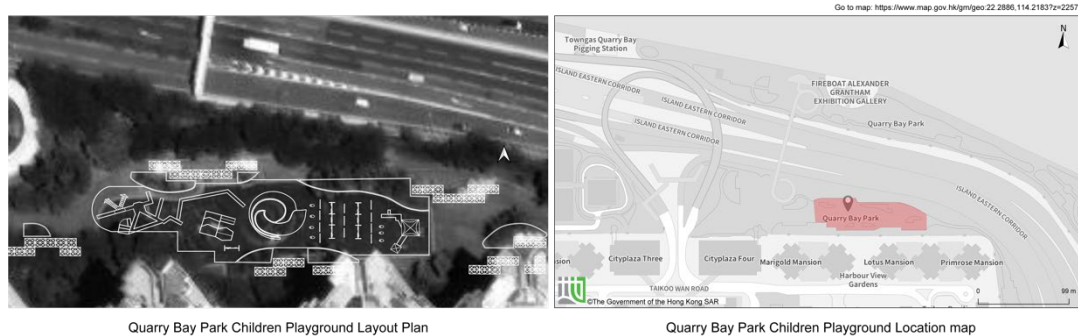


FIG.4.7 Quarry Bay Park Children Playground layout plan and location map

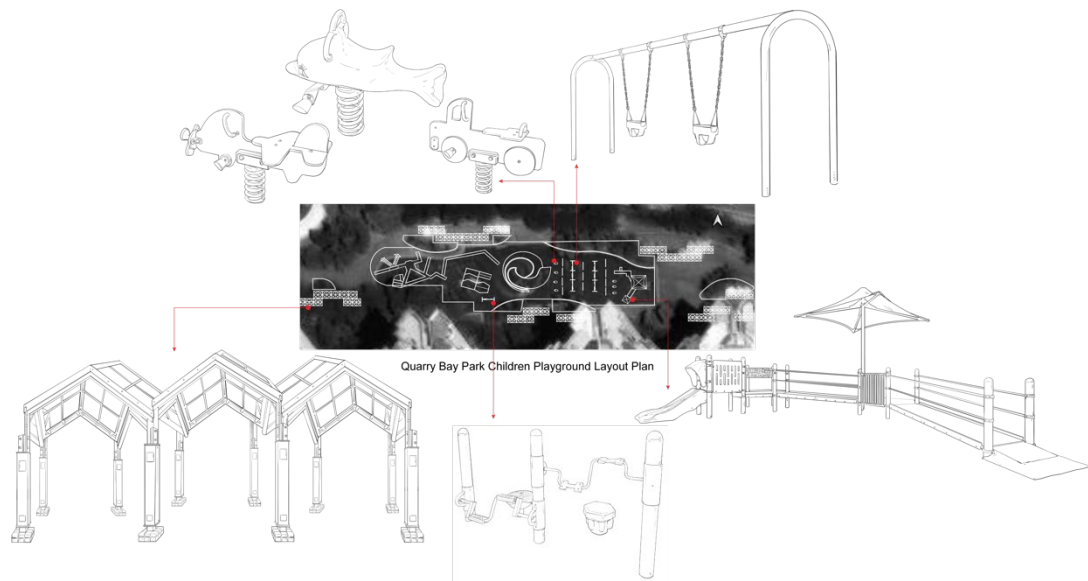


FIG.4.8 Quarry Bay Park Children Playground play facilities

Case C: Tuen Mun Park Children's Playground (TMP), Tuen Mun, New Territories

Tuen Mun Park is located in the centre of Tuen Mun District in the New Territories, bordering Tin Hau Road to the east, Pui To Road to the west, and close to the Tuen Mun River (see Figure 4.9). The park's children's playground is the first inclusive playground in Hong Kong to incorporate the natural elements of 'water' and 'sand'. The playground is divided into seven areas, covering children of different ages and abilities, including the music area, water play area, reptile paradise, etc.

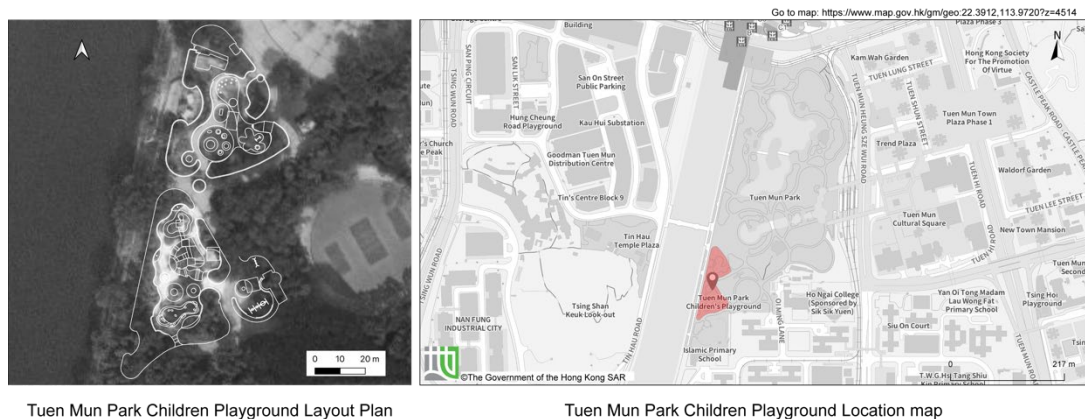


FIG.4.9 Tuen Mun Park Children Playground layout plan and location map

The design takes explicitly into account the needs of children with different physical abilities (see Figure 4.10). For example, the stainless-steel slide prevents children wearing cochlear implants from feeling uncomfortable due to static electricity, the roller slide is designed for children with limited mobility, and the sensory wall and small tunnel provide a safe space for children with autism to adapt to their environment gradually. The swing area has various types of swings to meet different needs.

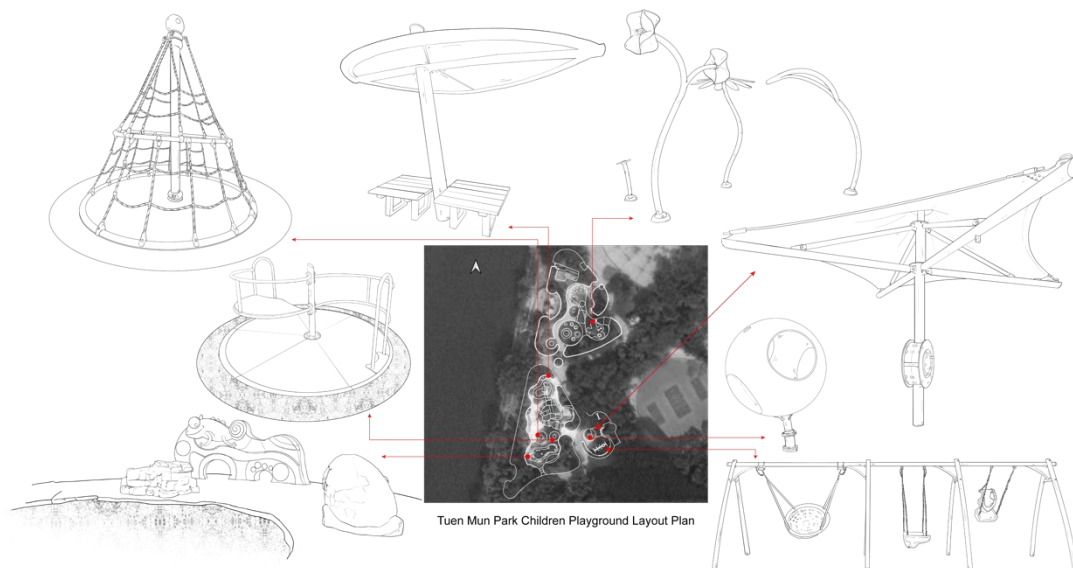


FIG.4.10 Tuen Mun Park Children Playground play facilities

Through in-depth observation and analysis of these three playgrounds, this study not only provides an understanding of the specific manifestations of inclusive playgrounds from the spatial and design perspectives, but also provides empirical data from the perspective of user behaviour, which provides reference for the optimisation of inclusive design.

4.3 Data Collection Methods

The research path below provides an overall framework for data collection (see Figure 4.11). Effective collection is essential to ensuring credibility of research results. In order to gain a deeper understanding of the needs of multiple stakeholders in inclusive public playgrounds, this study combines multiple data collection methods to capture users' actual needs and behaviour patterns systematically. Each method is purposefully aligned with the R-I-N-G

framework: informal interviews contribute to Reviewing stakeholders and their perceptions, unobtrusive observation enables Identifying behavioural patterns, SOPARC and BMAT help with Narrowing by clustering spatial behaviour, and all findings together support Generating design insights. Multi-dimensional data collection reveals the complexity of behaviour and provides designers with specific evidence for improvement.

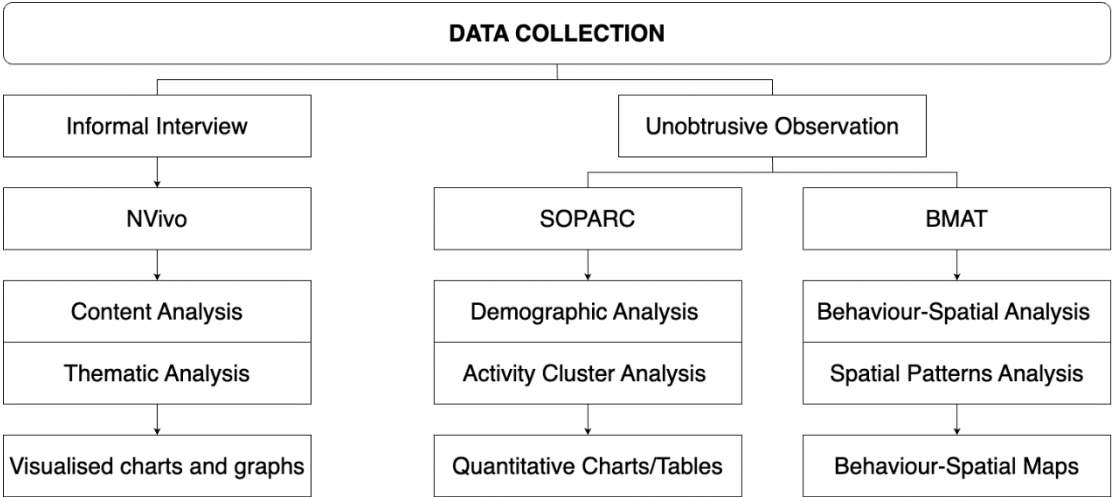


FIG.4.11 Data collection procedure

4.3.1 Informal interview

Building upon insights from the on-site questionnaire in Phase I, this section aims to deepen the understanding of adult stakeholders' experiences in inclusive playgrounds. The survey revealed that parents, grandparents, and domestic helpers—although not the primary design targets—hold strong emotional, physical, and supervisory expectations for playground environments. These emergent needs highlighted a critical gap in current design evaluations, prompting the necessity for qualitative exploration. Informal interviews were therefore introduced to provide a more nuanced, empathetic understanding of these user groups lived realities.

Aligned with the 'Reviewing' step of the R-I-N-G framework, informal interviews serve to establish a stakeholder landscape by identifying who is present, how they engage with playground spaces, and what perceived needs and barriers they encounter.

I held a questionnaire during a field interview to obtain data through a structured interview in preparation for subsequent quantitative research. One respondent's feedback triggered my reflection: **'If you really care about us, you should ask us what is on our minds, not measure us with questionnaires.'** At that moment, I sincerely appreciated the charm of qualitative research. It is not only a tool for data collection, but also a bridge to the inner world of individuals. In this context, informal interviews are not only exploratory tools, but also essential mechanisms for surfacing latent and affective dimensions of stakeholder experience—elements often missed in top-down, standardised design assessments.

Informal interview is similar to everyday conversation, with more natural and free interaction between the researcher and the interviewee (Cohen et al., 2002). There is no fixed interview outline or question sequence, and the researcher can adjust the interview content at any time according to the actual situation, to gain a deeper understanding of the interviewee's real feelings and opinions (Patton, 2014). This interview method is particularly suitable for exploratory research. It can capture the interviewee's more natural expressions in a relaxed atmosphere, providing valuable empirical evidence for fields such as social science and design research (Davis & Brown, 2024).

Informal interviews are more flexible and authentic than structured and semi-structured interviews. First, informal interviews provide fewer rigid frameworks and allow interviewees to express themselves freely in a stress-free environment (Davis & Brown, 2024). Second, researchers can quickly adapt their strategies depending on the progress of an interview, delving deeper into subjects' responses and topics to get more complete information (Roulston, 2010). In addition, this interview can also reduce power imbalance between researcher and interviewee, enabling both to express personal experiences and opinions freely through an equal dialogue (Swain & King, 2022). Through topics spontaneously raised by the interviewee, the researcher can discover new research perspectives and issues, inspiring follow-up research (Gubrium & Holstein, 2002).

Although informal interviews have the advantage of flexibility and authenticity, they still face many challenges at the ethical level. First, the issue of informed consent is particularly

prominent. Since interviews are usually not scheduled in advance, the researcher may only be able to obtain written consent from the interviewee after the interview begins (Israel & Hay, 2006), especially in public places or impromptu situations. Second, privacy and confidentiality issues also require special attention. Informal interviews may involve personal privacy or sensitive topics. Researchers need to protect the identity of interviewees during data recording and analysis to avoid adverse effects on them due to research disclosure (Swain & King, 2022). In addition, the researcher's role and power relations in the interview should also be taken seriously. Interviews may involve high degrees of flexibility that allow researchers to unknowingly influence interviewee responses or direct them towards specific opinions (Tracy, 2010). Therefore, researchers must frequently reflect upon their role during an interview in order to ensure objectivity and neutrality of research results.

To address these ethical challenges, researchers can adopt the following strategies. First, the purpose of the research and the way data will be used can be explained to the interviewee at the beginning of the interview through verbal informed consent, and the interview will be conducted after verbal consent is obtained (Wiles et al., 2008). For temporary interviews in public places, the interviewee can be informed of the research content after the interview and asked whether his or her remarks can be used as research data (Tracy, 2010). Second, to protect privacy and confidentiality, researchers must use pseudonyms or codes when recording and analysing data and avoid disclosing details that would identify interviewees (Creswell & Poth, 2016). Researchers should be cautious when discussing sensitive topics to avoid causing unnecessary emotional stress to the interviewee (Swain & King, 2022; Far, 2008). Finally, researchers should reflect upon their roles and behaviour during interviews promptly afterward and ensure objectivity and reliability of data analysis by engaging with other researchers (Yeomans et al. 2023). These measures are particularly crucial when informal interviews serve not only as data sources, but as foundational inputs into the Review stage of the R-I-N-G framework, influencing the scope and focus of subsequent behavioural observations.

To conduct informal interviews more naturally, I regularly conducted field observations and interviews at three selected public playgrounds from September 2023 to February 2024.

Weekdays were chosen because the playgrounds were less crowded, making encounters and communication easier. At first, I felt nervous and tried to present myself in different roles, such as a parent with a child or a young person who was just there to relax. However, as my time spent at these playgrounds increased, many parents and other stakeholders gradually went from being curious to being used to my presence, and even initiated conversations with me out of boredom or for other reasons. These prolonged engagements enabled informal interviews to occur organically, reinforcing the iterative and embedded nature of the Reviewing process. During these spontaneous communications, my informal interviews gradually started, and I began to obtain valuable data.

4.3.2 Informal interview application

The selection and application of informal interviews were directly informed by the findings of the preceding on-site survey. Responses from caregivers indicated recurring issues such as lack of resting spaces, inadequate supervision zones, and social disconnection. These themes formed the empirical basis for defining interview objectives and stakeholder priorities. In alignment with the ‘Reviewing’ phase of the R-I-N-G framework, informal interviews were designed to establish a comprehensive understanding of who the stakeholders are, what roles they play, and what expectations, challenges, and exclusions they perceive in the playground setting. The goal was to ensure that the subsequent stages of behavioural observation and strategy formulation are grounded in a valid stakeholder map.

According to the R-I-N-G framework, the first step is ‘Reviewing’. The informal interviews in this study aimed to gain an in-depth understanding of the needs and perceptions of specific stakeholders regarding public playgrounds, not only to document their concerns, but to identify latent user groups and overlooked actors that may be underrepresented in existing playground design narratives. The strategy for selecting interviewees was thus guided by both thematic relevance and frequency of presence within the space.

Through literature research and field research, I divided the stakeholders of public playgrounds into 15 categories, including children, parents and caregivers, family assistants and nannies,

teenagers, community residents, playground operators and managers, etc. (see Table 4.2 for details). This stakeholder taxonomy formed the initial analytical basis for the Reviewing phase and allowed for a systematic yet open-ended selection of interview participants. Each stakeholder has different needs and concerns reflecting different usage patterns/environmental interactions. To ensure the effectiveness of the interview, interviewees should prioritise interview subjects who frequently come up; such groups will have an influence over daily operations of playgrounds as well as user experience.

TABLE 4.2 Stakeholders in public playgrounds

Role	Needs	Focus
Children (2-12 years old)	safe, fun, and exciting. It caters to people of all ages and abilities.	It has a variety of rides, accessibility, safety, and opportunities for social interaction.
Parents and primary caregivers	convenient for supervising and monitoring children, a place to rest and socialise, and suitable for the whole family to interact.	The safety and hygiene of the facilities, the convenience (such as toilets, benches, and shade facilities), whether there is a clear line of sight to monitor children, the suitability of the facilities for children of different ages, and the space suitable for family activities.
Domestic assistants and professional nannies	Usually responsible for taking children to the playground, supervising their activities, and paying attention to safety and easy-to-watch designs.	The facilities should be safe and clean, the playground design should be easy to supervise, and the areas should be suitable for socialising with other carers.
Teenagers (13-18 years old)	Although adolescents are not 'children' in the traditional sense, they may also use playgrounds for social gatherings, leisure activities, and sports and fitness activities.	Leisure space to meet their social and sports needs.
Community residents	rest and socialise; the community lives in harmony.	Noise, traffic impact, maintenance, convenience of facilities, and fairness of community use.
Playground operators/managers	Effectively manage public recreational spaces and ensure the safety of facilities.	Facility safety.
Facility maintenance staff	Maintain and repair facilities regularly to ensure their safety and proper functioning.	Safety of the facilities, ease of maintenance, cost control, and use of durable materials.
Security staff	Protect the safety of the playground and its users against misconduct and accidents.	On-site security, crowd control, emergency response, monitoring and patrolling.
Cleaning staff	Keep the playground clean and hygienic to provide a healthy	Environmental cleanliness, waste management, and hygiene maintenance.

	environment.	
Emergency medical responders	Respond quickly and handle medical emergencies in the playground.	Availability of first aid equipment and emergency response time.
Designers and architects	Create a safe, creative space that meets users' needs.	Inclusive design, innovative design concepts, the use of sustainable materials and standard-compliant structural safety.
Playground equipment manufacturers and suppliers	Promote products and technologies; meet customer needs.	Product quality and safety, innovation and market competitiveness.
Child development and special needs supporters	Ensure that children's playgrounds are inclusive and adaptable for all children, including those with special needs, to promote children's holistic development and learning.	Whether the playground facilities support children's cognitive, social, emotional and physical development, accessibility, sensory play equipment, safe flooring materials, and areas and activities specifically designed for children with special needs.
Local government and municipal authorities	Ensure the safety, sustainability and fulfilment of community needs in public spaces.	The cost of planning and maintaining the playground, whether it meets urban planning and safety standards, and the community's overall satisfaction.
Nonprofit organizations and child advocacy groups	Advocate for children's rights and well-being.	The fairness, inclusion and safety of playgrounds and whether they are accessible to all children, especially those with special needs.

To estimate the presence and relevance of each stakeholder group, I adopted a two-step procedure combining observation and targeted communication. First, playground use was systematically observed to record the frequency of different stakeholder types. This frequency mapping process helped prioritise high-presence and high-impact groups for inclusion in the interview sample, strengthening the ecological validity of stakeholder selection. Second, members of the identified 'core circle' of stakeholders (see Figure 4.12) were engaged in informal conversations to clarify their roles and expectations. This helped refine the scope of later observations and analysis.

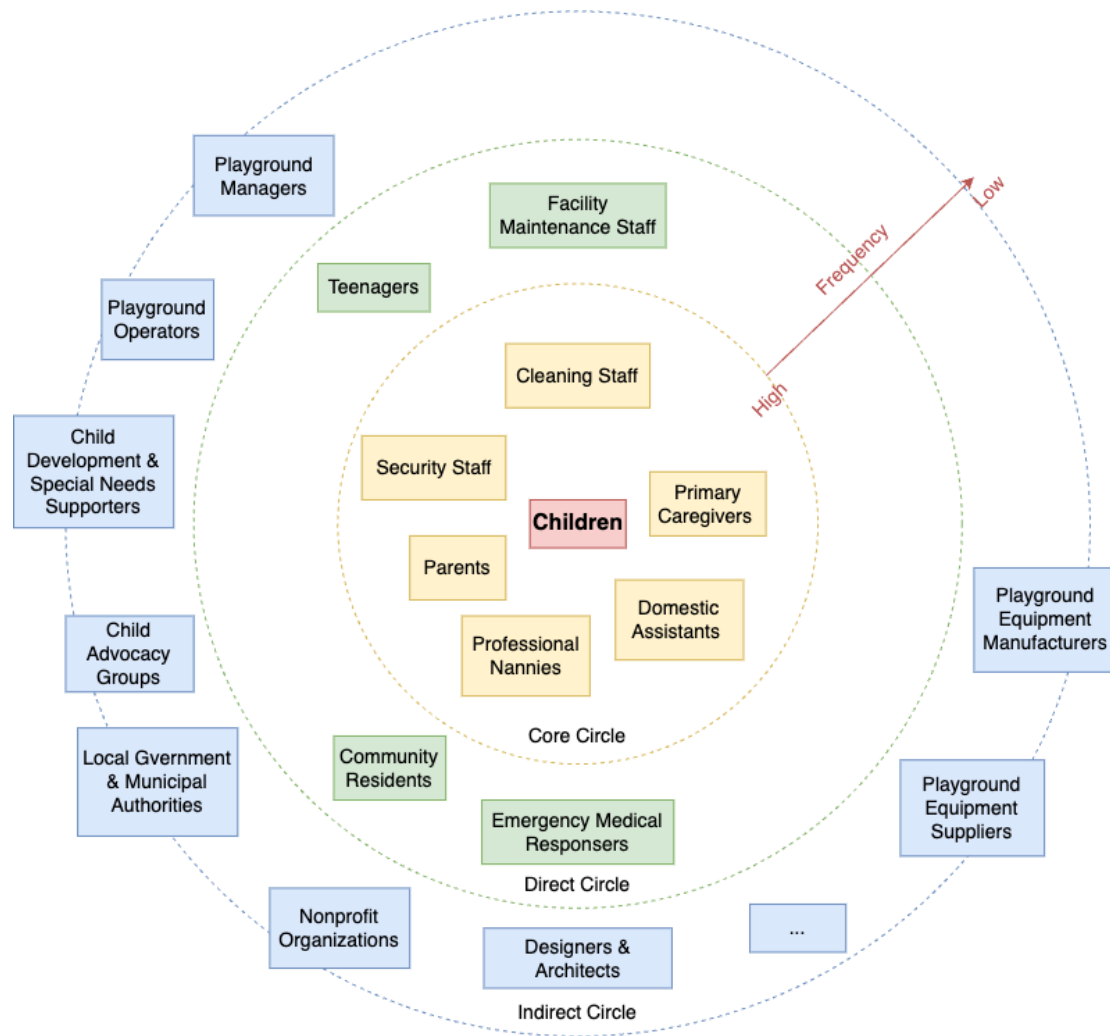


FIG.4.12 Stakeholders map

When conducting informal interviews, the following methods were adopted:

- (1) Choose low-traffic weekdays to approach and communicate with the target group quickly.
- (2) Used open-ended questions to encourage interviewees to share their experiences and opinions.
- (3) Created a friendly environment to reduce the psychological burden of interviewees in order to obtain deeper information.

These procedural strategies not only enhanced data quality but also ensured that the Reviewing step of the R-I-N-G framework was carried out with empathy, rigor, and contextual awareness.

A total of 35 informal interviews were conducted across three playground sites from January to February 2024. Participants included 17 parents, 5 grandparents, 7 foreign domestic helpers, and 6 staff (detail information see Appendices V), representing the most frequently present adult stakeholders identified during the observational phase.

Interviews followed a semi-structured protocol and were conducted in Cantonese, Mandarin, or English depending on participants' preference. Each conversation lasted 30–60 minutes and occurred in shaded seating areas or edges of the playground. Interviews were audio-recorded (with consent) and transcribed in full. To encourage rich narrative expression, open-ended prompts were used, exploring themes such as daily routines, spatial frustrations, emotional attachments, and desired improvements.

Sample interview prompts are listed in Appendices IV. Interviewees were positioned as co-producers of spatial knowledge, whose narratives revealed not only explicit concerns but also implicit environmental preferences and barriers.

These procedural strategies not only enhanced data quality, but also ensured that the Reviewing stage was grounded in empathetic, rigorously contextualised insights. In capturing both the expressed and implied concerns of diverse stakeholder groups, this method laid the experiential foundation for the behavioural clustering and spatial design strategies developed in later stages. Next, the study turns to the unobtrusive observation method to further substantiate and extend these preliminary findings through embodied behaviour data.

4.3.3 Unobtrusive observational method

Rather than re-examining the classification of stakeholder types, this section focuses on how unobtrusive observation supports the 'Identifying' phase of the R-I-N-G framework by empirically validating user behaviours and spatial interactions. This step is essential for detecting patterns of behaviour across different user groups, verifying self-reported narratives, and identifying latent needs that may remain unarticulated in interviews or surveys.

Following the survey and informal interview stages, several discrepancies emerged between stakeholders stated intentions and their actual behaviours. For example, while caregivers often described themselves as highly engaged in child supervision, interview insights and survey data occasionally revealed ambiguous or contradictory perceptions. These inconsistencies raised the need to empirically verify whether expressed attitudes corresponded to observable patterns of use. Unobtrusive observation thus provides a neutral, behaviour-first lens to complement perception-based data, helping identify potential mismatches between design assumptions and user adaptation.

During an interview with a domestic helper, I found that she had been killing time for an hour by playing with her mobile phone in the shade. When I interviewed her, she told me she was here to ‘take care of the children’. This moment illustrated a common phenomenon in public space research: social desirability bias. It underscored the need for methods that can reveal how people actually engage with space rather than how they say they do.

The unobtrusive observation method is a research method that systematically and scientifically records the behaviour and interaction between the social environment of the observed person without disturbing the observed person (Webb et al., 1999). In the study of public space design, this method can capture behaviour patterns from an observer’s point of view and uncover deep-level needs that cannot be ascertained through interviews or questionnaires. As Cooper Marcus et al. point out: ‘The direct participation of residents, together with systematically recorded behavioural data, is seen as the best way to obtain credible data for use in park design.’ (Cooper Marcus et al., 1998, p. 88).

Within the R-I-N-G framework, this method specifically contributes to the ‘Identifying’ stage by observing spatial practices in situ and discerning recurring activity types, interaction patterns, and movement trajectories. It moves beyond stakeholder roles to examine how these roles are enacted—or resisted—through spatial behaviour.

Unlike participatory observation or experimental research, the core of non-interference observation is to minimise the interference of the researcher’s presence on the observed

behaviour, to ensure the data's authenticity and naturalness (Marshall & Rossman, 2014). This method is particularly suitable for groups that are difficult to interview directly, observing rare behaviours, and research involving sensitive topics. It can effectively overcome the biases and limitations caused by self-reported data in traditional qualitative research (Musante & DeWalt, 2010) and provides an ideal research tool for environmental behaviour research. Researchers can even infer how users use facilities and their activity patterns in the environment by observing physical traces (such as signs of wear and tear, rubbish left behind, traces of informal use, etc.) (Zeisel, 2006). These artefacts allow the researcher to access layers of behaviour not readily visible during interviews or time-limited observations, reinforcing the interpretive depth of the 'Identifying' process.

When studying the inclusive design of public playgrounds, unobtrusive observation helps validate the behavioural relevance of stakeholder needs identified in prior stages. Instead of relying solely on self-reported roles or expectations, this method captures actual spatial practices, enabling the researcher to infer unspoken preferences, avoid response bias, and detect mismatches between design intent and user adaptation.

These observations allow researchers to evaluate better the effectiveness and shortcomings of public spaces in promoting social interaction among different groups and meeting diverse needs (Jerolmack, 2018; Zeisel, 1976).

Unobtrusive observation methods provide authentic data while being ethically challenging, since researchers usually do not inform those being observed of their studies, potentially violating their rights of privacy (Webb et al. 1999). In addition, this ethical issue may be exacerbated when using covert photography or video recording, especially in private spaces or scenes involving sensitive topics (King et al., 2013). To address these challenges, researchers must clarify the method and purpose of data collection when designing the research plan and seek approval from the ethics committee (King et al., 2013). In public observation, sensitive information that may identify individuals should be avoided, and all data should be anonymised to ensure that no details that can identify individuals are revealed (Chatman, 1992). When research involves illegal or inappropriate behaviour, researchers need to develop a response

strategy in advance to find a balance between social responsibility and participant protection (Page, 2000).

In this study, to observe the behaviour and activities of non-child users in public playgrounds in a natural setting, the researcher will try to use unobtrusive observation methods as much as possible. In practice, the researcher can adopt an unobtrusive role, such as a tourist or a parent accompanying a child, to covertly record the on-site behaviour patterns. This role as a marginal participant can minimise interference with the observed and capture natural behaviour patterns. For example, Moore used time-lapse photography on the school roof to record children's behaviour (Zeisel, 2006), thereby avoiding the influence of the researcher's presence on the children's behaviour.

This study will use various methods to record behavioural observation data, including text descriptions, diagrams, pre-set coding checklists, maps, photographs and video recordings. Researchers in the field need to decide which behaviours to record based on the actual situation and choose an appropriate level of abstraction to describe the characteristics of the behaviour. Pre-coded checklists based on these typical observations can provide detailed information about the probability and conditions for specific behaviours to occur, while map records provide insight into both space use simultaneously as well as temporal distribution of behaviours. In contrast, photos and videos can record subtle behavioural patterns and the trajectories of different groups of people in space. Unobtrusive observation methods reveal behaviours and needs that the interviewees fail to express through the bystander's perspective. The application and advantages of the SOPARC tool in data collection will be discussed in more detail below.

4.3.4 System for observing play and recreation in communities (SOPARC)

When designing public spaces, it is crucial to accurately understand who the space is intended for and how it is used. In new public spaces, designers must anticipate potential usage patterns and times, while improving or rejuvenating existing public spaces requires in-depth studies that combine current usage analysis with site assessments (Vassiljev et al., 2021). This process provides invaluable evidence regarding actual usage for subsequent layout and activity

planning efforts. Within the R-I-N-G framework, SOPARC plays a key role in the 'Identifying' phase by providing structured empirical data on who uses the space, when, and how. It also contributes to 'Narrowing' by enabling the identification of high-frequency activity types and user patterns across predefined spatial zones.

Among the many methods, SOPARC (System for Observing Play and Recreation in Communities) has attracted much attention for its systematic and standardised observation features. This tool aims to assess the use of public spaces and parks and users' physical activity levels (McKenzie et al., 2006). SOPARC uses systematic observation to record the number of participants and their sociodemographic characteristics, such as gender, age and ethnicity, and to analyse the type and intensity of activities carried out by different groups of people in a specific place. Specifically, SOPARC is used to quantify the number of users in predefined zones, assess observable sociodemographic characteristics, and estimate the amount of physical activity they perform within that area (McKenzie & Cohen, 2006). In addition, SOPARC can assess individual elements of park activity, including site accessibility, usability, supervision, equipment configuration, organised activities and lighting, to provide a comprehensive context for the site being used and assessed (McKenzie & Cohen, 2006; McKenzie et al., 2006).

This structured approach is particularly valuable when integrated with the behavioural typologies preliminarily identified during the Reviewing phase and further explored through informal interviews and unobtrusive observation. It allows researchers to move from individual cases to systematic quantification, bridging qualitative insights and behavioural mapping.

The main advantages of SOPARC are its non-intrusive, economical and efficient nature (Whiting et al., 2012; Cohen et al., 2011; Evenson et al., 2016). Researchers can quantify users' activities in predefined areas through a standardised observation procedure, providing insight into spatial usage patterns (Cohen et al., 2011). Research has shown that the reliability and validity of SOPARC has been validated in multiple studies (Cohen et al., 2011; McKenzie & Cohen, 2006; McKenzie et al., 2006; Umstattd Meyer et al., 2020; Puig-Ribera et al., 2022; Camplain et al., 2020). By testing the results between different observers, McKenzie et al. demonstrated the consistency of the tool in recording activity levels and demographic

information. Comparisons with objective measurement tools such as accelerometers also showed high accuracy in estimating physical activity levels (McKenzie et al., 2006; Complain et al., 2020). However, observer judgement remains a major limitation of SOPARC, and observer training and consistency in coding standards are crucial for data reliability (Hallgren, 2012; Evenson et al., 2016).

Researchers must address ethical issues when implementing SOPARC (McKenzie et al., 2006; Vassiljev et al., 2021). Although the tool is non-intrusive, prolonged observation may still cause unease in the observed, especially when children or minorities are involved. Researchers should, therefore, obtain permission from an ethics committee, ensure the anonymity of the data, and avoid any discriminatory behaviour or labelling when recording the gender, ethnicity and age of users. In addition, for observations of sensitive groups, researchers need to carry identification to explain the purpose of the research and obtain consent from guardians if necessary.

Although SOPARC has significant advantages in macro-level data collection, its limitations should be addressed (Vassiljev et al., 2021). First, the tool needs to be improved at recording the details of micro-behaviour, making it difficult to describe in depth the specific types of activities and interaction methods of users in public spaces. This makes it difficult for researchers to understand the specific impact of different spatial characteristics on user behaviour patterns. Second, SOPARC has limited analytical power regarding the relationship between spatial characteristics and behaviour, and cannot reveal how specific equipment or spatial design affects behavioural distribution and usage preferences. Furthermore, its recording of social interaction behaviour is relatively limited which reduces its efficacy in studying interaction patterns within public spaces.

To address these issues and strengthen the 'Narrowing' phase in the R-I-N-G framework, this study adopts a multi-tool approach by combining it with other behavioural recording tools like behavioural mapping to generate more comprehensive behavioural and spatial feature information. Refining the division of target areas and introducing specific spatial elements (such as facilities) as a basis can improve the analysis of the relationship between behaviour

and space. At the same time, by providing additional training to observers and increasing the recording of social interaction behaviours, researchers can supplement the social interaction data that SOPARC cannot capture. Moreover, triangulating SOPARC results with qualitative interview data enhances the explanatory power of the analysis, bridging the gap between visible activity and invisible intention.

4.3.5 SOPARC application

Before using the SOPARC tool to collect data, adequate preparations must be made. This study was based on the following steps (see Figure 4.13):

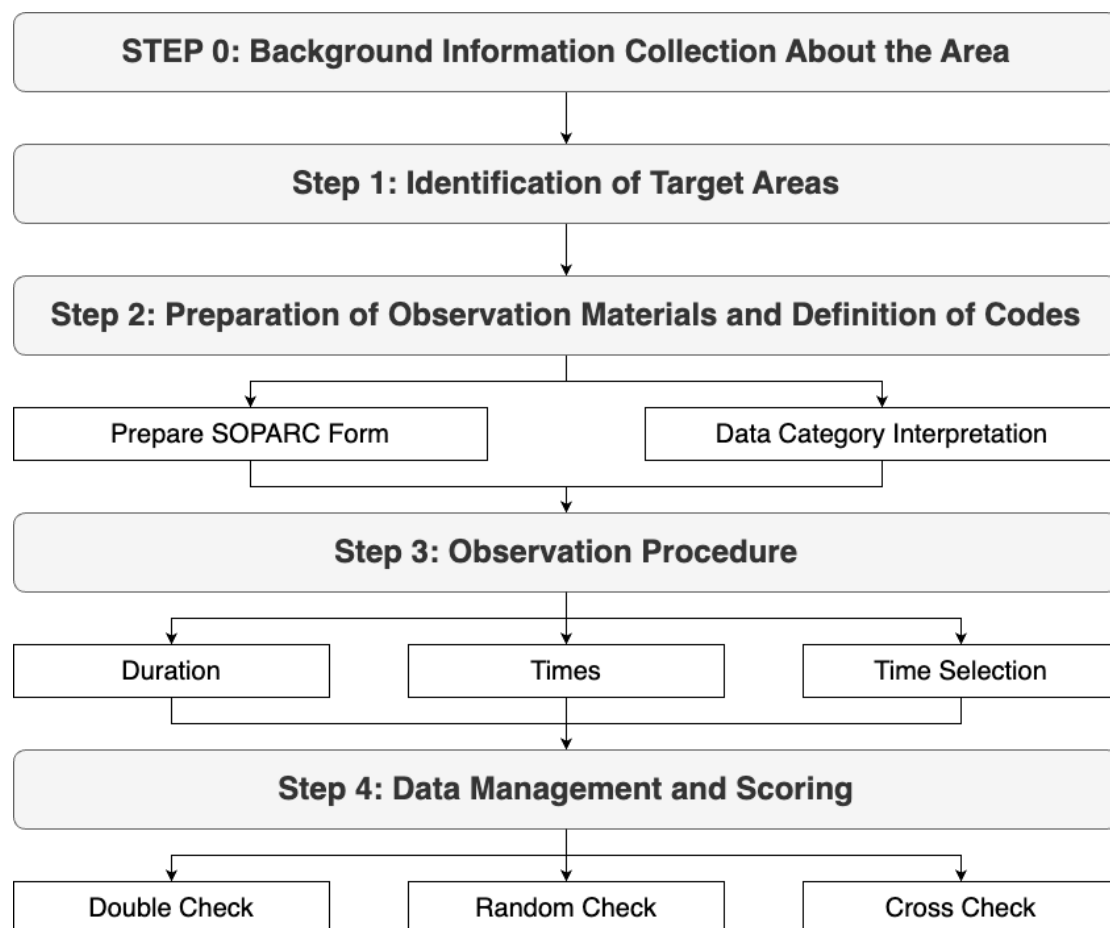


FIG.4.13 Workflow for SOPARC Application

Within the R-I-N-G framework, this section corresponds to the ‘Narrowing’ phase, where previously observed behaviours and user types are clustered into systematic patterns using

quantitative coding. SOPARC serves as the core tool to structure these behavioural clusters across time, space, and user demographics.

Step 1: Identification of Target Areas

Target areas are specific parts of the environment that need to be evaluated. Researchers should familiarise themselves with the environment before starting the assessment to identify the parts most representative of the area under study. These areas should cover all potential usage sites, and an observation position with good visibility should be selected to ensure precise observation. The size of the target area needs to be adjusted according to the expected number of users. It can be divided into sub-target areas to improve measurement accuracy (Mckenzie & Cohen, 2006). Given that playgrounds are easily obscured by trees or play equipment, this study clearly defined the observation path for each playground.

Clear spatial zoning was used not only for visibility and access, but also to ensure compatibility with behavioural typologies identified in the 'Identifying' phase.

Step 2: Preparation of Observation Materials and Definition of Codes

Observers were trained and prepared using the tutorials and manuals provided by Active Living Research (2006). Observation records for this study were completed manually using paper forms. Coding system was prepared before data collection and adapted according to the research objectives. The SOAPRC coding system for this study included the following data categories:

- (1) **Gender:** usually divided into female and male.
- (2) **Age Group:** According to the purpose of the study, it is divided into (i) adolescents (13-20 years old), (ii) adults (21-59 years old), and (iii) older people (60 years old and above). The age ranges are designed to facilitate observation. Since age is assessed through observation, these ranges are designed to be easy to identify.

- (3) **Ethnicity:** (i) Chinese, (ii) Other Asian, (iii) White, and (iv) Black.
- (4) **Disability:** (i) No disability; (ii) Visually impaired people (VIP); (iii) Walking device (walking stick or wheelchair); and (iv) Other disabilities.
- (5) **Body State:** Describes the physical state of the individual, including (i) Standing, (ii) Seating, (iii) Lying down, (iv) Moving, (v) Leaning, and (vi) Squatting.
- (6) **Behaviours:** List different behaviours in public playgrounds based on literature (Sun et al., 2020; Malek et al., 2015; Chen et al., 2016; Huang et al., 2016; Vidal et al., 2022) and field observations, such as Communicating, Eating or drinking, etc. (For specific coding interpretations, please see Annex IV).
- (7) **Activity Level:** Physical states and behaviours can be classified into three activity levels: (i) sedentary, when users are Lying down, sitting, squatting, or standing in place; (ii) moderate – such as walking at a casual pace; or (iii) vigorous, when users are engaged in vigorous activity such as running or cycling (Bell et al., 2021).

The final SOPARC coding system is provided in the table below (see TABLE 4.3) for observers to consult when needed.

TABLE 4.3 SOPARC coding system

Gender	
Female	0
Male	1
Age Group	
Teen = 13 to 20 years old	0
Adult = 21 to 59 years old	1
Senior >= 60 years old	2
Ethnicity	
Chinese	1
Other Asian	2
White	3
Black	4
Disability	
No disability	0

Visually impaired people (VIP)	1
Walking device (walking stick or wheelchair)	2
Other disabilities	3
Body State	
Standing	1
Seating	2
Lying down	3
Moving	4
Leaning	5
Squatting	6
Behaviours	
Communicating	1
Eating or drinking	2
Exercising	3
Having a picnic	4
Looking after children	5
Passing by	6
Phoning	7
Playing games or watching others play	8
Playing electronic machine	9
Playing musical instrument and singing	10
Playing on facilities	11
Reading or writing	12
Sanitation work (e.g., sweeping, watering, ...)	13
Sitting at leisure	14
Sleeping	15
Squatting to rest	16
Standing to rest	17
Taking photographs/videos	18
Repairing the facilities	19
Walking	20
Taking care of elderly	21
Smoking	22
Working with laptop	23
Queuing	24
Washing hands or feet	25
Activity Level	
Sedentary	0
Moderate	1
Vigorous	2

The coding system was deliberately aligned with categories relevant to playground stakeholder diversity, including activity type, physical state, and behavioural intention. These coded categories provide a structured framework for recognising patterns across time and space.

Step 3: Observation Procedure

The duration and period of the observations need to be defined in advance. Based on the flow of people in the playground, this study selected a ten-minute observation period four times a day. Observation is the practice of conducting systematic scans over an extended period, to quantify user characteristics and physical activity levels. To maintain the highest possible standard in observation, observations will be recorded via video and marked. Observations will be conducted at four different times (11:00-12:00 a.m., 1:00-2:00 p.m., 3:00-4:00 p.m., 5:00-6:00 p.m.) and on multiple days (including three weekdays and Sunday). Hong Kong is in the subtropical zone, and its climate varies significantly from season to season. The climate is mild and suitable in summer, while it is relatively dry and cold in winter. Therefore, this research project will mainly concentrate on summer (July-September) and winter (January) to capture their impact (see Figure 4.14).

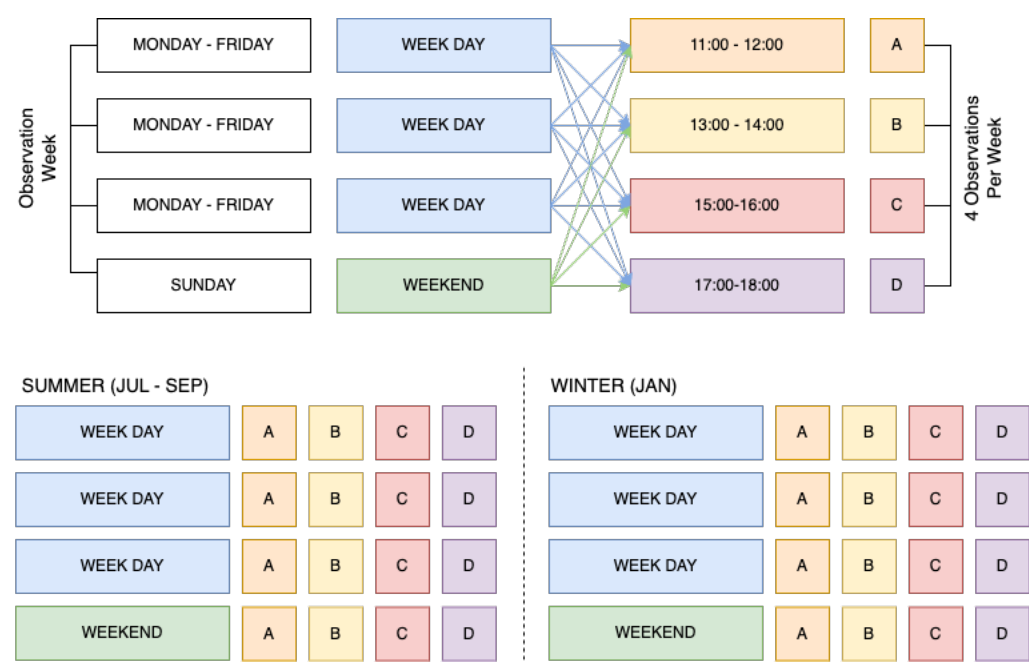


FIG.4.14 Observation Schedule

The observation schedule was synchronised with peak and off-peak usage times to capture temporal variations in behavioural clusters, enabling cross-period comparison essential for refining the ‘Narrowing’ process.

Step 4: Data Management and Scoring

Data from video screenshots will be filled in according to the SOPARC coding sheet and transferred to an Excel spreadsheet for analysis. A single observer can carry out observations, so in this study, in order to reduce the risk of incorrect observations being recorded, the same time and place were independently recorded by me. Two other researchers assisted in completing the data in the SOPARC coding sheet for double and random checks to verify the data and ensure its accuracy (Hallgren, 2012). The preliminary aggregated data will be used for descriptive analysis and statistical comparisons between categories (Mckenzie & Cohen, 2006). These structured data were then used to consolidate activity clusters, and to prepare for their spatial mapping in later analysis phases. This clustering marks the transitional output from ‘Narrowing’ to the subsequent ‘Generating’ step of the R-I-N-G framework.

Through a standardised observation process, the SOPARC tool provides a quantitative data basis for research. By codifying behaviour into repeatable and analysable clusters, SOPARC operationalises the R-I-N-G framework’s central task: translating observed complexity into design-relevant insights. Next, I will explore combining the BMAT tool with data analysis to understand public playground usage comprehensively.

4.3.6 Behavioural mapping and assessment tool (BMAT)

Due to limitations associated with SOPARC method, this study introduces a supplementary tool called Behaviour Mapping and Assessment Tool (BMAT). This choice records users participating at different physical activity levels. It aims to reveal the relationship between passive and active behaviours and explore the interaction between social groups and physical locations or behavioural scenarios in space, time and weather conditions.

Within the R-I-N-G framework, BMAT supports the ‘Narrowing’ phase by enabling finer-grained spatial-behavioural analysis. It builds on SOPARC’s quantitative base, adding depth through environmental context, user clustering, and interaction mapping.

Although a variety of behavioural mapping methods have been developed in the field of environmental behaviour to understand the interaction between people and places and to record behaviours in designed environments (e.g. Goličnik & Thompson, 2010; Unt & Bell, 2014; Cosco et al., 2010), these early methods often relied on paper records marked with colours and symbols, which are limited for statistical analysis. It is also difficult to effectively record the location of individuals, making it impossible to determine the relationship between behaviour and spatial layout accurately.

BMAT is a systematic tool used to assess user behaviour and their interaction with public spaces (Grellier et al., 2021; Vassiljev et al., 2021). It not only focuses on the use of a specific space by users, but also covers the type, frequency, location and relationship with environmental features such as plants and facilities. By capturing how specific user groups engage with particular spatial features, BMAT provides spatialised behavioural evidence that supports the clustering and zoning of user needs—critical for narrowing inclusive design strategies.

The core functions of BMAT lie in behavioural observation and environmental assessment (Vassiljev et al., 2021; Mishra et al., 2021). Through systematic observation and recording, researchers quantify users’ behaviour patterns in a specific environment, including activity types, interaction frequencies and engagement levels. These data provide empirical support for design improvement and help designers better understand user needs. At the same time, BMAT also conducts a qualitative analysis of environmental characteristics to evaluate factors such as facility configuration, safety, and accessibility. This dual function enables BMAT to link behavioural data with spatial affordances, strengthening the evidence chain between user activity, environmental triggers, and design implication.

Compared with other methods, BMAT shows several advantages. easily and precisely demonstrate user behaviour and its location in space, offering strong support for understanding

the relationship between user behaviour and spatial layout. In addition, its comprehensiveness enables researchers to combine behavioural data with environmental factors for greater insight into complex behavioural patterns in space. Furthermore, its flexibility allows researchers to adapt it according to specific research objectives or environments for maximum applicability of research findings.

This study specifically uses BMAT to refine activity clusters observed in SOPARC, such as social resting, passive monitoring, transitional loitering, and marginal co-presence. These clusters are then geographically mapped to identify usage zones, conflict areas, and underutilised opportunities for inclusive redesign.

Researchers employ various strategies to test and verify BMAT, such as data comparison, repeated testing, and expert review, in order to ascertain its validity and reliability. By comparing the data collected by BMAT with other validated methods (such as SOPARC), researchers can ensure the consistency and accuracy of the data (McKenzie & Cohen, 2006). Applying BMAT multiple times in different times and environments can test the consistency and reliability of the results and improve the credibility of the research results. In addition, inviting experts to review the research results can ensure its scientific and academic value (Cohen et al., 2007).

Researchers using BMAT must pay special attention to ethical considerations to ensure compliance with their research process. Privacy protection and informed consent are two crucial components, and researchers must take appropriate steps to protect users' privacy, particularly children and other vulnerable groups. Before the study begins, the researcher should clearly explain its purpose, process and possible impact on the participants and obtain written consent from the participants and their guardians (Floyd et al., 2008). To address ethical considerations, it is recommended to utilize anonymous observation. This approach ensures anonymity during the observation process, mitigates privacy risks for participants, and uses nonintrusive observation techniques without directly recording identity details of those being observed - all which help build trust and ensure ethical compliance in any study conducted.

By complementing SOPARC's breadth with spatial precision and contextual richness, BMAT plays a critical role in narrowing observed stakeholder behaviours into actionable design dimensions—supporting the R-I-N-G framework's progression from scattered input to synthesised spatial insight.

4.3.7 BMAT Application

Adequate preparation is key to ensure the smooth progress of research when using BMAT for data collection, similar to what would be necessary with the SOPARC method. Because BMAT pays more attention to detailed records and multi-dimensional analysis, its preparation must be more precise and systematic compared with SOPARC method. Within the R-I-N-G framework, this application phase directly supports the 'Narrowing' step by enabling refined clustering of spatially embedded behaviours, and sets the stage for 'Generating' spatial strategies in later chapters. Below are the specific preparation steps (see Figure 4.15):

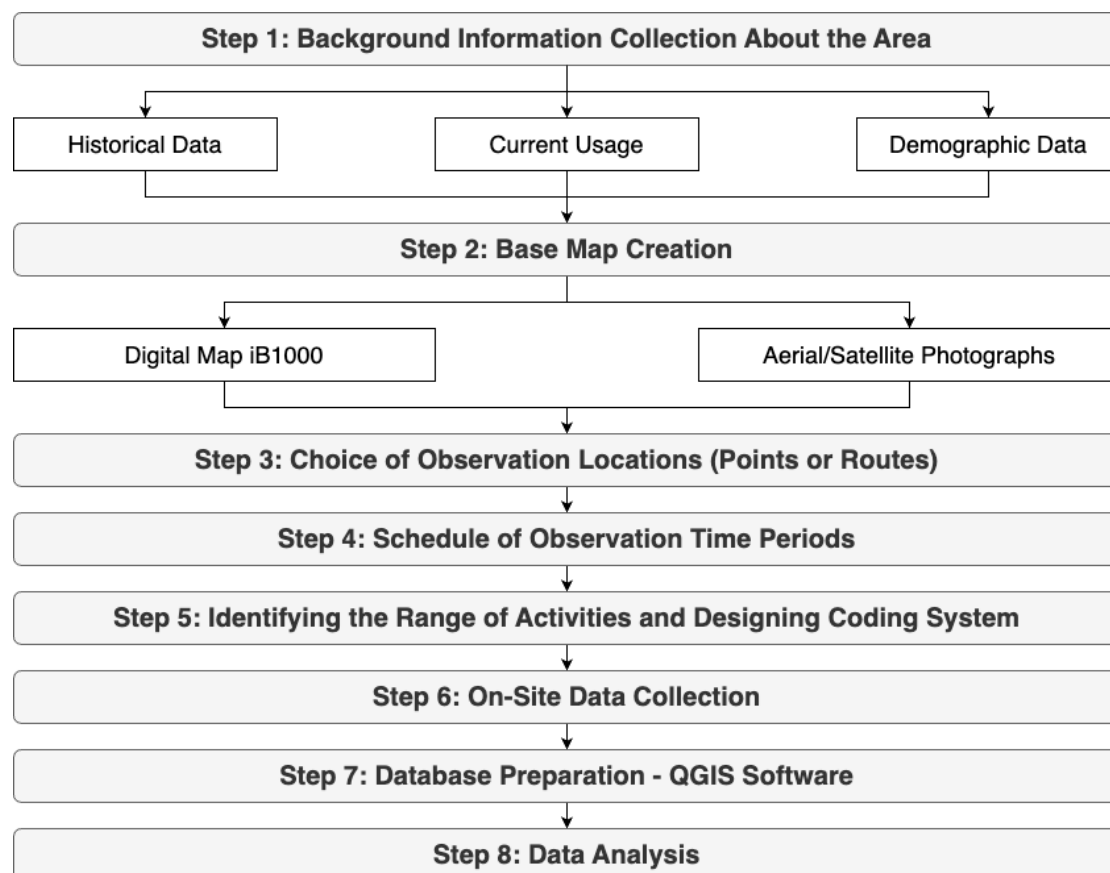


FIG.4.15 Workflow for BMAT Application

1. Background data collection

It is crucial to gather comprehensive background information about the site, including historical, current usage, demographic data and any historical references that exist for it. Doing this allows researchers to gain an understanding of its basic conditions and usage patterns as a platform for future investigations. Using these details, researchers can not only uncover characteristics related to users and users' behavioural tendencies but also discover possible activity types or activity-intensive areas - laying the groundwork for constructing use-frequency heatmaps and behavioural hotspots across stakeholder types.

2. Prepare a site map and divide it into specific areas or behaviour scenarios

Site maps are essential tools for behavioural observation. They are extracted from digital maps or aerial/satellite photographs and simplified appropriately to highlight key elements and remove unnecessary features. Dividing the site into specific areas or behaviour scenarios (e.g. activity areas, rest areas, etc.) can more effectively record the behaviours and activities in different areas. In this study, the researchers used maps provided by the Hong Kong Lands Department iB1000 and satellite images to accurately map the areas of the three playgrounds and the specific locations of the leading play equipment.

These spatial subdivisions allowed the overlay of observed behaviours with environmental features, enabling the identification of usage conflicts, unserved zones, or over-utilised areas by stakeholder group.

3. Plan observation points or routes

Appropriate planning observation points or routes is key to ensuring comprehensive and scientific data collection. When selecting observation points, priority should be given to locations that can cover all target areas to record the behaviour and activities within the site fully. As the size of the site, vegetation, and the degree of cover provided by play equipment may affect observation results, multiple observation points should be selected, and systematic and repeatable observation routes should be planned where necessary. Researchers should try to

choose observation locations that are not easily noticed by the observed to avoid the observer's presence from interfering with the behaviour in the field. Establishing multiple observation points at playgrounds with restricted views allows researchers to capture behavioural patterns across areas. Furthermore, this study's observation route aligns closely with that used in SOPARC to ensure data compatibility and subsequent analysis.

This spatial strategy ensures that patterns observed via BMAT can be reliably compared with those identified through SOPARC, maintaining triangulated integrity within the *Narrowing* phase of the R-I-N-G framework.

4. Determine which activities need to be recorded and design a specific coding system

Before data collection, researchers should compile an exhaustive list of all activity types on site and create a unique coding system for each activity type. This helps researchers keep consistent during data recording as well as aid in subsequent analysis and processing. In this study, the coding system used is the same as that in the SOPARC method and will not repeat here.

Consistency across methods ensures comparability while enhancing the capacity to map activity type with spatial configuration.

5. Select the sampling period

Researchers need to select an appropriate sampling period according to the research objectives to ensure that the data can reflect the use of the site at different times and seasons. Sampling periods should cover various time points, such as weekdays and weekends, mornings and evenings, to fully understand the site's usage patterns. The sampling period is the same as that of SOPARC.

6. Data collection

To conduct data collection successfully, researchers must first record observed activities and behaviours using an established coding system. Each activity's specific location, time and environmental information will be recorded through the analysis of on-site video recordings. All records should be anonymised, and no information identifying a specific individual should be recorded except for the required data information.

In this study, a total of 96 video segments were recorded across the three selected playgrounds: Kowloon Park, Quarry Bay Park, and Tuen Mun Park. Each segment lasted a minimum of 10 minutes, covering peak and off-peak hours from 10:00 AM to 6:00 PM on both weekdays and weekends. Figure 4.16 illustrates the behaviour coding process based on a video recorded in Quarry Bay Park at 17:24 on 13 September 2023 (00:00–03:21).



FIG.4.16 Behaviour video coding process based on a 201-second video clip recorded in Quarry Bay Park at 17:24 on 13 September 2023

This behaviour data provides spatial evidence for clustering common user practices and affordance responses across stakeholder groups—core to narrowing complex needs into designable categories.

7. Format after data collection

The data of each observation period should be saved in a separate folder with a unified naming convention for management and subsequent analysis. The naming convention used in this study is 'Location_Date_Time' (naming example: KLNP_20230712_1212). All observation data were subject to consistency and completeness checks before storage to ensure that each data point contained detailed information such as 'Gender', 'Age Group', 'Ethnicity', 'Disability', 'Body State', 'Behaviours', and 'Activity Level' and were recorded in QGIS software. Figure 4.17 illustrates the QGIS-based behaviour coding based on the video frame captured in Figure 4.16. It should be noted that both figures represent only a selected portion of the full recording file QUBP_20230913_1724.

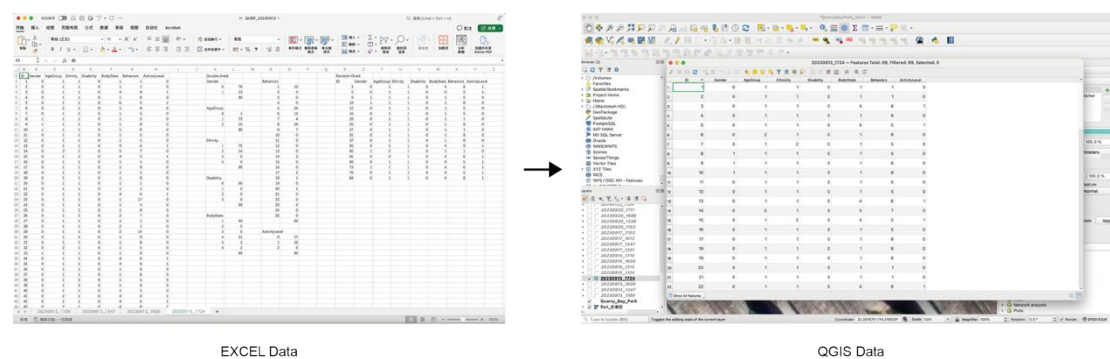


FIG.4.17 QGIS-based behaviour coding based on Figure 4.16 (file: QUBP_20230913_1724, partial)

A total of 5,866 spatial behaviour points was recorded and mapped onto individual GIS point layers for the three playgrounds. Figure 4.18 presents a time-specific segment at Quarry Bay Playground, showing the distribution and density of caregiver behaviours observed at 17:24 on 13 September 2023.

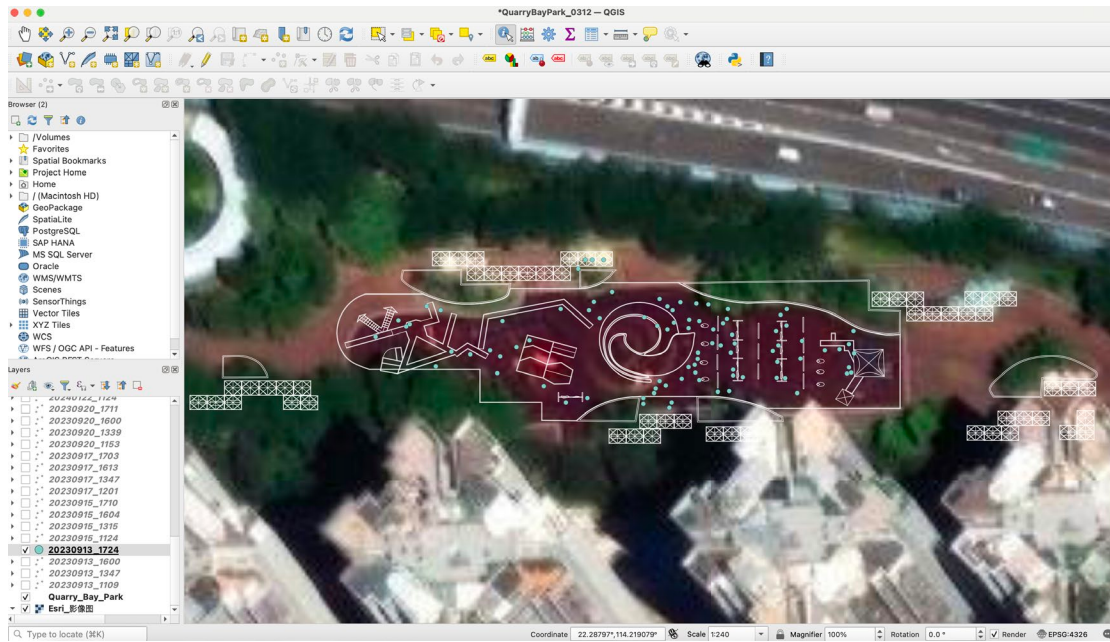


FIG.4.18 QGIS-coded showing spatial clustering of adult user behaviours (File name: QUBP_20230913_1724)

Two researchers repeatedly verified the data of this study. Then they merged into a single GIS point layer file, creating a dataset with rich spatial information that provides a solid foundation for various visual mapping, statistical analysis and geospatial statistical exploration.

This GIS-enabled spatial dataset forms the foundation for the next R-I-N-G step: ‘Generating’ place-based design strategies based on actual user trajectories and interaction hotspots.

8. Statistical and visual analysis results

Various visual charts can be generated during data analysis to visually present site usage and behaviour patterns. After the database is created, it can be checked and interpreted in detail in the GIS system based on observed activity types, ages, and other information, and all attribute data related to the point layer can be exported to a spreadsheet or statistical software for further analysis.

The resulting spatial analysis produced spatial location maps that reveal behaviour intensity zones, overlap between movement and resting paths, and identification of ‘dead zones’ where

behavioural avoidance occurred. These spatial patterns provided critical insights for targeted design intervention.

The visual-spatial outputs are not merely descriptive—they provide the basis for clustered behavioural pattern recognition, informing design trade-offs, stakeholder prioritisation, and spatial programming in the Generating phase.

4.4 Conclusion

This chapter systematically describes the methodological framework of this study, from research design to specific implementation, and thoroughly demonstrates the academic considerations and practical steps of the method selection. The study is based on the qualitative research paradigm. It aims to explore in depth the behavioural patterns and spatial usage habits of different stakeholders in public playgrounds and reveal their fundamental needs for playgrounds. The researcher can analyse user behaviour and its impact on spatial design in a specific context through the case study strategy. This study uses inclusive children's playgrounds provided by LCSD as the research object, laying a solid foundation for subsequent understanding and analysis of the experiences and needs of diverse groups in public playgrounds.

The research path consists of four main stages. The first stage identified representative research cases through on-site research and inclusive quality assessments, providing basic data for in-depth research. In the second phase, in-depth case studies and multi-dimensional observations were conducted to collect data on the interaction patterns and spatial use characteristics of different stakeholders in the playground. In the third phase, the data collected in the previous two phases was systematically analysed to identify and extract the diverse needs of users in public playgrounds. In the fourth phase, practical design recommendations were proposed based on the results of the data analysis, providing a theoretical basis and practical guidance for optimising inclusive playground design. This research approach followed the R-I-N-G framework proposed in Chapter 3, guaranteeing methodological rigor and systematicity.

Data was gathered by means of unobtrusive observation, the SOPARC tool and BMAT tool, in order to capture behavioural patterns of different stakeholders and their interactions with their environment from multiple angles. Unobtrusive observation reduces researcher interference to indeed reveal the behavioural characteristics of users in a natural setting. The SOPARC tool systematically and quantitatively records the behavioural characteristics, activity intensity, and sociodemographic distribution of different user groups in the playground, providing rich data that supports understanding usage patterns. The BMAT tool, as a supplement to SOPARC, provides a more in-depth understanding of user interactions with playground facilities and layout, through detailed behavioural observation and environmental assessment. Combining these methods enables a comprehensive and in-depth understanding of public playgrounds' diverse user needs and behaviour patterns, providing a reliable basis for formulating subsequent design strategies.

This chapter also describes the detailed steps and data collection methods. Through cross-validation of multiple methods, such as behavioural mapping and non-participant observation, the researchers fully captured different stakeholders' behavioural patterns and needs. They provided a rich empirical basis for subsequent design optimisation through systematic data analysis and multi-level field observations.

In summary, this chapter has fully collected behavioural data from different stakeholders through rigorous research design and systematic analysis methods and has explored in depth the behavioural patterns and needs of users in public playgrounds, laying a theoretical and practical foundation for understanding and analysing usage behaviour in public playgrounds. Next chapter will analyse various stakeholders' patterns and needs based on these data.

Chapter 5 Data analysis and findings

5.1 Survey results and analysis

As the first stage of empirical data collection, the questionnaire survey plays a foundational role in this study's multi-method design. It provides a broad, structured understanding of stakeholders' basic perceptions, emotional evaluations, and practical experiences in inclusive playgrounds. The findings from this phase serve not only as standalone evidence for evaluating current design effectiveness (sub-RQ1 and sub-RQ2), but also as the basis for identifying key user groups and generating critical issues to be further explored in the subsequent informal interviews and behavioural observations. In this sense, the survey operates as both a diagnostic tool and a thematic primer, grounding the deeper qualitative investigations that follow.

During the Pilot Study phase, I conducted field research with two other researchers at playgrounds on the list of inclusive playgrounds of LCSD in Hong Kong. First-hand data on using these public inclusive playgrounds was collected through a questionnaire survey. The questionnaire was designed to gain a comprehensive understanding of the perceptions and experiences of different playground stakeholders, including information on their relationship with children, age, and gender, as well as their purpose of using the playground, satisfaction with the playground design and specific needs for facilities.

The following analysis will focus on the following three main aspects:

1. Explore the demographic characteristics of the participants to understand their backgrounds.
2. Analyse the respondents' views and evaluations of the inclusive design of playgrounds, focusing on whether the existing design can meet the needs of diverse users.

3. Discuss the respondents' current experience of playgrounds and future expectations and analyse their specific suggestions for facility improvement and design optimisation.

Through these analyses, practical strategic recommendations can be made to optimise inclusive playground design to meet the needs of different groups better and improve the inclusiveness and user experience of public playgrounds.

5.1.1 Demographic characteristics analysis

5.1.1.1 Age distribution

Figure 5.1 shows age distribution data that revealed that respondents aged 36-50 constituted 40 per cent, followed by respondents between 21-35 who made up 29.47 per cent. Conversely, proportions for those under 20 and 65 and above were relatively low at only 6.32 per cent and 7.37 per cent respectively. This data indicates that most people accompanying children to public playgrounds are young and middle-aged adult caregivers aged 21-50.

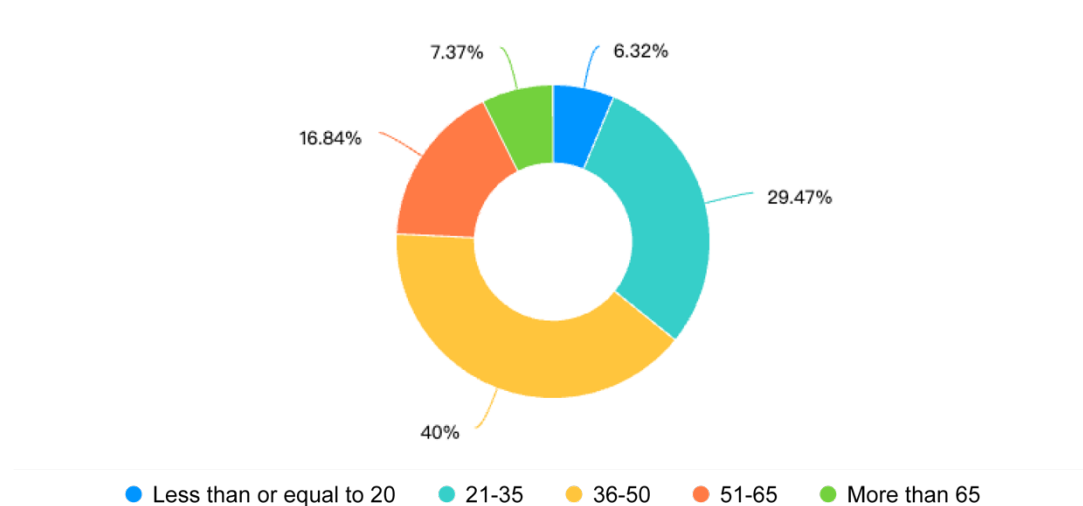


FIG.5.1 Age distribution

These data reflect the current dominance of young and middle-aged adult caregivers as users of public playgrounds but also reveal the low participation of older people. Older people and

grandparents generally agree that playgrounds should be designed more inclusively so as to accommodate users of various ages - which suggests public playgrounds should take more consideration into multigenerational use and create spaces which foster interaction among different generations; doing so would foster enhanced sense of participation from older users, meet diverse family member needs better while simultaneously enriching overall experience of playground usage.

5.1.1.2 Gender distribution

According to the data in Figure 5.2, among the respondents who completed the questionnaire effectively, the proportion of females was the highest, reaching 80 per cent; the proportion of males was 18.95 per cent; and the proportion of other genders was 1.05 per cent. This result shows that females are more active in children's playground activities or are more inclined to participate in such questionnaire surveys. The data reflects females play more important roles when caring for children as caregivers, and also indicates their critical role in children-related activities.

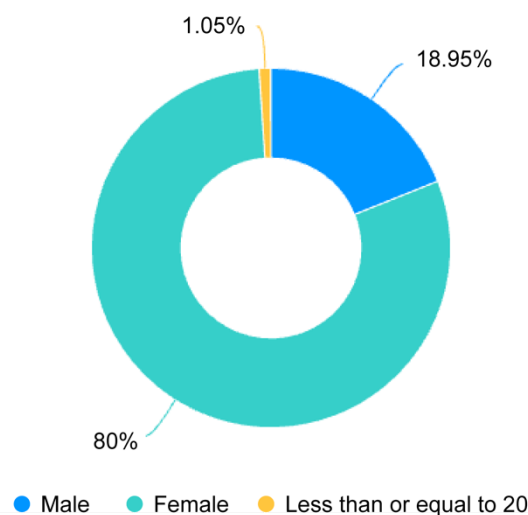


FIG.5.2 Gender distribution

Gender distribution patterns show the need to consider gender factors in designing public playgrounds. Since caregivers of different genders may have different needs and expectations of playgrounds, gender-sensitive design elements must be incorporated into the design process.

It includes providing facilities and spatial arrangements suitable for caregivers of different genders to ensure that playgrounds become public spaces where all genders feel comfortable and included.

5.1.1.3 Relationship to the child(ren)

According to the data in Figure 5.3, parents play the most crucial role in accompanying children in playground activities, accounting for as much as 61.05 per cent. It is followed by grandparents, accounting for 20 per cent, and designated caregivers (such as home assistants), accounting for 11.58 per cent. The proportions of other relatives and other people are relatively low, at 6.32 per cent and 1.05 per cent respectively. It shows that the prominent people accompanying children to the playground are parents, grandparents and designated caregivers such as home assistants.

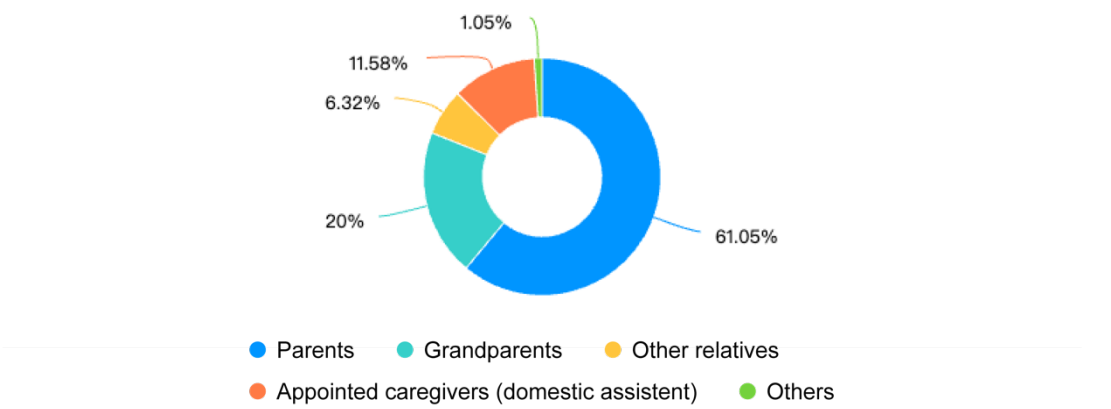


FIG.5.3 Relationship to the child(ren)

This data reflects the current composition of the primary users of public playgrounds and also reveals the degree of participation of different groups in accompanying children. Although parents and grandparents are the main accompanying groups, the relatively low participation of other family members and community members indicates that there is still room for improvement in the inclusive design of playgrounds. Design of playgrounds should consider the needs of various groups, particularly community members and non-core family members

such as family assistants. Such an approach expands playground usage while encouraging socialization and integration.

The results are in keeping with those identified by an age distribution analysis and underscore the significance of considering all user needs when designing public playgrounds. Facilities and spatial arrangements must provide comfortable experiences for all accompanying roles to create an inclusive public playground experience.

5.1.2 Respondents’ evaluation of inclusive playground design

5.1.2.1 Purpose of visiting the playground

According to the data in Figure 5.4, the primary purpose of most respondents’ visits to playgrounds was to play with their children (91 responses), followed by enjoying nature (45 responses) and relaxing (41 responses). There were also other noteworthy purposes, such as exercising (33 responses), family gatherings (18 responses) and educating children (15 responses).

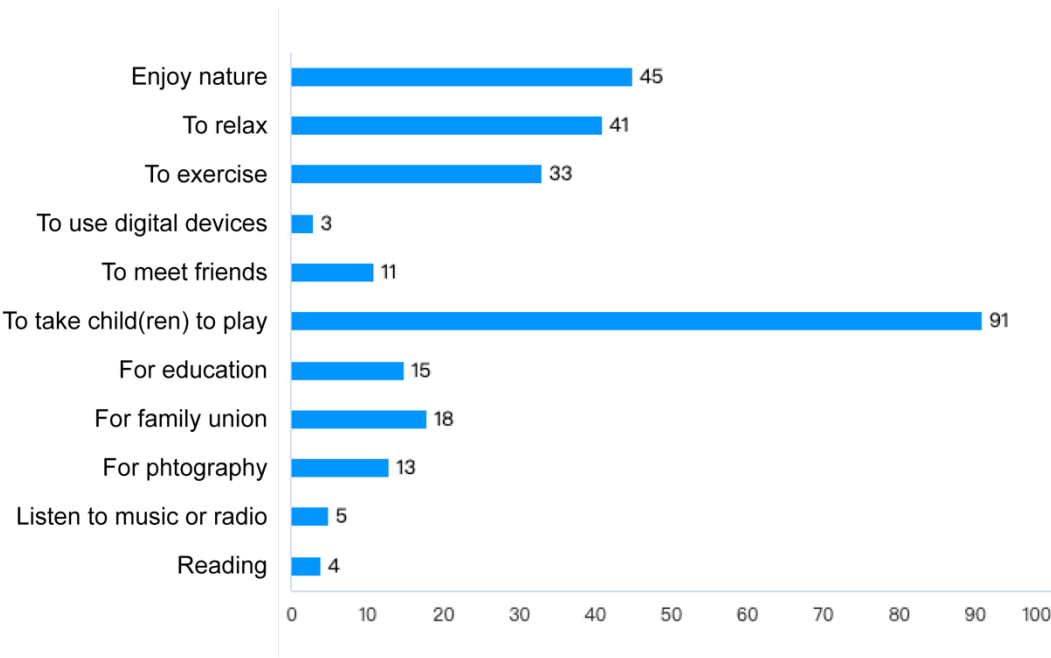


FIG.5.4 Purpose of visiting the playground

The data shows that although playing with children is the main reason respondents go to the playground, they have other significant reasons for choosing it. In addition to the function of children's activities, the playground, as a public space, also plays multiple roles in relaxation, closeness to nature, and physical exercise. It shows that the public not only sees the playground as a place for children to but also as a place for adults to relax and socialise. Further analysis found that the emergence of purposes such as exercise, family gatherings and child education reflect people's demand for the diverse functions of playgrounds.

5.1.2.2 Perceptions on who the playground is designed for

According to the data in Figure 5.5, most respondents (94 responses) believe that playgrounds are primarily designed for children. It indicates that the existing playground design is child-centric, consistent with the traditional playground design concept.

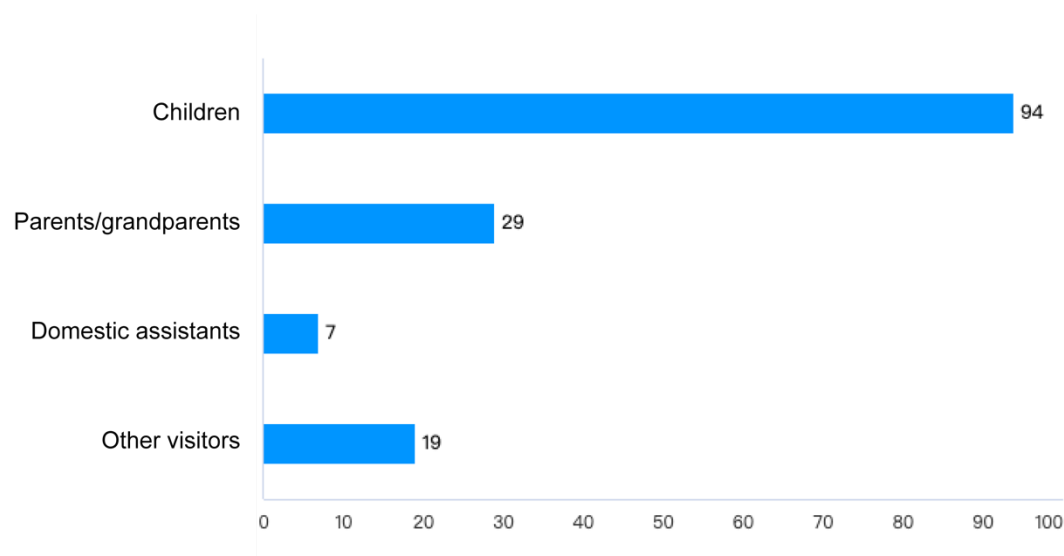


FIG.5.5 Perceptions on who the playground is designed for

However, about 29 respondents believe that playgrounds should also meet the needs of parents or grandparents, which indicates that some people are aware that playgrounds should provide appropriate facilities and environmental support for adult caregivers who accompany children, although this view is not mainstream. 19 respondents believed that playgrounds should welcome additional visitors, illustrating that playgrounds are part of their communities' public

space and can provide service for a more comprehensive social group. Only seven respondents agreed with this statement, suggesting current playground designs do not cater sufficiently to professional caregivers like domestic assistants. This evidenced how current designs might not adequately satisfy these professionals' needs.

From these data, it can be seen that playgrounds fulfil four key spatial roles in their design:

1. For **children**, the playground is a **play space** consistent with the traditional function of the playground.
2. For **parents or grandparents**, the playground is **an inter-generation/multi-generation space** that meets their needs for rest and social interaction during the accompanying process.
3. For **other visitors**, playgrounds serve as **community space** that facilitate more social and interactive functions.
4. For **professional caregivers** (e.g. domestic assistants), playgrounds act as workspaces for supervision and childcare.

Although most people believe that the playground design is child-centred, it also shows that the playground plays its due role in providing activity space for its primary users, children. However, fewer respondents felt that playgrounds should also consider the needs of adults, suggesting that future playground design should pay more attention to the experience of adult users. For example, more seating, social spaces or adult fitness equipment could be added to enhance the functionality and inclusiveness of playgrounds. In addition, only a few people currently feel that playgrounds should meet the needs of caregivers such as family assistants, suggesting that the inclusiveness of these users in playground design still needs to be adequately considered.

5.1.3 Respondents' current experiences and future expectations

5.1.3.1 Desire to play with children

As shown in Figure 5.6, most respondents (88 people, 92.63 per cent) expressed a desire to participate in games with their children in the playground. It indicates that respondents are strongly interested in engaging in activities with their children and are inclined to interact with them in the playground. Only seven respondents (7.37 per cent) showed signs of disinclination toward play activities with their offspring which may reflect differences in interests, physical abilities or participation preferences between observers and participants.

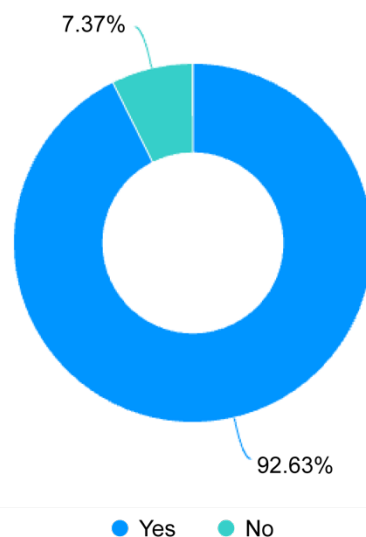


FIG.5.6 Desire to play with children

Most respondents had a positive attitude towards playing with children, reflecting the importance of parent-child interaction and family relationships. The data shows that playgrounds should be designed to fully consider the needs of parent-child interaction, including creating spaces and facilities to promote parental-child interactions like interactive equipment and multi-generational play areas so families have more opportunities for joint activities together. It will not only enhance the family-friendliness of the playground, but also

attract more families to participate, thereby enhancing the social inclusiveness and utilisation of the playground.

5.1.3.2 Current activities in the playground

According to Table 5.7, the main activity of most interviewees (79 people) at the playground was accompanying their children. At the same time, they played, which is consistent with their strong desire to participate in their children’s play actively. Many interviewees also used the playground to relax and enjoy the natural environment (41 and 39 people, respectively), which shows that the playground is not only a space for children to play but also a multi-purpose place for leisure and natural enjoyment.

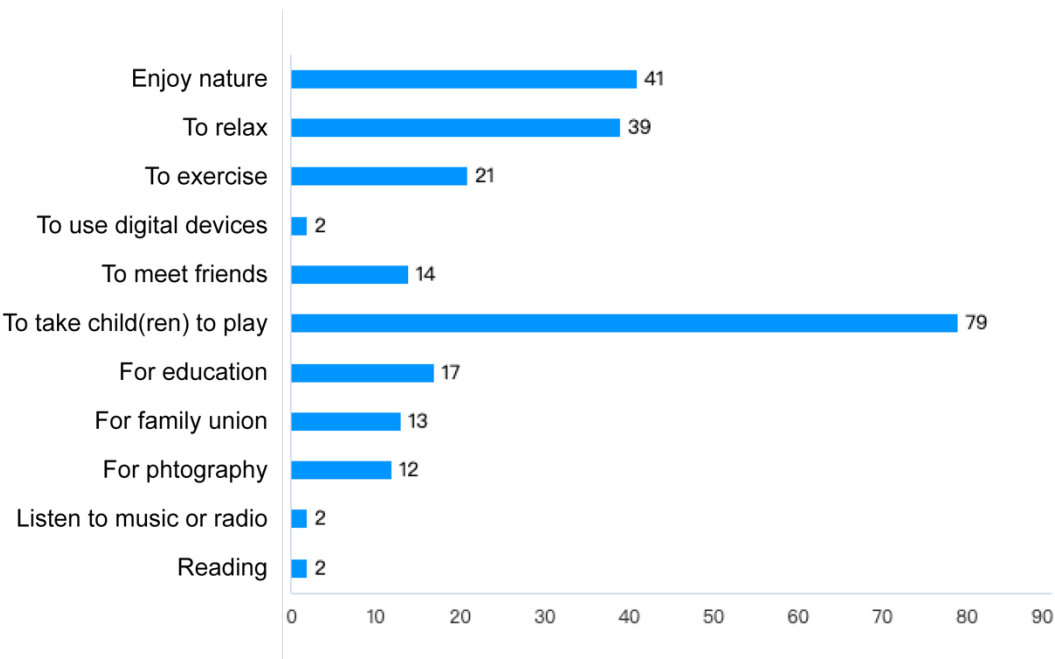


FIG.5.7 Current activities in the playground

In addition, 21 respondents said they used playgrounds for physical exercise, which shows that playgrounds also play a role in adult fitness activities. Seventeen respondents saw playgrounds as a good opportunity to educate children, suggesting that the design could consider educational elements. Fourteen respondents saw playgrounds as social places to meet friends, which further emphasises the importance of playgrounds as community social centres.

These data confirm that ‘playgrounds are not just places for children to play’. Playgrounds fulfil multiple functions for children’s play and leisure, getting close to nature, fitness and socialising. As a result, future playground design should take these multiple purposes into account and support various activities by offering amenities like comfortable seating areas with shaded areas for gatherings of different age groups as well as community interaction spaces aimed at reaching a broad range of users.

5.1.3.3 Factors influencing interaction with children

Figure 5.8 presents key factors affecting interactions with children on playgrounds. ‘Facilities’ playfulness’ (28 respondents) and ‘willingness of child(ren)’ to participate are identified as two of the primary motivating factors affecting adult-child interactions on playgrounds, suggesting that appealing and well-designed play equipment is important in encouraging interactions between adults and children, improving both their quality and frequency of interactions between parents and children.

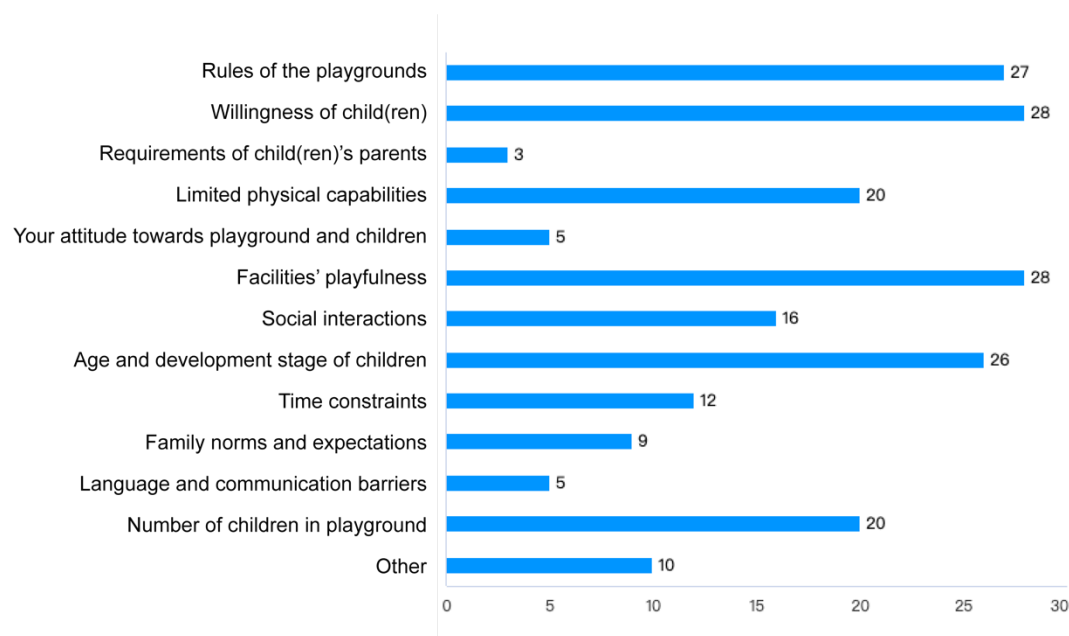


FIG.5.8 Factors influencing interaction with children

Meanwhile, 20 respondents mentioned that physical ability restrictions as hindering their interaction with children, while 27 respondents believed that playground rules prevented

interaction This result indicates that playground design must be more inclusive and flexible to accommodate users of different physical abilities while striking a balance between safety and freedom of play - thus creating an inclusive playing environment where users with physical conditions such as arthritis can find ways to play that suit them all. Adaptive designs could help achieve this balance to create a flexible play space suitable for everyone who visits it.

In addition, 26 respondents also pointed out that children's age and developmental stage were important components of playground design that contribute to its interactive effect, meaning playground designers must consider these needs when designing playgrounds for different age groups of children, providing amenities tailored to each age group so all can take full advantage of their play space. An age-appropriate design not only meets children at various developmental stages but also effectively fosters interaction between various age groups as well as adults.

Therefore, when designing playgrounds, it is imperative that special consideration be paid to inclusiveness and accessibility. As the data shows, factors such as physical ability and the fun factor indicate that inclusive design should cover different age groups and user groups with different physical abilities. Playgrounds should encourage interaction with a broader range of users by improving accessibility and providing various equipment. The design also needs to find a balance between structure and flexibility. The impact of playground rules on interaction shows that the design should allow for more accessible forms of play while ensuring safety and exploring the balance between safety and freedom.

5.1.4 Design strategies based on survey

The survey results show that playground users are not limited to children. A solely child-centric design is unlikely to meet diverse needs. The experience of the adults accompanying children – such as parents, grandparents and family helpers – has an important indirect impact on children's experience in the playground. Their needs and purposes reflect the multifunctional characteristics that define playgrounds as social environments. As public spaces, playgrounds must promote positive interactions between children and adults while offering various facilities and spaces that meet the needs of different users. Such a design can make the playground a

place with more community functions, promote active participation and social interaction, and create an inclusive atmosphere.

Based on the above findings, design strategies to enhance the inclusiveness of playgrounds can be explored from two aspects: **multi-generational design** and **the needs of specific groups**.

(1) Multi-Generational Design

Research shows that older people and grandparents, in particular, have high expectations regarding playground designs that meet all generations. They want playgrounds that not only meet the activity needs of children but also provide suitable activity spaces for adults, especially older people and other family members who accompany children. Therefore, future playground design should pay more attention to the use of multi-generational families and enhance the inclusiveness of playgrounds by introducing design elements suitable for different age groups. For example, adult-friendly amenities such as comfortable seating, shaded rest areas and fitness equipment designed for adults can be added. These facilities not only provide adults and older people with suitable places to exercise but also encourage them to actively take part in playground activities while accompanying children, thus strengthening interaction between themselves and children. In addition, intergenerational play areas, such as sizeable interactive play equipment, outdoor musical instruments or garden areas, can be set up to provide a shared play experience for family members of different ages. These areas not only attract users of different age groups, but also promote interaction and communication among family members through common activities, thus enhancing family cohesion and social integration.

(2) Addressing Demographic-Specific Needs

While designing for multigenerational use, playgrounds also need to consider the specific needs of different user groups, especially the experience of primary caregivers such as family assistants and grandparents. They often require comfortable rest areas, convenient sanitary facilities, and a spatial layout that facilitates the supervision of children. Therefore, playground

design should provide facilities that specifically meet these needs, such as shaded rest areas, convenient access to toilets, and seating arrangements with an open view, to improve their experience and fulfil their supervisory responsibilities more effectively.

In addition, caregivers of different genders may have different preferences and needs when using playgrounds. Therefore, gender-sensitive elements should be incorporated into the design better to meet the different needs of male and female caregivers. For example, activity areas that better more in line with the preferences of male caregivers can be set up, or more private and comfortable spaces for rest and communication can be provided for female caregivers to improve the overall inclusiveness and user experience of the playground.

In summary, inclusive playground design should meet diverse needs and consider the specific requirements of users of different generations, genders and roles. Improving the inclusiveness and versatility of playground design will better serve all users and strengthen its role as a community public space, promote social interaction and integration, and provide community members with a richer public life experience.

5.2 Informal interview results and analysis

Based on the survey findings in Phase I, which revealed that adult stakeholders—particularly caregivers and support staff—face multiple unmet needs in playground settings, the informal interviews were designed to delve deeper into the motivations, tensions, and emotional realities behind these findings. While the survey provided quantitative overviews of satisfaction levels and general concerns, interviews offered a qualitative lens to understand how these needs are shaped by everyday routines, embodied experiences, and social roles. In this way, the interview stage functioned as a focused elaboration of themes surfaced in the survey, enabling a contextual understanding of playground use from the stakeholder perspective.

This informal interview focused on three selected playgrounds and targeted all significant groups in the core stakeholder circle, with a total of 35 interviewees (see Appendices IV for details). Of these, 29 were primary caregivers related to children, including parents,

grandparents, nannies and other primary caregivers caring for children aged between 2 and 10. Another six are security and cleaning staff in the three study areas. The purpose of this interview was to explore the expectations and needs of different stakeholders for playgrounds.

The interviews with primary caregivers were divided into two parts: first, as caregivers of children, what were their concerns and main issues regarding playgrounds; second, as individuals, what were their own needs and expectations for playgrounds. The results showed that most interviewees said they took their children to the playground once or twice a week, and some even went daily. The frequency of playground use mentioned in the interviews was usually affected by the weather and family schedules. For the staff working in the playgrounds (such as security guards and cleaners), the interviews focused on their concerns and expectations in this work environment. The interviewees were mainly from Hong Kong, and there were also a few migrants from mainland China and other countries.

5.2.1 Stakeholder interview analysis

To provide an in-depth analysis of the content of the interview transcripts, a systematic approach was used to review the interview data to identify recurring themes, concepts and the frequency of use of specific terms. This method quantifies the qualitative data, thereby revealing the general concerns and emotional expressions of the interviewees. The analysis was divided into key categories to gain a comprehensive understanding of the expectations of parents and carers and the areas in which playgrounds may need to be improved.

In the specific content analysis, each interview transcript was first coded to identify recurring keywords and phrases mentioned by respondents, such as 'safety,' 'facilities,' 'social,' and 'comfort,' which represent the core concerns of respondents. Next, the most prominent themes and issues among the respondents were identified by calculating the frequency of occurrence of each keyword. Similar keywords and phrases were then grouped into broader categories, such as 'safety concerns' includes 'protective measures,' 'fall prevention,' 'facility safety,' etc. Finally, by analysing the relationships between the various categories and the patterns of their occurrence, potential trends and focal issues in the interview texts were revealed.

The frequency analysis of keywords and phrases (see Table 5.1) shows that ‘safety’ was the most frequently mentioned word by interviewees, appearing 48 times, reflecting the high level of concern among parents and caregivers about playground safety. ‘Facilities’ (40 times) and ‘social’ (35 times) also appeared frequently among interviewees, indicating their desire for playgrounds to provide various facilities and foster children's social development. ‘Hygiene’ (11 times), ‘shade’ (3 times) was frequently mentioned, showing caregivers’ importance of having comfortable playground environments that promote social development of their children.

TABLE 5.1 Frequency analysis of keywords and phrases

Keyword/Phrase	Frequency	Category
Safety	48	safety concerns
Facilities	40	variety and appropriateness of facilities
Social	35	social and developmental opportunities
Hygiene	30	comfort and environmental conditions
Shade	28	comfort and environmental conditions
Interaction	26	variety and appropriateness of facilities
Time	24	play time and frequency
Environment	22	comfort and environmental conditions
Outdoor	20	variety and appropriateness of facilities
Social skills	18	social and developmental opportunities

Based on the results, the respondents’ concerns can be divided into the following five main categories and themes:

(1) Safety concerns

Keywords include: ‘safety’, ‘fall prevention’, ‘protective measures’, ‘facility safety’, and ‘supervision’. Interviews revealed that parents and caregivers are concerned about the safety of playground equipment, the adequacy of protective measures, and the potential risks involved in children’s activities. In particular, they have precise requirements regarding facility safety and supervision measures.

(2) Variety and appropriateness of facilities

Key words included: ‘facilities’, ‘interaction’, ‘slides’, ‘climbing frames’, ‘swings’, ‘outdoor’, and ‘age-appropriate equipment’. Respondents wanted playground facilities to be more diverse and

age appropriate. They wanted facilities that appealed to younger children and provided enough challenge and appeal for older children.

(3) Comfort and environmental conditions

Keywords include: 'hygiene', 'shade', 'rest areas', 'environment' and 'cleanliness'. During the interviews, caregivers expressed a high level of concern about the cleanliness of the playground, shade facilities and overall environmental comfort. Especially in hot weather, they have high expectations for providing adequate rest areas and shade measures.

(4) Social and developmental opportunities

Keywords include: 'social', 'interaction', 'social skills', 'cooperation', and 'social opportunities'. Interviews show that parents and caregivers believe playgrounds are essential in promoting children's social skills and physical development. They hope that children can learn to cooperate, communicate, and solve problems through play activities, thereby improving their social adaptability and cognitive abilities.

(5) Play time and frequency

Keywords include: 'time', 'frequency', 'daily', 'weekly', and 'after school'. The frequency and duration of playground use varied according to family schedules and weather conditions. Most families chose to go to the playground after school or on weekends, and the duration of play ranged from 30 minutes to 3 hours.

Considering that the time and frequency of playground use are affected by a variety of factors, such as the weather, family schedules, children's interests and parental permission, which are not entirely within the control of the playground itself, the four categories mentioned above will be used as the basis for the next part of the discussion to specifically analyse the main concerns and issues of child carers at the playground.

5.2.2 Playground issues from caregiver's perspective

This section will provide a detailed analysis of the interview content based on the four categories extracted from the previous section.

5.2.2.1 Safety concerns

TABLE 5.2 Safety concerns analysis

Quotas	Facts	Issues
'Some [equipment] have no barriers, and if it's too low, kids could hit their heads.' (P2)	Insufficient protective barriers	Inadequate equipment design
'The equipment isn't very durable; it gets dirty or damaged quickly. There's not much maintenance.' (P3)	Poor durability and cleanliness	Inadequate equipment maintenance
'He likes running around with other kids, but it gets dangerous when it's too crowded.' (P3)	Overcrowding	Safety risks due to crowding
'A lot of the equipment here is often broken, and repairs take too long. It feels like management isn't priority.' (P5)	Slow repair response	Poor maintenance management
'It's too crowded, and kids end up pushing each other.' (P6)	Overcrowding	Safety risks due to crowding
'Safety is an issue. Some kids don't follow the rules.' (P8)	Rule-breaking behaviour	Insufficient supervision
'She likes to play with others, but I worry when older kids get rough. It can be intimidating.' (P9)	Rough play behaviour	Insufficient supervision
'Some equipment is a bit damaged, or repairs aren't done quickly. Rust could cause injuries.' (P10)	Damaged and rusted equipment	Poor maintenance management
'Some of the equipment looks worn out and unstable. I'm nervous to let my child play on it.' (P11)	Unstable and worn equipment	Poor maintenance management
'Safety is the most important thing. I have to watch closely because sometimes kids push each other.' (P11)	Rough play behaviour	Insufficient supervision
'There aren't enough barriers to prevent falls. I get anxious every time we come here.' (P12)	Insufficient safety barriers	Inadequate equipment design
'There are areas where I can't see my child, and it makes me uncomfortable.' (P14)	Poor visibility	Insufficient supervision
'It gets too crowded sometimes, and I worry about safety. It's hard to keep track of my child.' (P17)	Overcrowding	Safety risks due to crowding
'It's stressful when older kids play roughly around younger ones. I'm always worried about accidents.' (P17)	Rough play behaviour	Insufficient supervision
'The playground is too close to the road, and there are no proper barriers. I'm always worried about the open gates.' (P18)	Proximity to traffic	Inadequate safety barriers
'Some of the equipment is rusty. It could be dangerous and poses a health risk.' (P19)	Rusted equipment	Poor maintenance management

'Some facilities are <u>rusty</u> and could easily hurt children. They need prompt maintenance.' (P20)	Rusted equipment	Poor maintenance management
'I worry about <u>bullying and rough play</u> because there's not enough supervision. It makes me anxious.' (P21)	Bullying and rough play behaviour	Insufficient supervision
'It's stressful watching kids <u>run around without much control</u> . I'm always worried about accidents.' (P22)	Lack of control in play areas	Insufficient supervision
'The ground gets <u>very slippery</u> when wet. It's dangerous, and I'm always worried someone might get hurt.' (P23)	Slippery surface	Unsafe equipment design
'These facilities have been <u>used too long</u> , and some parts <u>aren't safe</u> , especially the slides and climbing equipment.' (p23)	Unsafe equipment	Poor maintenance management
'I'm always on edge because the playground is <u>too close to the street</u> . I'm afraid the child could run into traffic.' (P25)	Proximity to traffic	Inadequate safety barriers
'It's <u>hard to see</u> what's going on in some parts of the playground. It's <u>difficult to keep an eye on</u> the kids.' (P25)	Poor visibility	Insufficient supervision
'Some of the equipment looks like it <u>hasn't been cleaned</u> in a while. You don't know what germs might be on it.' (P27)	Unhygienic equipment	Poor maintenance management
'The playground is too small and feels <u>crowded</u> . I'm worried about kids running into each other.' (P27)	Overcrowding	Safety risks due to crowding
'The playground is <u>too close to the road</u> , and there <u>aren't enough barriers</u> . It makes me very uneasy.' (P27)	Proximity to traffic	Inadequate safety barriers
'Some of the equipment looks really <u>old</u> and <u>worn out</u> . I'm nervous to let my grandchild play on it.' (P28)	Unsafe and old equipment	Poor maintenance management

Interviewees unanimously agreed that **safety** is the most critical issue in playgrounds, as interviewee P1 said: 'Safety, the most important thing is safety.' Caregivers are generally concerned about the improper design, maintenance, and management of playground equipment. The lack of adequate supervision measures may threaten children's safety. Parents have noted that some playground equipment lacks protective measures such as inadequate guardrails or structures too low, leading to collisions or falls while in use. Old equipment with rust, old parts and lack of timely maintenance also remain significant concerns among them. They believe inadequate equipment maintenance affects children's play experience and, more importantly, increases the risk of injury during use.

Regarding site management, **overcrowding and playgrounds near roads without practical safety barriers** are worrying issues. Caregivers are concerned that too many children using the play equipment simultaneously can easily lead to chaos and collisions, especially when older and younger children share the same space, leading to conflicts and accidents. In addition, when the playground is close to a busy road and lacks safety gates and

fences, they must be constantly alert for children who may suddenly run onto the road. In this situation, parents can hardly relax and are always in a state of high tension.

Inadequate supervision and safety monitoring are also frequently mentioned problems by caregivers. They said there is a lack of adequate supervision of children's behaviour management in the playground, mainly when older and younger children are engaged in activities together, which can easily lead to disputes and conflicts. In addition, there are blind spots in the playground, and parents feel uneasy because they cannot always watch their children. Therefore, due to these safety risks, carers are always on high alert when accompanying their children to play. They cannot wholly relax for fear that an accident may occur if they are not careful. In short, all aspects of playground design and management need to be further optimised to ensure the safety of children and peace of mind for carers.

5.2.2.2 Variety and appropriateness of facilities

TABLE 5.3 Variety and appropriateness of facilities analysis

Quotas	Facts	Issues
'The facilities are fine, but there aren't many options. It could be more diverse.' (P2)	Lack of variety in play options	Insufficient play diversity
'There's <u>not much variety</u> . <u>More options</u> would keep the kids interested.' (P3)	Lack of variety in play options	Insufficient play diversity
'There's <u>not much choice</u> here. My kids get bored because there's <u>nothing new or exciting</u> .' (P5)	Lack of variety in play options	Insufficient play diversity
'Is he <u>falling</u> ? Some of the smaller equipment is <u>easy to fall from</u> .' (P7)	Unsafe for younger children	Inadequate age-appropriate design
'The playground feels very basic. There's <u>not much to stimulate their creativity</u> or keep them engaged.' (P10)	Limited creative play opportunities	Lack of interactive and creative elements
'He likes playing here, but <u>it gets boring after a while</u> . <u>More variety</u> would help.' (P11)	Lack of variety in play options	Insufficient play diversity
'The equipment is more suitable for older kids; there's <u>not much for younger ones</u> .' (P12)	Inadequate options for younger children	Lack of age-appropriate facilities
'The playground is okay, but it <u>could be more exciting with innovative structures</u> .' (P13)	Lack of innovative play options	Lack of innovative design

'My child is too young, and <u>some facilities aren't safe for him.</u> ' (P14)	Unsafe for younger children	Inadequate age-appropriate design
'There <u>aren't many options for toddlers.</u> ' (P14)	Lack of variety in play options	Insufficient play diversity
'Some facilities are <u>too high for younger children</u> and could <u>cause falls.</u> ' (P18)	Unsafe for younger children	Inadequate age-appropriate design
'Older kids dominate the playground, making it <u>hard for younger ones to join.</u> ' (P18)	Limited opportunities for younger children	Lack of age-appropriate facilities
'The playground could use <u>more variety, especially for sensory play and dynamic activities.</u> ' (P19)	Lack of sensory play options	Insufficient sensory stimulation
'The playground <u>needs more variety.</u> Kids <u>get bored</u> playing on the same equipment.' (P21)	Lack of variety in play options	Insufficient play diversity
'The equipment is either <u>too hard for young kids</u> or <u>too easy for older ones.</u> ' (P22)	Not suitable for children of all ages	Inadequate age-appropriate design
' <u>Interactive facilities</u> like sound walls or touch panels would enhance the learning experience.' (P24)	Limited interactive play options	Lack of interactive and creative elements
'There's <u>not enough variety</u> here. Kids need more activities that challenge them physically and mentally.' (P25)	Lack of challenging play opportunities	Insufficient play diversity
'There <u>aren't enough facilities</u> or <u>play options</u> ; it feels <u>monotonous.</u> ' (P26)	Lack of variety in play options	Insufficient play diversity
'Most of the equipment is <u>too big or advanced</u> for young kids.' (P27)	Unsafe for younger children	Inadequate age-appropriate design
'The playground is <u>missing sensory elements.</u> It's too focused on physical play.' (P28)	Lack of sensory play options	Insufficient sensory stimulation
' <u>Adding sensory facilities</u> like water play area or a sensory garden is important for children.' (P29)	Lack of sensory play options	Insufficient sensory stimulation

The interview results show that caregivers generally believe that playground facilities need to be improved and suitability. Most existing facilities are designed for a specific age group and need more overall appeal for children of different ages and developmental stages. Younger children have limited options, and the safety of some equipment does not meet their needs; for

older children, existing facilities need to provide sufficient challenge, and they lose interest after a short period.

Caregivers hope playgrounds can introduce more interactive and creative facilities, such as sensory play equipment and interactive learning facilities, to stimulate children's creativity and imagination. They believe that a single form of play will gradually reduce children's interest in playgrounds, especially as they age. Simple and repetitive facilities can hardly meet their expanding needs for exploration and learning. Therefore, providing a rich and diverse play experience for children of different ages and improving the interactivity and creativity of facilities are the key directions for the future design and improvement of playgrounds.

5.2.2.3 Comfort and environment conditions

TABLE 5.4 Comfort and environmental conditions analysis

Quotas	Facts	Issues
'I often see litter around, and it worries me. I want my child to play in a clean and safe environment.' (P11)	Litter present	Poor cleanliness
'There aren't enough shaded areas. It's unbearable on hot days, and not healthy for kids to be in the sun for so long.' (P12)	Lack of shaded areas	Sun exposure risk
'The sand in the sandbox looks dirty. I doubt it's cleaned often.' (P14)	Dirty sandbox	Poor cleanliness
'The air feels dusty, especially when there's construction nearby. It's not good for the kids' health.' (P15)	Dust from construction	Poor air quality
'The restrooms are often dirty and not well-maintained.' (P16)	Dirty restrooms	Poor hygiene
'There are too many insects near the trash bins. I worry about my child getting bitten.' (P17)	Insect infestation	Pest control issues
'The sandbox and water play areas often have standing water, which can breed bacteria and cause infections.' (P20)	Standing water	Health risk
'There's often litter on the playground, and I'm worried kids might pick up something harmful.' (P21)	Litter present	Poor cleanliness
'It's hot here, and the kids get tired quickly. It would be great to have more cool places to rest.' (P24)	Lack of shaded areas	Sun exposure risk
'The restrooms are always dirty. It's hard to maintain hygiene when facilities aren't clean.' (P25)	Dirty restroom	Poor hygiene
'The kids get thirsty after playing, but there aren't enough water fountains.' (P26)	Lack of drinking water facilities	Insufficient hydration
'There are too many mosquitoes and flies here. It's uncomfortable and could be dangerous if my kid gets bitten.' (P26)	Insect infestation	Pest control issues
'There's nowhere to properly clean your hands after playing. This makes it easy to spread germs.' (P29)	Lack of handwashing facilities	Poor hygiene

Caregivers generally expressed concerns about the environmental comfort and hygiene conditions of playgrounds. Interviews revealed that poor cleaning conditions, untimely garbage removal, worrying hygiene conditions of facilities such as sand pits, and poorly maintained public toilets have seriously affected the overall experience. In addition, the lack of hand-washing facilities and drinking fountains facilities prevented children from performing basic hygiene after playing, potentially increasing risk for bacterial transmission.

Playgrounds often lack adequate shade in hot weather, leaving children exposed to heatstroke and sunburn for extended periods. Furthermore, playgrounds located near heavy traffic or construction sites often suffer from poor air quality; pollution damages children's respiratory health while raising parents' worries.

Pest control was another frequent theme during interviews. Caregivers generally reported many mosquitoes and other insects in the playgrounds, especially near rubbish bins and other areas, and the problem was severe in the summer. Mosquito bites not only cause skin discomfort but can also trigger allergic reactions, which pose a threat to children's health. Caregivers' hope playground management can take more effective pest control measures to ensure children can play in a safe, clean and comfortable environment.

In summary, there is an urgent need for improvement in environmental hygiene management, infrastructure construction and health and safety protection in playgrounds. Therefore, measures like improving cleanliness, adding sanitary facilities and strengthening pest control will give children a healthier and safer playing environment, alleviating caregiver worries at the same time.

5.2.2.4 Social and developmental opportunities

TABLE 5.5 Social and development opportunities analysis

Quotas	Facts	Issues
‘He sometimes makes friends, but it’s not easy. More activities for kids to socialize would be great.’ (P6)	Lack of social play activities	Limited social interaction
‘I wish there were more chances for kids to play together. They often play alone because there aren’t enough group	Lack of group activities	Limited social interaction

activities.’ (P11)		
‘Most of the equipment here is designed for solo play. There should be more options that encourage kids to play together.’ (P12)	Individual-focused equipment	Limited social interaction
‘There aren’t many organized activities for the kids to join. Structured activities would help them learn to cooperate.’ (P13)	Lack of structured activities	Limited social interaction
‘My child often plays alone because there aren’t enough group activities that encourage interaction.’ (P15)	Lack of group activities	Limited social interaction
‘Social play is essential for my child’s development, but there’s not much here that supports it.’ (P17)	Lack of social play opportunities	Limited social interaction
‘There’s not much here to spark creativity or encourage kids to work together.’ (P23)	Lack of creative and collaborative activities	Limited social interaction

Interview results demonstrate that caregivers hold high expectations of playgrounds as environments for fostering children's social interaction and development, but current facilities and activity design must meet this need adequately. Most equipment currently only suitable for single player activities should encourage more group play equipment that encourages interaction and cooperation among children. Respondents generally hope that playgrounds can add more activities and structural facilities that promote social interaction, such as group games and cooperative tasks, to help children learn social skills, enhance their ability to cooperate and improve their problem-solving abilities through play.

Due to limited opportunities for interaction and cooperation, children often play alone in playgrounds, which is not a practical social and developmental experience. Caregivers believe that playgrounds should pay more attention to the configuration of diverse play equipment and the organisation of social activities in their design and management to enhance their support for children’s development. Specific improvements could include adding equipment that stimulates creativity/teamwork or designing game formats which promote interaction between children allowing them to naturally develop social skills/emotional ties naturally.

By examining interview content, it can be observed that caregivers’ concerns regarding playgrounds mostly revolve around three aspects: safety; diversity and suitability of facilities; and comfort and opportunities for social development. They expect playgrounds to create a

safer, more prosperous, more interactive environment through improved design and management practices that increase opportunities for comprehensive child development.

5.2.3 Individual needs and expectation

As seen in the preceding section, most caregivers' concerns when discussing playground use centred around child safety issues; however, playgrounds also serve as spaces where carers and adults can socialise and unwind after long days at work. Therefore, when we shift the perspective of the analysis from childcare to the individuals interviewed, their needs and expectations as individuals when using playgrounds should also be considered.

TABLE 5.6 Analysis of the needs and expectations of the caregiver as an individual

No.	Quotas	Issues	Needs	Theme
P2	'The space is fine, but when it <u>gets crowded</u> , it becomes <u>uncomfortable</u> , especially in hot weather.'	Overcrowding	Visitor management	Spatial management
P3	'There are <u>some plastic boards</u> ... In strong winds, they can be <u>blown over</u> , which is dangerous.'	Unsafe materials	Use durable materials	Surface safety
P4	'When it suddenly rains, <u>there isn't enough shelter</u> , and there <u>aren't enough places to sit</u> .'	Insufficient shelter and seating	Increase seating and shelter	Weather protection
P5	'The kids mostly play alone, and it's <u>hard for parents to connect</u> without group play or activities.'	Lack of group play spaces	Provide group-oriented equipment	Social interaction
P6	'It's difficult to <u>meet and talk with other parents</u> while the kids play. More ways to connect would be nice.'	Insufficient social spaces	Design spaces for parental interaction	Social engagement
	'It would be good to have drinking water stations too.'	Absence of drinking facilities	Install water fountains	Basic amenities
P7	' <u>Mosquitoes are a big issue</u> . I can't relax because I'm constantly <u>worried about getting bitten</u> .'	Pest issues	Implement pest control	Health and safety
	'There <u>isn't much shade</u> , and it gets very hot. It's easy to <u>get sunburned</u> .'	Lack of shade	Increase shaded areas	Weather protection
	'I sometimes <u>feel isolated</u> here; there <u>aren't many opportunities to interact with other parents</u> .'	Lack of social interaction	Design spaces for social engagement	Social engagement
P9	'The <u>cleanliness and facilities vary a lot</u> between playgrounds. Some are well-maintained, others are not.'	Management inconsistency	Standardize maintenance	Operational management

	'It's <u>stressful when conflicts arise between kids</u> ; parents could use more support in these situations.'	Lack of conflict management	Provide conflict resolution support	Parental support
	'There's a lack of <u>drinking water and restrooms</u> nearby, which is inconvenient.'	Inadequate amenities	Improve access to basic facilities	Basic amenities
P10	'Some playgrounds <u>don't have enough public restrooms</u> , which can be a problem.'	Lack of restrooms	Increase restroom facilities	Basic amenities
P11	'It bothers me when I see <u>litter around</u> . I want to relax in a clean environment, but sometimes it's not possible here.'	Poor waste management	Enhance waste disposal	Cleanliness and maintenance
	'The playground <u>isn't well-maintained</u> . There's <u>litter</u> , and <u>some equipment is broken</u> .'	Neglect in upkeep	Regular maintenance	Infrastructure maintenance
	'There <u>aren't enough places to sit</u> . It's hard to relax when I have to stand the whole time.'	Insufficient seating	Add more seating areas	Seating and comfort
P12	'I'm worried about tripping or falling because there <u>aren't enough barriers</u> .'	Insufficient safety barriers	Install protective barriers	Safety infrastructure
	'Safety issues <u>take weeks to get fixed</u> . It feels like <u>management isn't paying attention</u> .'	Management inaction	Proactive issue resolution	Operational management
	'It's hard to stay here long <u>without shade</u> . It's uncomfortable, especially on hot days.'	Lack of shade	Increase shaded areas	Weather protection
	'It's frustrating when there <u>aren't any restrooms</u> nearby. I have to leave the playground if I need to use the facilities.'	Lack of nearby restrooms	Improve restroom proximity	Basic amenities
	'There aren't many spaces or activities that <u>encourage socializing</u> . It's mostly just watching our kids play.'	Lack of social spaces	Create social interaction zones	Social engagement
P13	'I feel tense when it's wet because <u>the ground is slippery</u> , and I'm afraid I might slip.'	Unsafe surfaces	Use slip-resistant materials	Surface safety
	'It's frustrating when <u>parts of the playground are closed without any warning</u> . There's <u>no clear communication</u> from management.'	Poor communication	Improve information dissemination	Visitor communication
	'It's <u>hard to meet and talk with other parents</u> here. There <u>aren't any spaces designed for us to interact</u> .'	Lack of social spaces	Design social interaction zones	Social engagement
	'There's <u>no place to get drinking water</u> , and it's inconvenient to always bring my own.'	Lack of water stations	Install drinking fountains	Basic amenities
P14	'Some parts of the playground <u>aren't well-lit</u> or are <u>blocked by equipment</u> , which makes me feel uneasy.'	Limited visibility	Improve lighting	Safety and visibility
	'It <u>seems like no one enforces the rules</u> here. It	Insufficient rule	Strengthen	Safety

	feels like the <u>management is absent</u> , making the playground less safe.'	enforcement	management oversight	management
	'There's <u>almost no shade</u> here, and it's uncomfortable to stay for long when it's hot.'	Lack of shade	Increase shaded areas	Weather protection
	'Everyone seems to stay in their own world. It would be nice if there were more ways to interact with other parents.'	Limited social interaction	Create social engagement zones	Social engagement
P15	'There <u>aren't enough trash bins</u> around. It's <u>inconvenient</u> to hold onto trash until i find one.'	Lack of waste facilities	Increase trash bins	Waste management
	'I mainly worry about conflicts between kids. The playground is generally safe, but I feel <u>management hasn't thought about how to handle it.</u>	Lack of conflict resolution	Provide parental support	Parental support
	'I'm <u>uncomfortable with the air quality</u> here, especially when there's construction nearby. It's not a pleasant place to spend time.'	Poor air quality	Implement air quality measures	Environmental quality
	'There's <u>not much encouragement for parents to interact</u> here. We end up just sitting alone, watching the kids.'	Lack of social spaces	Design parental engagement areas	Social engagement
P16	' <u>Restrooms are often dirty or lacking supplies</u> . It makes me hesitant to come here.'	Poor restroom conditions	Regular maintenance	Cleanliness and maintenance
	'I often <u>feel alone</u> here because <u>there's no real way to meet and interact with other parents.</u>	Lack of social interaction	Design parental interaction spaces	Social engagement
P17	'It's hard to enjoy myself here with <u>so many insects</u> . It's <u>uncomfortable and annoying.</u>	Pest presence	Regular pest control	Health and safety
	'The playground <u>doesn't feel welcoming</u> . There's <u>no sense of community</u> among parents.'	Lack of welcoming environment	Create social spaces	Social engagement
P18	'It feels like management doesn't listens to <u>feedback or complaints</u> . Issues just don't get addressed.'	Lack of responsiveness	Improve feedback systems	Operational management
	'There's <u>nowhere to store my things safely</u> , so I have to carry everything with me.'	Lack of storage	Provide storage facilities	Visitor amenities
	' <u>The noise and pollution</u> from the road make it hard to relax. It's not an enjoyable place.'	Environmental pollution	Implement noise reduction measures	Environmental quality
P19	'The <u>rusty equipment looks bad</u> and makes me uneasy. It doesn't feel safe or welcoming.'	Equipment deterioration	Regular maintenance	Infrastructure safety
	'Some areas are well-maintained, but others are neglected. It's <u>inconsistent</u> and makes me question the management.'	Inconsistent management	Standardize maintenance practices	Operational management

	'It's <u>hard to find a place to sit and eat</u> . More picnic tables would be helpful.'	Lack of dining space	Provide picnic tables	Visitor amenities
P20	'There <u>aren't any clear safety instructions</u> . It feels like I'm in an unsafe without knowing the rules.'	Absence of safety guidelines	Display safety rules	Safety and management
	'There's <u>nowhere comfortable to sit</u> , and it gets <u>too hot</u> here in the summer.'	Lack of shaded seating	Add shaded seating	Seating and comfort
	'It's uncomfortable to stay here for long <u>without anywhere to sit or escape the sun</u> .'	Inadequate seating and shelter	Improve seating and shelter	Weather protection
P21	'I feel uncomfortable when there's <u>trash around</u> . It doesn't make for a pleasant environment.'	Poor waste management	Regular waste disposal	Cleanliness and maintenance
	'I feel uneasy when <u>there isn't enough supervision</u> . I worry about what might happen if things get out of hand.'	Lack of rule enforcement	Strengthen safety oversight	Safety management
P22	'I've <u>reported</u> safety issues before, <u>but it takes too long for anything to happen</u> . It feels like they don't care about our safety.'	Lack of responsiveness	Enhance issue resolution processes	Operational management
	'It gets too hot here, and there's <u>hardly any shade</u> . I worry about <u>sunburns and heat exhaustion</u> .'	Lack of shade	Increase shaded areas	Weather protection
	'It's <u>inconvenient to walk far to find a restroom</u> . It makes it difficult to stay for long.'	Lack of nearby restrooms	Improve restroom access	Basic amenities
	'Kids mostly play alone, so there's <u>not much opportunity for adults to interact</u> .'	Lack of social spaces	Create adult social spaces	Social engagement
P23	'The ground is really <u>slippery when it's wet</u> , and i feel like I could <u>easily fall</u> . It's nerve-wracking.'	Unsafe surfaces	Use slip-resistant materials	Surface safety
	'The seating areas are <u>too spread out</u> , making it <u>hard to talk with other parents or helpers</u> .'	Poor seating arrangement	Rearrange seating for social engagement	Seating and social interaction
	'There's <u>no place to get water</u> , which is inconvenient, especially when it's hot.'	Absence of water stations	Install drinking fountains	Basic amenities
P24	'When the children play for a long time, we need to rest too, but there <u>aren't enough seats</u> here.'	Lack of seating	Add seating near facilities	Seating and comfort
	'You often have to <u>wait a long time to use the restroom</u> , especially when it's crowded.'	Insufficient restrooms	Increase restroom capacity	Basic amenities
P25	'It gets <u>too crowded</u> here, and <u>management doesn't seem to control the numbers</u> . '	Overcrowding	Implement visitor management	Spatial management
	'There <u>aren't enough restrooms or places to wash hands</u> . It's hard to stay clean.'	Insufficient amenities	Increase restroom and	Basic amenities

			handwashing facilities	
	'I have to carry all my belongings, which is <u>inconvenient without storage facilities.</u> '	Lack of storage	Install lockers or storage areas	Visitor amenities
P25	'The <u>lack of cooperative play</u> means both kids and adults feel more isolated.'	Insufficient group play spaces	Provide group-oriented equipment	Social interaction
P26	'There are <u>too many mosquitoes</u> , which is worrying due to <u>the risk of bites.</u> '	Pest presence	Regular pest control	Health and safety
	'It gets <u>too dark</u> in some areas, making it feel <u>unsafe</u> , especially late in the day.'	Insufficient lighting	Improve playground lighting	Safety and visibility
	'Some parts are in good shape, but others are neglected. It feels <u>inconsistent in maintaining.</u> '	Inconsistent management	Standardize maintenance	Operational management
	'Parents <u>need more shaded areas and comfortable seating</u> so we can relax.'	Lack of shaded seating	Add shaded seating areas	Seating and comfort
	'It's <u>hard to find shade</u> here, and it gets uncomfortable quickly. There's <u>nowhere to escape the sun.</u> '	Lack of shade	Increase shaded areas	Weather protection
	'There aren't many activities I can do with my <u>grandchild</u> . More interactive features would be nice.'	Lack of interactive features	Add intergenerational play equipment	Family engagement
P27	'The <u>noise</u> from the road is constant and stressful. It's hard to enjoy the playground.'	Environmental noise	Implement noise control measures	Environmental quality
	'The playground focuses on individual play, so there's <u>not much interaction between kids or parents.</u> '	Lack of social interaction	Incorporate social features	Social interaction
	'It's confusing to navigate here. There <u>aren't enough signs to direct visitors.</u> '	Poor signage	Improve wayfinding and signage	Accessibility
	'It's <u>hard to move around</u> here. The playground <u>isn't very accessible.</u> '	Limited accessibility	Improve accessible paths and facilities	Mobility access
	'The playground is all about the kids, and there's <u>not much thought given to how we can interact</u> . It feels <u>disconnected.</u> '	Inadequate adult facilities	Provide age-appropriate spaces	Visitor amenities
P28	'The playground often <u>looks dirty</u> , and it's clear that <u>cleaning isn't done regularly</u> . It doesn't make for a pleasant visit.'	Poor maintenance	Regular cleaning and upkeep	Cleanliness and maintenance
	'There's <u>no one enforcing rules or ensuring things run smoothly</u> . It feels chaotic and stressful.'	Lack of rule enforcement	Display and enforce rules	Safety management
	'There <u>aren't enough shaded spots</u> where we can	Lack of shade	Add shaded	Weather

	sit and talk. It's uncomfortable to stay in the sun for long.'		areas	protection
	'The air doesn't feel clean, and the noise from the nearby road is constant. It's stressful and unhealthy.'	Poor environmental quality	Improve air quality and reduce noise	Environmental quality
	'There aren't any handwashing stations. It's inconvenient, especially after using playground equipment.'	Lack of handwashing facilities	Install handwashing stations	Basic amenities
P29	'I don't know how decisions are made or where the money goes. Management should be more transparent.'	Lack of transparency	Improve management communication	Governance
	'I don't see any safety rules posted, so it's hard to know what's safe. It feels uncertain.'	Absence of safety guidelines	Display safety instructions	Safety and management
	'There's nowhere comfortable to sit where I can still see the child clearly. It's frustrating.'	Lack of suitable seating	Add seating with clear sightlines	Seating and comfort
	'As a grandparent, it's hard to find anyone to talk to. The playground doesn't cater to older adults.'	Lack of elderly-friendly spaces	Design for older adults' needs	Visitor amenities

Through the analysis of the needs of respondents as individuals on playgrounds, they can be grouped into six core categories (see Figure 5.9), namely 'space and facility optimisation', 'health and safety management', 'comfort and environmental management', 'social and family engagement', 'operations and governance', and 'infrastructure and services.' To these categories point out some of the critical issues that have been omitted in the design of inclusive playgrounds. The needs of each category will be elaborated in detail below.

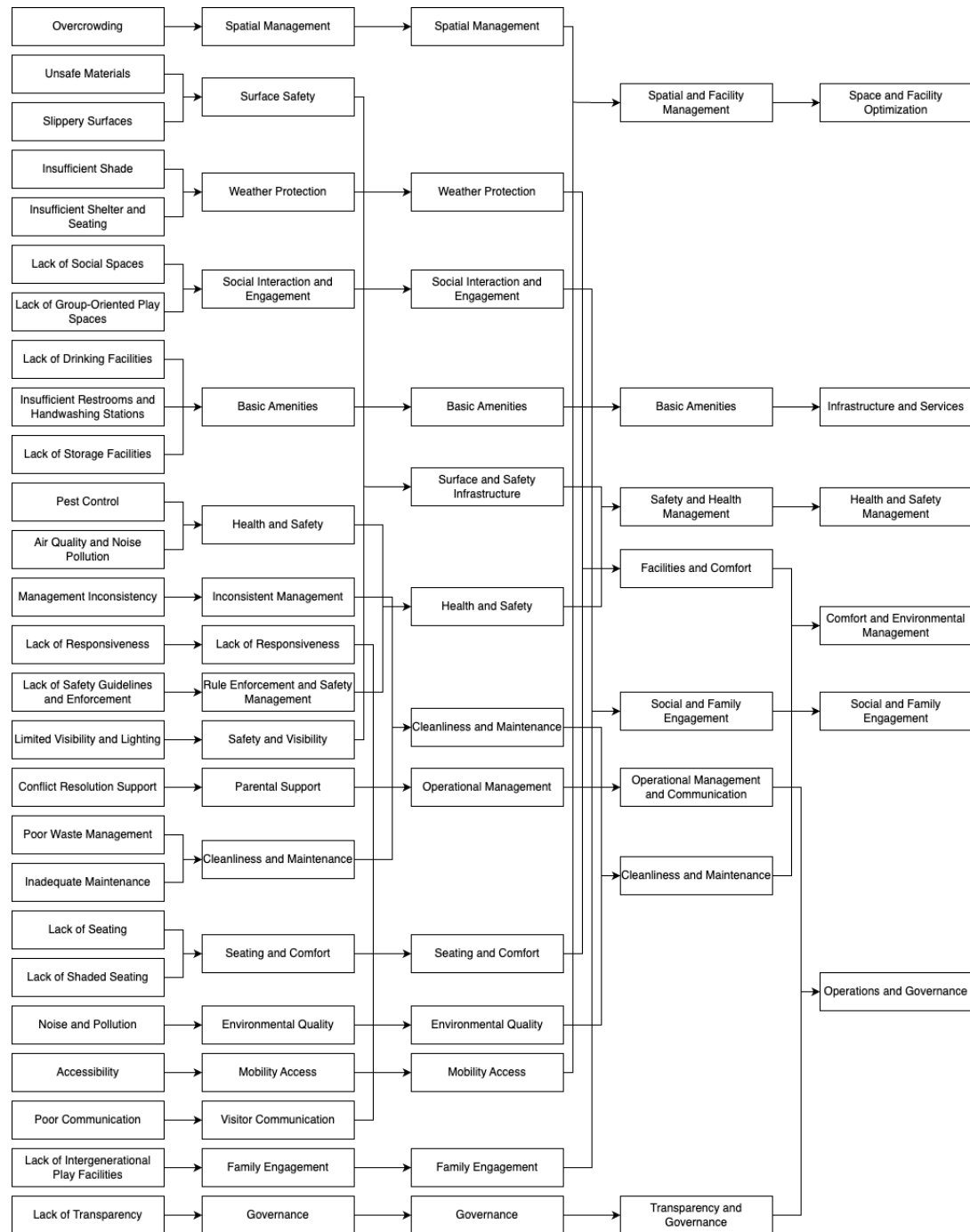


FIG.5.9 Needs of the respondents as an individual

(1) Space and facility optimisation

Rational space management is the basis for efficient operation and high user satisfaction. Flow and access management is significant during peak times. Overcrowding not only affects the comfort of the playground but also increases potential safety risks. Therefore, it is necessary to

optimise the distribution of people and reduce the risk of accidents through effective visitor management strategies and scientific adjustments to the layout of facilities. At the same time, the lack of accessibility and convenience facilities poses a significant barrier to people with mobility issues and families. For example, the need for more facilities such as lockers, drinking fountains and toilets limits the convenience and comfort of users. Therefore, improving the accessibility of the overall playground infrastructure, especially the construction of barrier-free facilities, is necessary to improve the user experience.

(2) Health and safety management

Users' health and safety needs are core elements of playground design. Facility and environmental safety involve not only the physical safety of playground equipment but also potential risks to the surrounding environment. For example, slippery materials and floors, poor air quality, noise pollution, and pest problems pose health threats to users. This not only affects the health of children but also causes anxiety in parents and carers. Therefore, comprehensive measures to ensure equipment safety, improve air quality, control noise, and reduce pests are the keys to ensuring playground safety. In addition, inadequate enforcement and supervision of rules often exacerbate these problems. Management must ensure that users can play in a safe and orderly environment through more effective enforcement and supervision mechanisms, enhancing trust.

(3) Comfort and environmental management

Comfort is an essential factor that affects the user experience and directly determines the length of stay and satisfaction of users at the playground. In terms of shade and seating facilities, the lack of shade areas and seating makes it difficult for parents and caregivers to accompany children for long periods in hot weather, causing physical discomfort and affecting the adequate supervision of children. By adding shade areas, rest areas and seating facilities with shade, the user experience at the playground can be effectively improved. In addition, environmental cleanliness and maintenance issues need to be urgently addressed. Failure to promptly remove rubbish and clean properly damages the playground's aesthetics and poses potential hygiene

risks. Regular maintenance and prompt environmental cleaning enhance the playground's visual appeal and effectively ensure hygiene and safety.

(4) Social and family engagement

Playgrounds are play spaces for children and essential places for family members to socialise and interact. The lack of social and group activities limits the opportunities for interaction between children and parents and undermines the development of social and cooperative skills. Therefore, designers should consider how to promote interaction and cooperation between different age groups by adding group play equipment and social spaces. At the same time, intergenerational interaction and family participation are also dimensions that cannot be ignored in modern playground design. Many parents, especially grandparents, say that playgrounds lack facilities that can be used by different age groups together, resulting in less interaction between family members. Therefore, designing and introducing facilities for intergenerational interaction and promoting the participation of family members together will not only enhance the inclusiveness of the playground but also increase its attractiveness to different age groups.

(5) Operations and governance

The daily operation and management of the playground also affect the quality of the user experience. Management and information transparency are the basis for user trust. The lack of transparency in management decisions and the imperfect user feedback mechanism have led to a lack of public trust in the management. Playground managers should enhance public participation and trust by improving feedback mechanisms, increasing management transparency, and regularly publishing operational information. In addition, the establishment of a response and feedback mechanism is also crucial to improving user satisfaction. Management needs to ensure that it can respond promptly to comments and suggestions from users in order to meet user needs better and improve operational efficiency.

(6) Infrastructure and services

A well-developed infrastructure is a prerequisite for ensuring the proper functioning of the playground. Currently, the playground lacks barrier-free access, lockers, and washing facilities, which significantly affects the user experience. Therefore, improving the infrastructure layout, especially the construction of barrier-free facilities for people with mobility impairments, is the key to improving the quality of playground services. At the same time, the lack of safety and comfort services also needs attention. For example, the safety and comfort of the playground equipment are low, and there needs to be corresponding safety guidance and service support. If these problems are not solved, they may reduce the playground's long-term attractiveness and negatively impact user satisfaction.

5.2.4 Staff challenges and needs

The previous interviews focused on the different types of caregivers who come with children, and they discussed how to make playgrounds more inclusive from the perspective of caring for children and using playgrounds to meet their needs. However, playground staff such as cleaning and security personnel also use playgrounds regularly as workspaces; cleaning/security employees regularly utilize playgrounds in this manner in order to enhance their work experiences; therefore, this study interviewed staff from two perspectives: on one hand to understand concerns at work as well as exploring their specific needs.

5.2.4.1 Playground staff challenges and key issues

TABLE 5.7 Playground staff challenges and key issues

No.	Quotas	Facts	Challenges	Issues
P30	'We need to <u>change the pool water often</u> because kids throw trash or food in, and it gets dirty really fast.'	Water contamination	Water quality control	Water Quality Management Issues
	'We don't have the <u>right equipment to check the water quality all the time</u> .'	No real-time monitoring	Inadequate monitoring systems	Water Quality Management Issues
	'The <u>sandpit sometimes has trash or even sharp things</u> like glass, which is really dangerous for kids.'	Hazardous items in sand	Safety hazards	Inadequate Equipment Safety Inspection
	'If we don't <u>refresh the sand regularly</u> , it becomes dirty and clumpy.'	Dirty sand	Poor maintenance	Sanitation and Maintenance

				Challenges
P31	'The hardest parts to clean are those <u>tiny gaps on the play equipment and the less crowded corners.</u> '	Difficult areas to clean	Cleaning inefficiency	Sanitation and Maintenance Challenges
	'When the playground is packed, there's <u>so much trash that we miss some spots</u> , especially hidden corners.'	Missed spots	Cleaning challenges during peak times	Sanitation and Maintenance Challenges
	'At night or in bad weather, the <u>lighting is poor</u> , making it really hard to clean.'	Poor visibility	Environmental constraints	Sanitation and Maintenance Challenges
P32	'I can only <u>use a long pole to clean high places</u> like the top of slides, and it's tough to reach everywhere.'	Inaccessible high areas	Cleaning tool limitations	Sanitation and Maintenance Challenges
	'When there are <u>too many people, trash piles up quickly</u> , and I can't clean up everywhere by myself.'	Trash accumulation	Staff shortage during high traffic	Crowd Management Issues
P33	'We might not <u>check the play equipment thoroughly enough</u> , especially those high-use ones needing frequent inspections.'	Insufficient inspections	Safety risks	Inadequate Equipment Safety Inspection
	'When it's crowded, there can be <u>congestion or pushing incidents.</u> '	Overcrowding	Crowd control issues	Crowd Management Issues
	'If <u>multiple things happen at once, security can't handle everything</u> quickly.'	Limited response capacity	Security management challenges	Emergency Response Challenges
	'If there's a problem with the equipment, we have to <u>evacuate everyone quickly</u> and call maintenance.'	Slow evacuation	Safety management inefficiencies	Emergency Response Challenges
	'We don't have enough <u>safety signs and guidance for kids with special needs</u> , like those who are visually or hearing impaired.'	Lack of inclusive facilities	Inadequate support for special needs	Emergency Response Challenges
	'I <u>check the play equipment every day</u> for any safety issues, like broken parts or loose bolts.'	Daily safety checks	Safety inspection protocols	Inadequate Equipment Safety Inspection
P34	'Kids might <u>lose their balance when climbing too high</u> on slides and frames.'	Fall risk	Equipment safety concerns	Inadequate Equipment Safety Inspection
	'This is especially true for <u>challenging equipment like climbing frames and swings.</u> '	High-risk areas	Safety vulnerabilities	Inadequate Equipment Safety Inspection
P35	'When the sand <u>gets wet from rain, it turns muddy</u> , and the pool area can get slippery.'	Slippery surfaces	Hazardous conditions	Inadequate Equipment Safety Inspection

‘Kids <u>throw sand at each other or get it in their eyes</u> . Sometimes, I wish we could just close the sandpit.’	Sand-related	Safety	Inadequate
	injuries	concerns	Equipment
‘The areas around the play equipment <u>gets crowded</u> , so I try to guide the kids to spread out.’	Congested	Ineffective	Crowd
	play areas	space management	Management Issues

Based on the above analysis of staff interviews, the problems faced by amusement parks can be mainly summarised into five areas, namely (1) **water quality management**, (2) **hygiene maintenance**, (3) **crowd management**, (4) **equipment safety inspections**, and (5) **emergency incident handling**.

First, in terms of **water quality management**, water-related facilities in amusement parks, such as pools and fountains, are often at risk of water pollution. Due to the lack of real-time water quality monitoring equipment, managers are unable to take effective measures in a timely manner, making it difficult to effectively control and maintain water quality, affecting the safety and experience of users.

Second, in terms of **hygiene maintenance**, playground sand pits and play equipment are heavily utilized, making them susceptible to collecting rubbish and potentially hazardous items. Unfortunately, due to a limited allocation of existing resources and workforce available for regular cleaning and maintenance tasks during peak periods or poor lighting conditions - regular maintenance efforts cannot be conducted efficiently, and this leads to inefficient overall hygiene management. Cleaning equipment gaps and corners is even more challenging and thus compromises overall hygiene management efficiency.

Management of **people flow** is also a significant challenge. At peak hours, playgrounds become overcrowded with excessive numbers of patrons increasing the safety risks and creating significant management difficulties. In addition, special groups (such as children with visual or hearing impairments) lack particular safety guidelines and auxiliary facilities when using amusement facilities, which leads to inadequate protection of their play experience and safety and limits the inclusiveness of the playground.

In terms of **equipment safety inspections**, the high-frequency use of amusement facilities requires frequent and comprehensive safety inspections, especially in high-risk areas such as slides and climbing frames. However, because inspections are not frequent and comprehensive enough, potential safety hazards are not discovered and dealt with in time, which may lead to equipment aging or failure, seriously threatening the safety of users.

Finally, the challenges of **emergency response** cannot be ignored. When multiple emergencies occur simultaneously, it may be difficult for security personnel to effectively respond and handle them in a short period of time, resulting in delayed emergency response and affecting the efficiency of the overall safety management of the playground. In addition, when the equipment fails, the slow response of management personnel to emergency evacuation and maintenance will also hurt the regular operation of the playground and the user experience.

5.2.4.2 Staff needs analysis

TABLE 5.8 Playground staff needs and suggested improvements

No.	Quotas	Needs	Themes
P30	'I really need <u>better tools and equipment</u> for cleaning and <u>checking water quality</u> . It would make my job much easier and faster.'	Better cleaning tools; water testing devices	Resource and Equipment Support
	'Having <u>more staff during busy times</u> would really help us handle the extra trash more efficiently.'	More staff during peak hours	Human Resource Allocation
	'I'd love to get more <u>training, especially on water quality and dealing with emergencies</u> , so I'm prepared for any situation.'	Training on water quality; emergency handling	Training and Skill Development
P31	'If everyone could just use the <u>designated eating areas</u> and not litter, it would be so much easier to keep the playground clean.'	Public cooperation; designated eating areas	Public Cooperation and Environmental Management
P32	'We really need <u>more cleaning staff during peak times</u> to keep up with the mess.'	More cleaning staff	Human Resource Allocation
P33	'We need <u>more security cameras and emergency call systems</u> to cover more areas, so we can locate and respond to incidents faster in emergencies.'	More cameras and emergency systems	Resource and Equipment Support
	'I think more <u>training on communicating</u> with kids and parents, especially those with special needs, would be really helpful.'	Communication training	Training and Skill Development

	'Expanding the coverage of security cameras and emergency call systems would help us respond to incidents more quickly during emergencies.'	Expand security and emergency systems	Resource and Equipment Support
P34	'My job isn't just about keeping kids safe physically. It's also about making sure every child, including those with special needs, feels welcome and comfortable.'	Inclusive training; special needs awareness	Training and Skill Development
P35	'Having more staff to help with cleaning during busy times would really make things easier for everyone.'	More cleaning staff	Human Resource Allocation
	'I hope we can get more cleaning staff during busy periods to keep up with all the work.'	More staff during busy periods	Human Resource Allocation

According to the interview results, the needs of playground staff mainly focus on the following four aspects: (1) **resource and equipment support**, (2) **human resource allocation**, (3) **training and skills development**, and (4) **public cooperation and environmental management**.

Regarding **resource and equipment support**, staff need better cleaning tools and equipment, such as efficient cleaning equipment and water quality testing devices, to improve work efficiency and maintenance. In addition, strengthening the construction of the security system and increasing the coverage of surveillance cameras and emergency call systems can better monitor the site's conditions, respond to emergencies, and effectively improve the site's security management capabilities.

Human resource allocation is also at the heart of management. During peak hours and busy periods, additional cleaning and security staff can effectively alleviate the management pressure caused by the increased flow of people. At the same time, a reasonable allocation of human resources to meet the diverse needs of children with special needs can help improve the inclusiveness and service quality of the playground.

Training and skill development are critical elements in strengthening staff professionals. Specialized courses on water quality management and emergency response can increase staff members' response abilities during emergencies; conversely, communication skills training enables staff members to interact more efficiently with different groups, particularly children with special needs and their parents. Inclusive and special needs awareness training can help

staff better understand and support children with special needs and provide them with a safe and friendly play environment.

Public cooperation and environmental management require effective publicity and signage that guides visitors towards compliance with playground rules such as eating only in designated areas and keeping the site tidy; this not only reduces staff workload but also increases public participation in environmental management - leading to an organized playground environment and offering all users an enjoyable playing experience.

Although the issues and needs discussed by the staff mainly focused on the management level, their demands on playground design are also significant. Reasonable functional zoning can improve the safety and management efficiency of the playground. Staff want designs that clearly distinguish high-risk areas (such as slides and climbing frames) from general activity areas to reduce accidents and facilitate evacuation in case of emergency. At the same time, crowd control and circulation planning play a crucial role in coping with high levels of footfall during peak periods. Through reasonable circulation design and signage guidance, footfall can be effectively dispersed, reducing congestion and potential risks in specific areas and reducing management pressure.

In addition, the playground design should fully consider the accessibility experience of particular groups in need. Providing clear floor markings, tactile cues or visual guidance for people with visual and hearing impairments, as well as providing barrier-free pathways and dedicated facilities at key features can make playgrounds more inclusive and accessible. Reasonable layout of security equipment is also an important guarantee for ensuring site safety. Arranging surveillance cameras and emergency call systems in blind spots, densely populated areas, and high-risk areas can help obtain information quickly and take adequate measures to respond to emergencies.

Through the interviews, it was found that despite the researchers' repeated attempts to guide the caregivers to think from the perspective of visitors, to abandon the constraints of social roles, and to consider their needs or expectations in the playground as individuals, they still

unconsciously brought their roles into it. Whether parents, grandparents, assistants or other types of caregivers, they always thought about their needs and expectations in the playground from the perspective of caring for children. Some interviewees even deliberately ‘beautified’ their actions or concealed their true thoughts after understanding the background of the interview, trying to exaggerate the challenges and needs in childcare or their work responsibilities, thus concealing some real difficulties and needs. It limited the study’s exploration of their actual needs to a certain extent.

In order to avoid these limitations as much as possible, this study used unobtrusive observation to collect data from the perspective of an external observer. By stripping the respondents of their social roles and reducing them to independent individuals, their natural behaviours in the playground were recorded, and their needs were analysed. These observational data supplement the questionnaire and interview results and help to provide a comprehensive understanding of the behaviours and potential needs of other stakeholders besides children.

5.3 SOPARC results and analysis

Following the survey and informal interview stages, it became essential to test whether users’ self-reported needs and expectations aligned with their actual behaviours in playgrounds. While previous methods uncovered subjective perceptions and emotional narratives, SOPARC-based behavioural observation offers an objective lens to validate, contrast, or contextualise those claims. In particular, this phase addresses Research sub-Question 4 by identifying mismatches between perceived use and real-world patterns, thus completing a triangulated understanding of stakeholder needs. It also reveals spontaneous or informal uses of space—often overlooked in verbal accounts—that reflect latent spatial demands and design gaps.

This study explores how behaviour changes with the seasons and varies according to demographic factors by observing and analysing the behavioural patterns of three public playgrounds in summer and winter. Data collection is based on the SOPARC system, and the analysis focuses on different demographic characteristics, behavioural patterns, and the

performance of Heatmap in multiple dimensions to fully understand the dynamic changes in behavioural patterns.

Heatmap is used as a visualisation tool to display the distribution of values of the primary variable on two axes using colour changes, making complex data more intuitive. The study will use Heatmap to analyse the frequency distribution of different behaviours regarding age, gender, ethnicity, disability status and activity level.

5.3.1 KLNP Behavioural analysis

5.3.1.1 Demographic breakdown

The demographic statistics of the participants in different seasons show noticeable differences and trends in gender, age, ethnicity, and disability status.

As shown in Figure 5.10, in terms of gender ratio, women always dominate, accounting for 66.33 per cent in summer and 60.19 per cent in winter, while men account for 33.67 per cent and 39.81 per cent, respectively. The stability of this gender distribution indicates that seasonal changes have little effect on gender composition, and female participants account for a higher proportion of the overall participation.

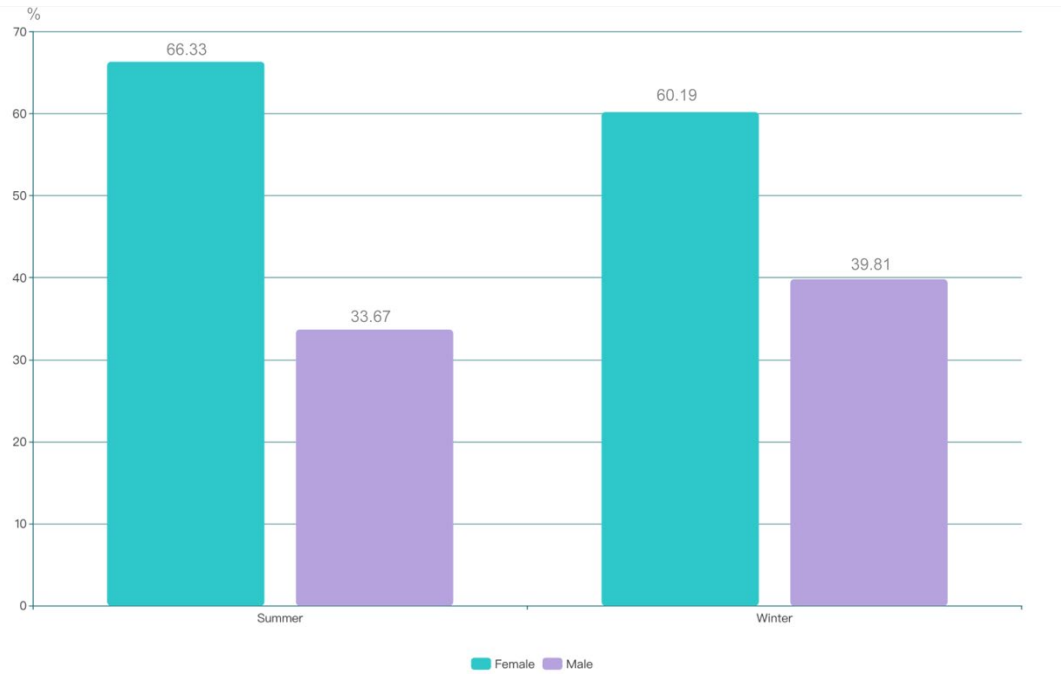


FIG.5.10 Gender breakdown

Figure 5.11 shows an analysis of the age structure. It can be seen that adults are the primary participant group in both summer and winter, accounting for 90.18 per cent and 91.49 per cent, respectively. The participation of young people and the elderly is relatively low, with young people accounting for 3.01 per cent and 1.56 per cent in summer and winter, respectively, and the elderly accounting for 6.81 per cent and 6.95 per cent. The stability of this age distribution reflects that young people and elders tend to engage significantly less than adults in this public space, possibly reflecting whether activity needs match well with venue characteristics.

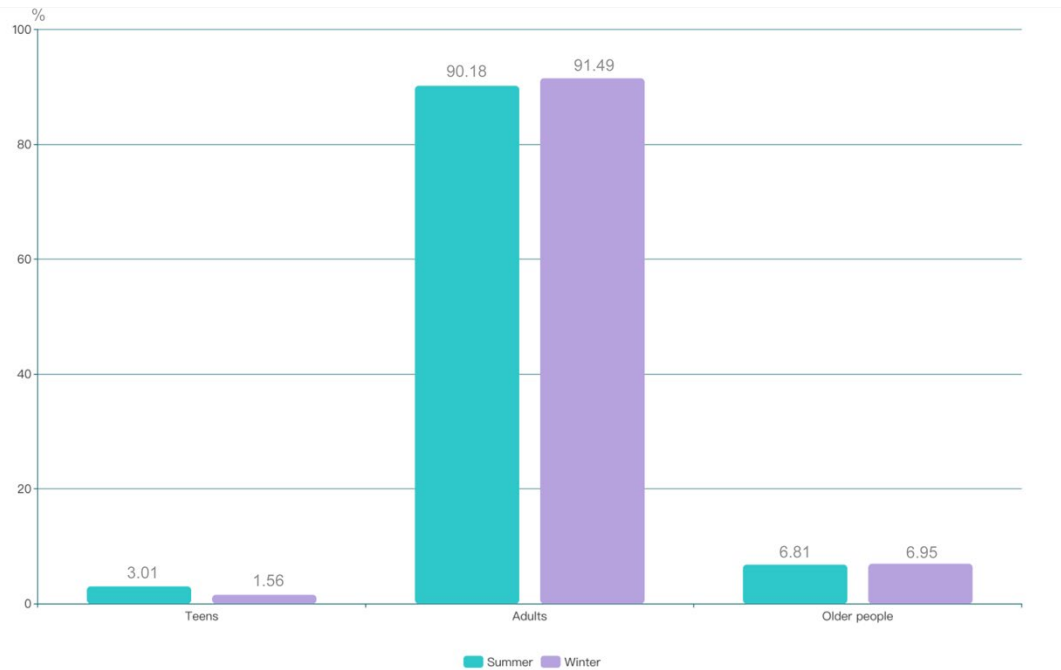


FIG.5.11 Age group breakdown

Regarding ethnic composition (see Figure 5.12), Chinese participants dominated both summer and winter, accounting for 81.36 per cent and 86.57 per cent, respectively. Other Asian ethnic groups and the white group accounted for a relatively small proportion, 13.23 per cent and 5.41 per cent in the summer and 7.55 per cent and 5.52 per cent in the winter. Black participants made up none in summer but increased to 0.36 per cent by winter. This phenomenon highlights an inequity in ethnic distribution: Chinese descent people predominate this public space while participation from other groups such as black community is low or non-existent altogether. This shows that in multicultural settings some ethnicities may face barriers to using the space properly or be restricted by social factors that restrict their usage.

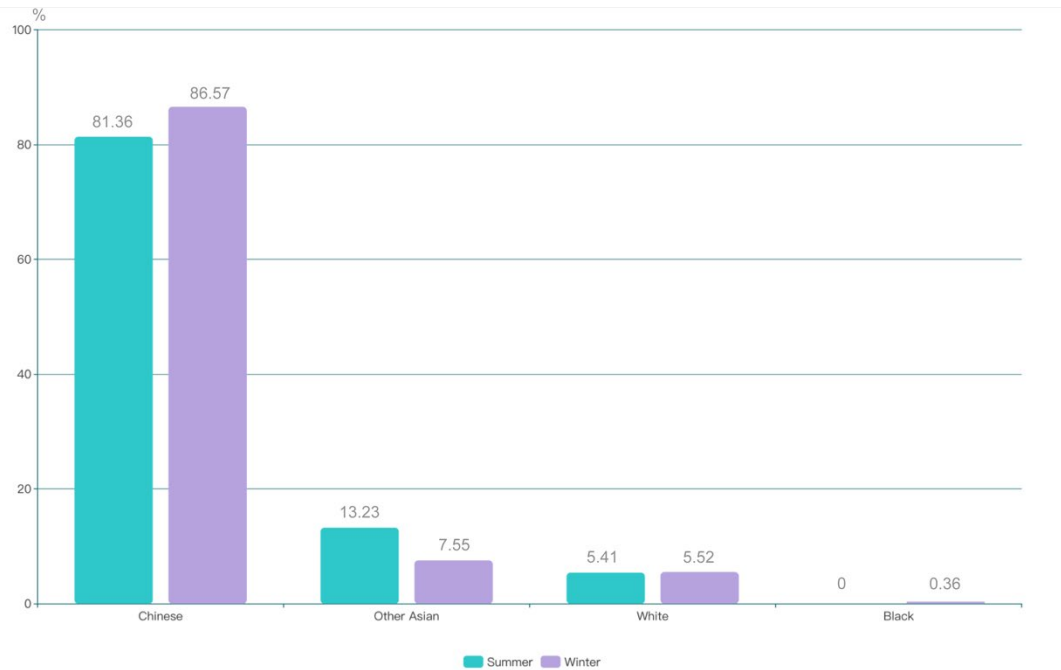


FIG.5.12 Ethnicity breakdown

The results of the survey on disability status (see Figure 5.13) show that almost all participants, 100per cent in the summer and 99.76 per cent in the winter, had no disabilities. Only 0.24 per cent of participants used walking aids in the winter. This data shows that the participants were mainly able-bodied people, and that the participation rate of individuals with disabilities in this public space was extremely low. This may reflect the current site design, which is not attractive enough for people with disabilities or the accessibility of the facilities needs to be improved.

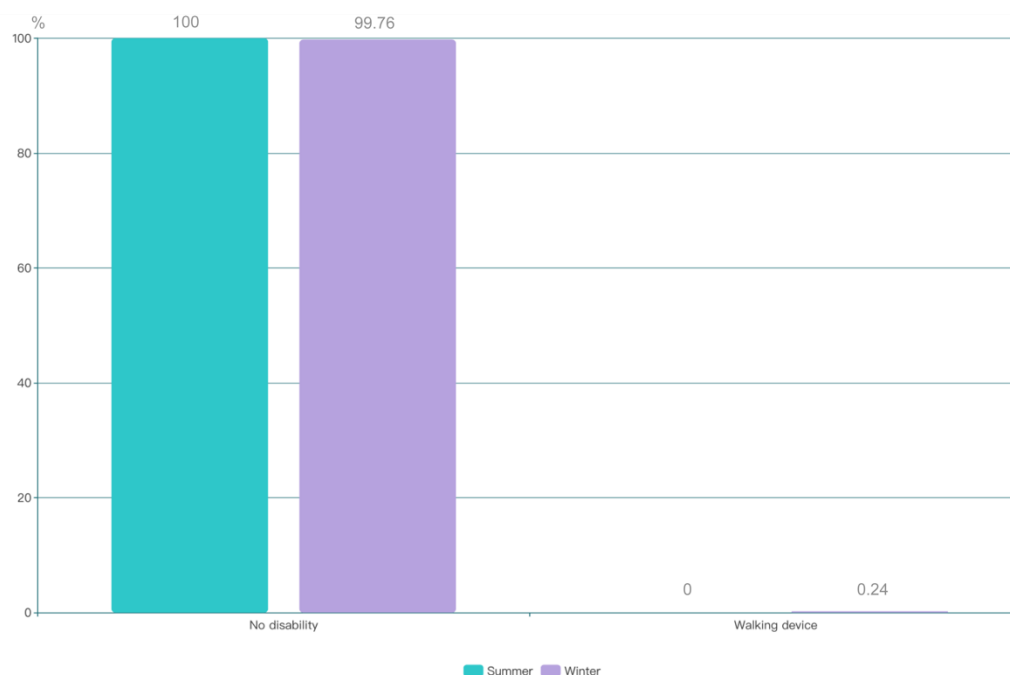


FIG.5.13 Disability status breakdown

5.3.1.2 Behavioural analysis based on demographic

An analysis of behavioural patterns in different seasons shows that there are significant differences in the use of public spaces based on gender, age, ethnicity and disability.

In terms of **gender**, women showed a higher level of participation in behaviours 8 (24.77 per cent) and 9 (13.29 per cent) in the summer, while the distribution of male behaviours was relatively even, with significant participation rates in behaviours 8 (20.24 per cent) and 11 (11.31 per cent). In winter, the participation of both genders in Behaviour 8 remained at a high level, with women slightly more involved than men. This shows that participants of different genders have clear preferences in their choice of activities, with men more inclined to satisfy their entertainment or fitness needs through behaviours 8 and 11.

For **age**, adults were always the group with the highest participation, both in summer and winter, especially in Behaviour 8 (24 per cent in summer and 23.85 per cent in winter) and Behaviour 9 (12.22 per cent in summer). Older people tended to focus more on specific activities, such as Behaviour 1 and Behaviour 11, showing their preference for health and social

activities. This shows that Behaviour 8 is the main activity purpose for people of different ages, and the design should consider better meeting the needs of adults and the elderly.

Regarding **ethnicity**, the high participation of Chinese people in Behaviour 8 (22.91 per cent in summer and 23.96 per cent in winter) and Behaviour 9 (11.58 per cent in summer and 17.87 per cent in winter) reflects the importance they attach to family communication, while other ethnic groups prefer to use playgrounds as places for fitness or work. Furthermore, this cultural preference remained stable across seasons, reflecting consistent behaviour choices throughout them all.

Analysis of **disability status** indicates that, regardless of season, most participants are non-disabled individuals while participation among disabled people remains low due to inadequacies in design with regards to activity diversity and accessibility. Therefore, participation by disabled people should be improved by optimising accessibility and designing more inclusive activities, so as to truly achieve diversity and inclusiveness in playgrounds.

5.3.1.3 Heatmap analysis

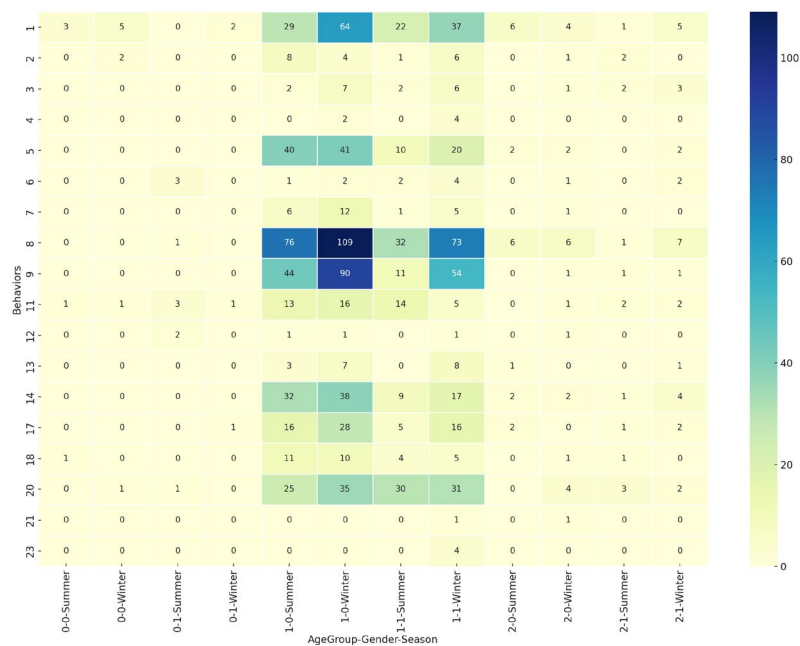


FIG.5.14 Behavioural differences by age group-gender-season

The results of the analysis (see Figure 5.14) show that behaviour 8 exhibited the highest frequency of activity in several age groups, especially in the middle-aged group (age group 1). In winter, 109 occurrences of this behaviour were recorded in the 1-0-Winter group, compared to 76 in the 1-0-Summer group, indicating that middle-aged women were more engaged in winter. Middle-aged men recorded 73 occurrences in the 1-1-Winter group, indicating that their behavioural activity also increased in winter.

Behaviour 9 was also significant in winter, with 90 recorded in the 1-0-Winter group and 44 in the 1-0-Summer group, highlighting that this behaviour is mainly associated with the middle-aged group. In the elderly group (age group 2), the activity level was significantly lower than in the other groups, with behaviour eight recorded only six times in the 2-0-Summer group and seven times in the 2-1-Winter group, indicating less participation in the elderly group.

Gender differences were non-existent among behaviour 8 and 9 participants of age group 1. Adult men participated equally in behaviour 5, showing slightly lower participation (41 times) during winter than their female counterparts (20 times), suggesting that certain behaviours are affected by gender.

Season has an important bearing, with participation rates in behaviours 14 and 17 among adult participants (age group 1) increasing significantly from 32 times in fall to 38 and 28 times respectively in winter - suggesting certain activities become more prevalent due to cold temperatures. In contrast, the frequency of activity in the younger group (age group 0) was extremely low, with a record high of only five times for behaviour 1.

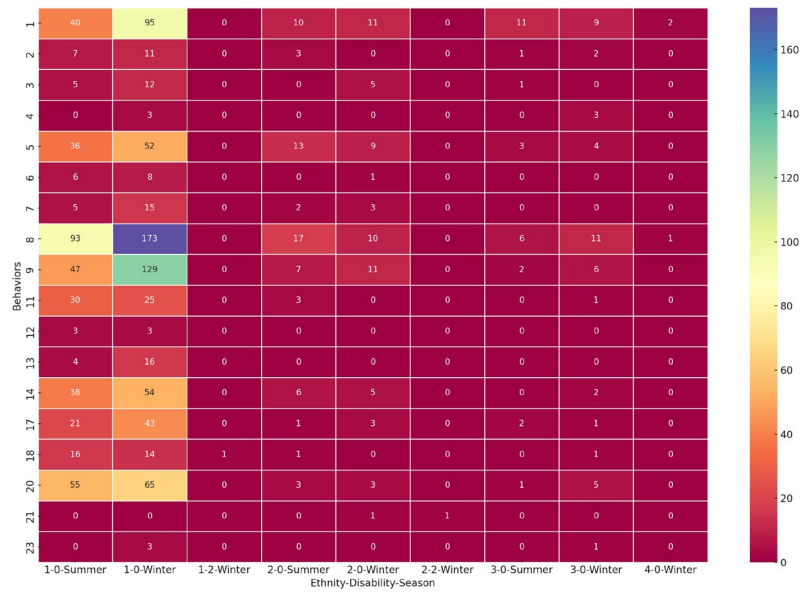


FIG.5.15 Behaviour differences by ethnicity-disability-season

The analysis results (see Figure 5.15) show that behaviour 8 was performed most frequently in the non-disabled Ethnicity 1 group, with 173 occurrences recorded in the 1-0-Winter group and 93 in the 1-0-Summer group. This indicates that individuals in Ethnicity 1 showed more frequent participation in winter. Behaviour 9 also stood out significantly, recording 129 instances during winter and 47 as summer, reflecting this seasonal uptick.

Within the Ethnicity 1 group, there were noticeable seasonal differences in terms of behavioural activity. For example, the participation rate for Behaviour 1 increased from 40 times in the summer to 95 times in the winter, and for Behaviour 14, from 38 times to 54 times, indicating that the behaviour of this group was significantly affected by seasonal changes.

In contrast, the disability group shows extremely low participation rates in all ethnic groups. Behaviours 8 and 9 are almost entirely absent in both the 1-2-Winter and 2-2-Winter groups, reflecting the significantly lower participation of people with disabilities in these behaviours regardless of ethnicity.

Nevertheless, behaviour 14 still showed some participation in ethnic group 1 without disabilities, with 54 recorded in the 1-0-Winter group and 38 in the 1-0-Summer group, and

behaviour 20 also reached 65 in winter and 55 in summer, indicating that some behaviours are more common in specific subgroups.

In contrast, ethnicities 3 and 4 had almost zero participation rates, with no instances of the vast majority of behaviours recorded, which may indicate that these ethnicities are underrepresented in the data or that the tracked behaviours are of lower relevance to them.

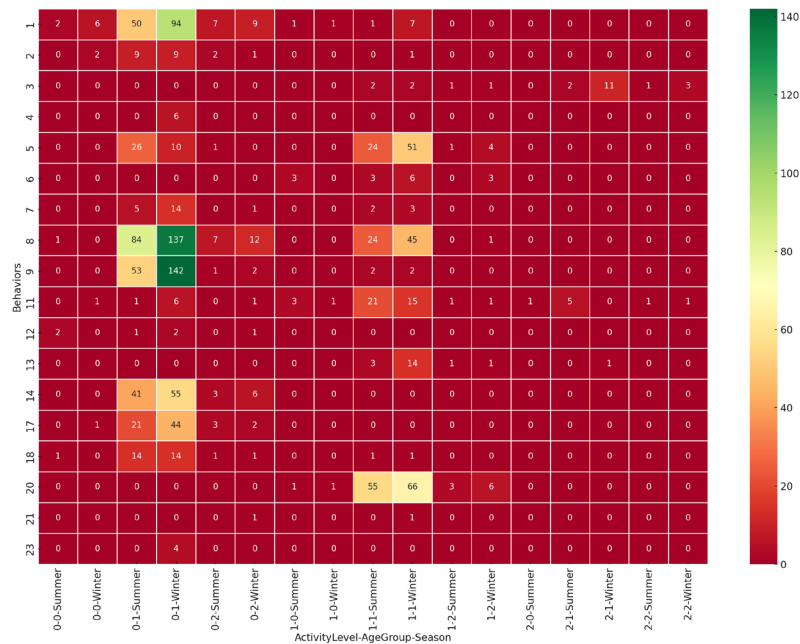


FIG.5.16 Behaviour differences by activity level-age group-season

The analysis results (see Figure 5.16) show that in winter, in groups 0-1 (activity level 0, age group 1), behaviours 8 and 9 showed significant activity, with 137 and 142 records, respectively, indicating that individuals in middle age with a low activity level increased their engagement in winter. In groups 0-1 in summer, the activity of behaviours 8 and 9 was 84 and 53 times, significantly lower than in winter, reflecting strong seasonal influences.

Behaviour 20 was recorded 66 times in groups 1-1 (activity level 1, age group 1, winter), the highest number for this behaviour, indicating that this behaviour is particularly relevant for young individuals with a moderate activity level. In summer in group 1-1, behaviour 20 was recorded 55 times, which, although also affected by the season, was not as pronounced as in winter.

At the same time, some behaviours were almost negligible in activity in specific groups, especially at higher activity levels (level 2). Behaviours 12 and 13 were recorded extremely limitedly in all seasons and groups, indicating that these behaviours occurred less frequently or had little effect on the tracked variables. In addition, the occurrence of behaviour 23 was almost zero, with only four records in winter 0-1, further indicating that it needed more overall participation.

Based on the analysis of the three behavioural heatmaps of KLNP, various factors such as age, gender, season, ethnicity, disability and activity level were considered, and the following key findings were obtained.

First, behaviours 8 and 9 showed a higher frequency of occurrence across all dimensions, especially among middle-aged individuals (age group 1) with a lower activity level in winter. Specifically, in the 0-1 winter group, behaviour eight was recorded 137 times and behaviour nine was recorded 142 times, both significantly higher than in summer. Meanwhile, the first ethnic group without disabilities showed high frequencies of these behaviours, with 173 and 129 times, respectively.

Second, seasonality had an obvious impact on behaviour patterns: all groups saw higher activity levels during winter than summer. This seasonal shift was most apparent for middle-aged people and individuals with lower activity levels; disabled group showed lower participation across most recorded behaviours, suggesting they are less engaged, or other influences are missing from this dataset.

In addition, ethnicity significantly affected behaviour patterns, with Ethnicity 1 being more active in behaviours 8 and 9 than the other races. Gender differences were minor, but there was still some variation across age groups and seasons. The behaviour patterns of males in age group 1 remained consistent across seasons, while the behaviour patterns of females may vary depending on the type of behaviour and the season.

Finally, some behaviours (e.g. behaviours 12, 13 and 23) were highly infrequent in most groups, suggesting that they are rare or not significantly affected by the tracked variables. Participation in these behaviours was almost zero in groups with high activity levels and the older age group, especially in winter.

5.3.2 QUBP behavioural analysis

5.3.2.1 Demographic breakdown

Regarding gender distribution (see Figure 5.17), female participants dominated the summer and winter seasons, accounting for 61.97 per cent and 66.38 per cent of participants, respectively, while male participants accounted for 38.03 per cent and 33.62 per cent of participants. This data shows that female as the predominant participants throughout both seasons while maintaining stable gender distribution with no notable seasonal changes.

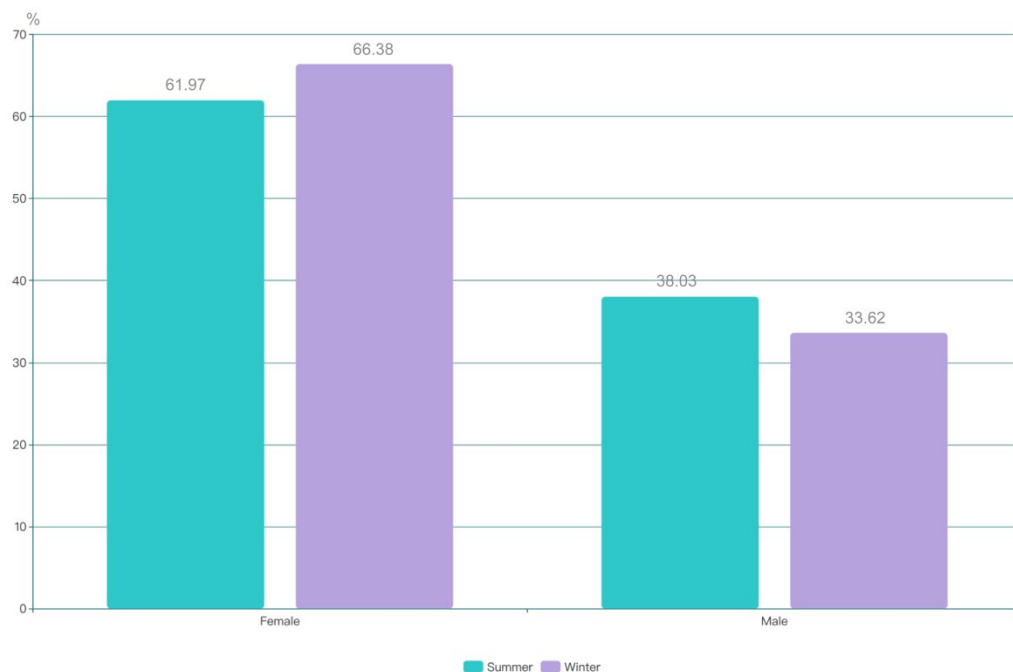


FIG.5.17 Gender breakdown

An analysis of the age structure (see Figure 5.18) shows that adults are always the most active group. In the summer, adults accounted for 85.40 per cent, seniors for 12.68 per cent, and adolescents for only 1.93 per cent. The situation changes slightly in the winter, with the participation of adolescents rising to 6.55 per cent, while the proportions of adults and seniors are 86.04 per cent and 7.41 per cent respectively. This apparent increase in adolescent participation may reflect the fact that adolescent kennel prefers to participate in playground activities in the winter.

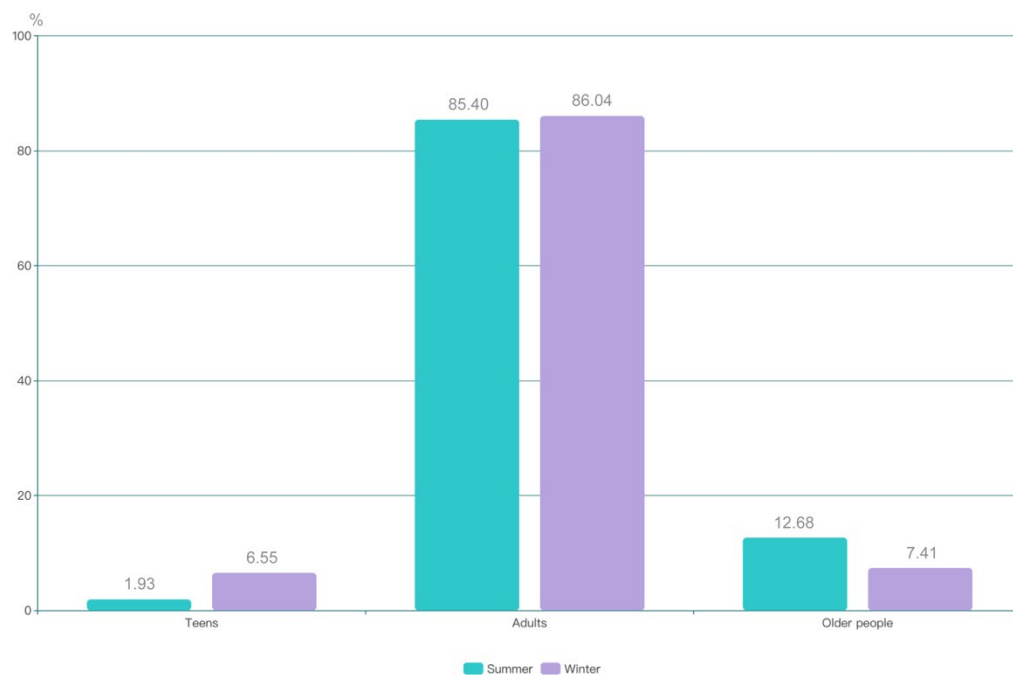


FIG.5.18 Age group breakdown

In terms of ethnicity (see Figure 5.19), Chinese people accounted for 89.15 per cent in the summer and 86.89 per cent in the winter. The participation of other Asian people increased in the winter, while the participation of the White and Black groups was lower but slightly increased.

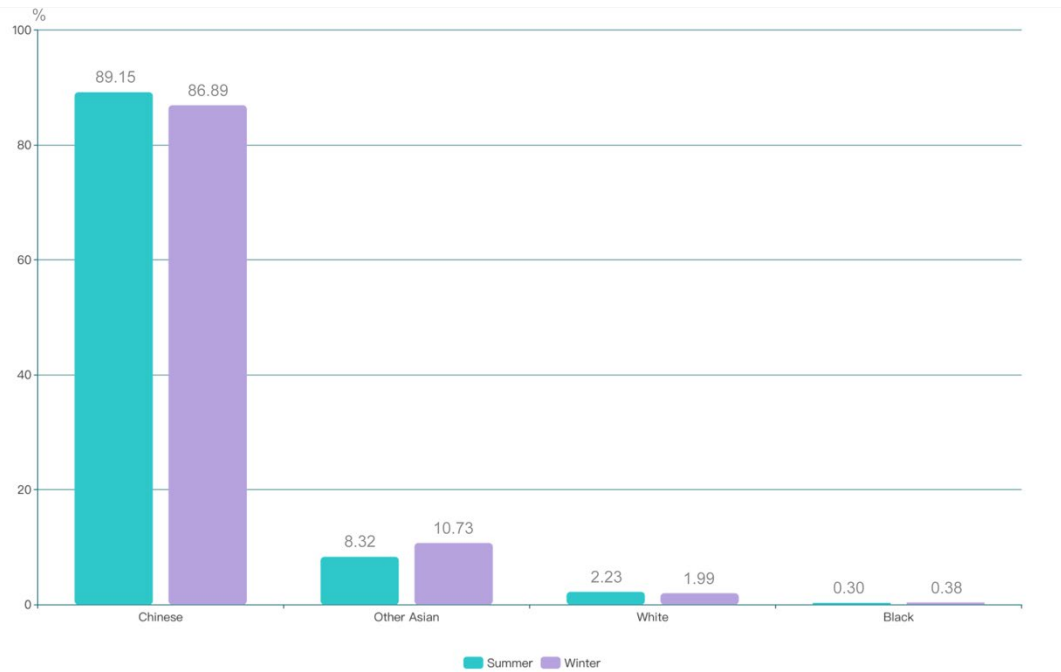


FIG.5.19 Ethnicity breakdown

The analysis of disability status (see Figure 5.20) shows that most participants were not disabled in both summer (98.99 per cent) and winter (99.34 per cent). The proportion of disabled people increased slightly in winter, but overall participation was significantly lower than for people without disabilities, especially among older people. This highlights the need for public space design to pay attention to the needs of people with disabilities to improve their participation.

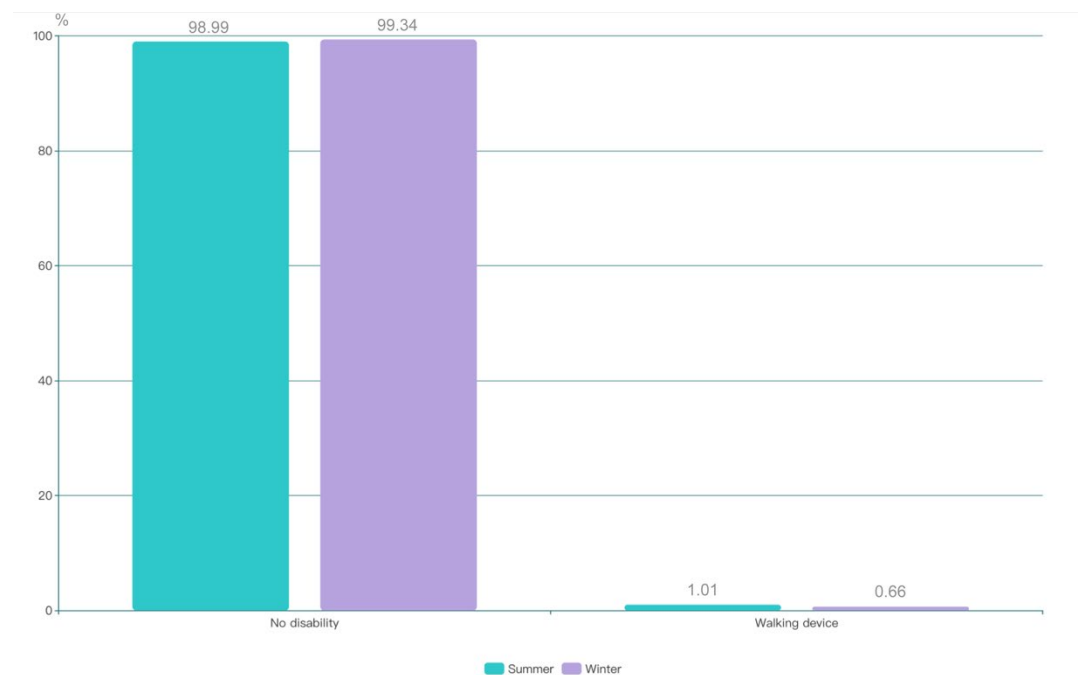


FIG.5.20 Disability status breakdown

5.3.2.2 Behavioural analysis based on demographic

Analysis of participant's gender, age, ethnicity and disability status revealed some noteworthy trends and patterns.

Gender distribution showed females to make up 30.93 per cent of participants in Behaviour 8, while 27.47 per cent were male participants during summer months; wintertime showed high participation across both genders for this activity, suggesting preferences may depend on popularity or accessibility; Behaviour 8 encourages participants to observe others playing or interact socially in an effort to accentuate its social function for participants.

Age analysis shows that adults dominate in behaviours 8, 1 and 5, with older people tending to participate in behaviour 8. The participation of teenagers in winter increases in behaviours 1 and 11, reflecting the participation of adults in diverse activities, while the changes in teenagers emphasise the importance of seasonal items. This trend demonstrates their diverse participation, suggesting the playground provides many choices of activity options to cater for this group of participants while teenaged behaviour changes also reinforce this need.

Ethnicity analysis shows that Chinese participants in the summer had a high participation rate of 31.40per cent in behaviour 8, while white participants also showed significant participation in behaviours 1, 5 and 8. In the winter, Chinese participants maintained a participation rate of 26.78per cent in behaviour 8. This trend shows the influence of cultural preferences on behaviour choices. The Chinese group values the parent-child interactive attributes of the playground more, while other ethnic groups tend to favour the social function.

Regarding disability status, disabled people showed engagement in Behaviours 14 and 20 in the summer and maintained their focus on Behaviour 14 in the winter. This highlights the need to ensure access to facilities and activities as well as inclusive programs.

5.3.2.3 Heatmap analysis

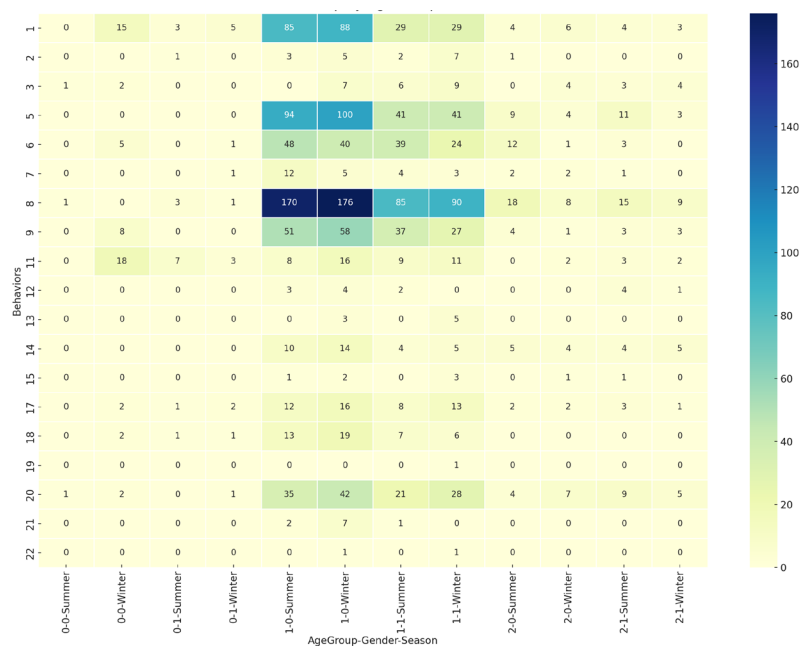


FIG.5.21 Behavioural differences by age group-gender-season

In the analysis of multiple behaviours (see Figure 5.21), behaviour 8 dominated across age groups, genders and seasons, especially in the middle age group (age group 1) in winter (1-0-Winter group), with a frequency of 176 times, while in summer (1-1-Summer group) it was 90 times, showing a significant increase in participation in winter.

Seasonal variations affect behaviour frequency, with activity levels usually being higher during winter than summer. Behaviour 5 was recorded 100 times in the 1-0-Winter group versus 94 in summer; similarly, behaviour 9 was witnessed 58 times during winter but 51 during summer; suggesting winter encourages participation in certain behaviours.

Middle-aged individuals (age group 1) consistently participate in multiple behaviours, regardless of gender. For example, behaviour five was recorded 100 times in the 1-0-Winter group and 41 times in the 1-1 group, showing the behavioural tendencies of middle-aged individuals.

In contrast, the younger group (age group 0) and the older group (age group 2) were relatively inactive in most behaviours. For example, behaviours 1 and 5 occurred at almost negligible frequencies in these age groups.

The gender-specific behaviour patterns generally show slight variation. The similar participation of males and females in age group 1 in behaviours 8 and 9 indicates the universality of these behaviours across genders.

It is worth noting that some behaviours, such as behaviours 12 and 21, were consistently less active in all groups. For example, the highest frequency of behaviour 12 was only four times, occurring in the 1-0-Winter and 2-1-Summer groups. Behaviour 22 was almost entirely absent, indicating limited participation in these behaviours.

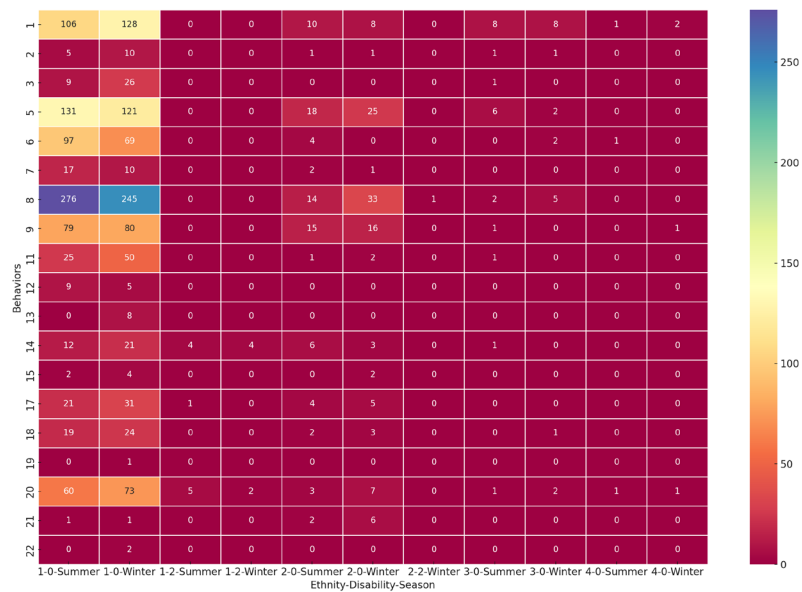


FIG.5.22 Behavioural differences by ethnicity-disability-season

It can be seen in Figure 5.22, behaviour 8 was particularly prominent in the first group without disabilities, especially in the 1-0-Summer group (276 times) and the 1-0-Winter group (245 times), indicating that this group showed apparent activity in participating in this behaviour, although participation in winter decreased slightly.

Seasonal changes had a significant effect on some behaviours. In the 1-0-Winter group, the frequency of behaviour 1 was 128, an increase compared to 106 in the 1-0-Summer group, indicating that seasonal factors may promote this behaviour. Behaviour 20 also increased in winter, with 73 recorded in the 1-0 group and 60 in the summer.

However, disabled individuals (group marked -2) generally had lower activity frequencies for most behaviours. For example, behaviour eight did not occur in the 2-2-Summer group and was only recorded once in the 2-2-Winter group. In addition, the ethnic minority group also had lower activity levels for all behaviours and seasons, suggesting that their behavioural performance may be inadequate.

Despite seasonal differences, the behaviour of some groups was relatively stable. For the first group without disabilities, behaviour 5 was consistent across seasons, with 121 occurrences in

the 1-0-Winter group, indicating that this behaviour was relatively stable in this group. Similarly, behaviour 9 occurred 79 times in the summer and 80 times in the winter, showing that seasonal changes had little effect on it.

Some fewer common behaviours, such as behaviour 13 and behaviour 22, were recorded less frequently. Behaviour 13 was recorded up to 8 times in the 1-0-Winter group, while behaviour 22 was rarely recorded, indicating that these behaviours are rare or irrelevant in the data context.

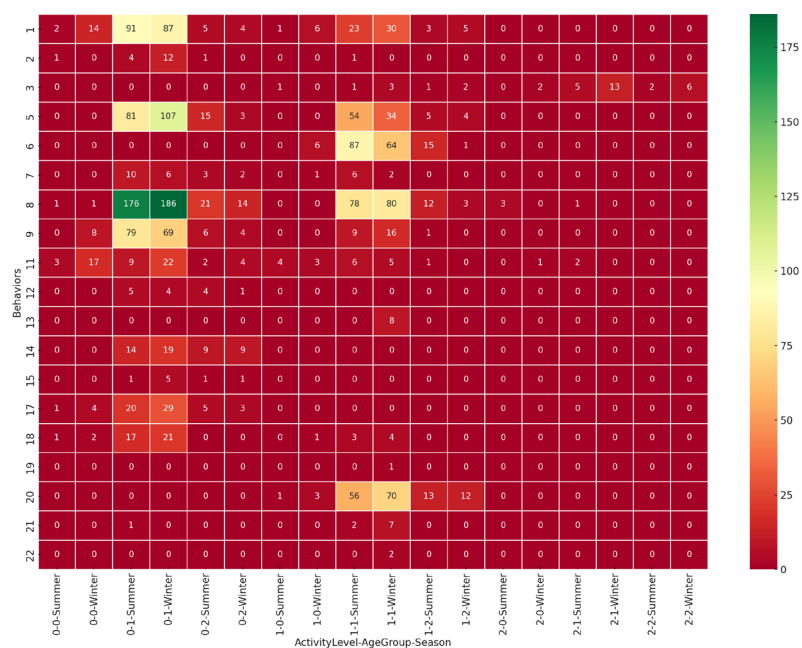


FIG.5.23 Behavioural differences by ethnicity-disability-season

It can be seen in Figure 5.23, behaviour 8 showed a significant dominance in multiple groups, especially in the 0-1-Winter group (186 times) and the 0-1-Summer group (176 times). This phenomenon indicates that the middle-aged group (age group 1) has a high level of participation at a low activity level, which increases especially in winter. At the same time, the 1-1-Winter group was also active in behaviour 8 (80 times), indicating that this behaviour is common at different activity levels.

The effect of seasonal variation on behavioural patterns was significant, with activity generally higher in winter than in summer. For example, behaviour 1 was recorded 91 times in summer

but only 87 in winter; similarly, behaviour 5 was more likely observed in winter with 107 records versus 81 recorded during summer, suggesting an increase in some behaviours due to colder months.

Middle-aged individuals (age group 1) showed consistently high activity across all behaviours, regardless of season. For example, behaviour 9 was recorded 79 times in the 0-1-Summer group and 69 times in the 0-1-Winter group, maintaining relatively high activity throughout the year despite a slight decline in participation in winter.

In contrast, certain fewer common behaviours, such as behaviour 22, were almost invisible, appearing extremely rarely, suggesting that these behaviours appear infrequently in the data or are not significantly affected by the tracked variables.

The analysis of the three behaviour heat maps, combined with multiple factors such as age, gender, season, ethnicity, disability and activity level, led to the following key findings.

Behaviour 8 consistently stands out across all groups, especially among non-disabled individuals of the first race and middle-aged individuals with a low activity level (age group 1). This indicates the importance of this behaviour in these groups.

Seasonal changes significantly affect behavioural patterns, with winter often increasing the activity of specific behaviours. For example, in group 1-0, the frequency of behaviour 1 increased from 85 times in the summer to 88 times in the winter, while behaviour 5 increased from 94 times to 100 times. Behaviour 20 was also relatively prominent in the winter, especially in group 1-1-Winter, where 70 times were recorded, showing the driving effect of seasonal factors on behaviour.

Middle-aged individuals showed high activity in many behaviours, especially behaviours 8 and 9. In contrast, disabled individuals and ethnic minority groups were less active in most behaviours, and behaviours 8 and 9 were almost never seen in these groups, suggesting that these groups may be limited in terms of behavioural participation. In addition, behaviours 14

and 17 also showed low activity in these groups, suggesting that these behaviours may not be relevant enough in the relevant groups.

At the same time, some behaviours, such as behaviours 11, 13 and 22, remain consistently low across all groups and seasons. Although behaviour 11 peaked at 50 times in the 1-O-Winter group, it remained low overall. Behaviour 22 is not visible in almost all heat maps.

5.3.3 TMP Behavioural analysis

5.3.3.1 Demographic breakdown

When analysing the gender, age, ethnicity and disability of the participants, some significant trends were identified. First, regarding gender distribution (see Figure 5.24), women accounted for most participants in both the summer and winter programmes, with participation rates of 65.51 per cent and 63.72 per cent, respectively. The stability of these rates indicates that seasonal changes have little impact on female participation rates.

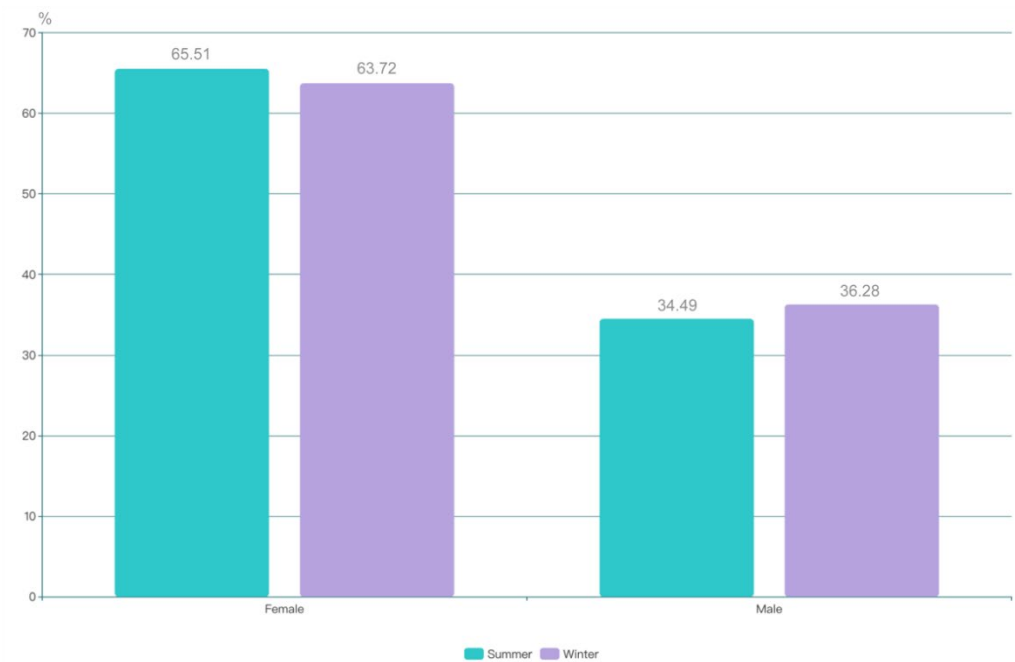


FIG.5.24 Demographic breakdown

In terms of age group distribution (see Figure 5.25), only 1.30 per cent of participants in the summer were teenagers, 93.78 per cent were adults, and 4.93 per cent were elderly people, while the proportion of teenage participants in the winter increased to 7.03 per cent. Adults are still the main group of participants, but the participation of teenagers and the elderly in the winter has increased, showing seasonal changes in participation.

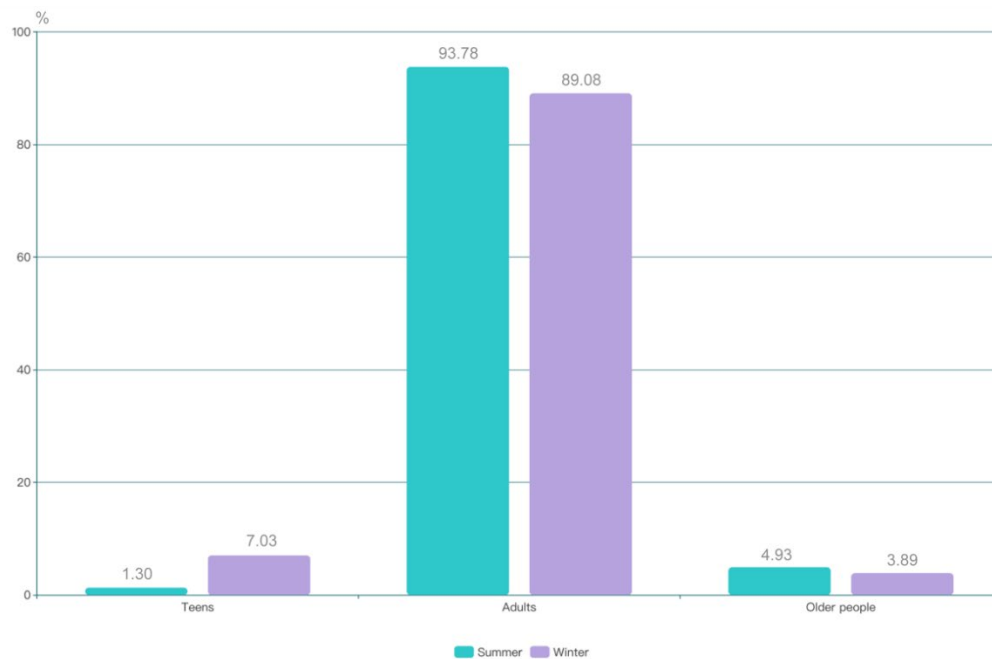


FIG.5.25 Age group breakdown

In terms of ethnic composition (see Figure 5.26), Chinese participants accounted for 94.64 per cent and 94.76 per cent of participants in the summer and winter seasons, respectively, while other Asian participants accounted for 4.58 per cent and 4.64 per cent, and white and black participants were extremely rare. This distribution shows how Chinese participants predominated across both seasons while other groups were significantly underrepresented.

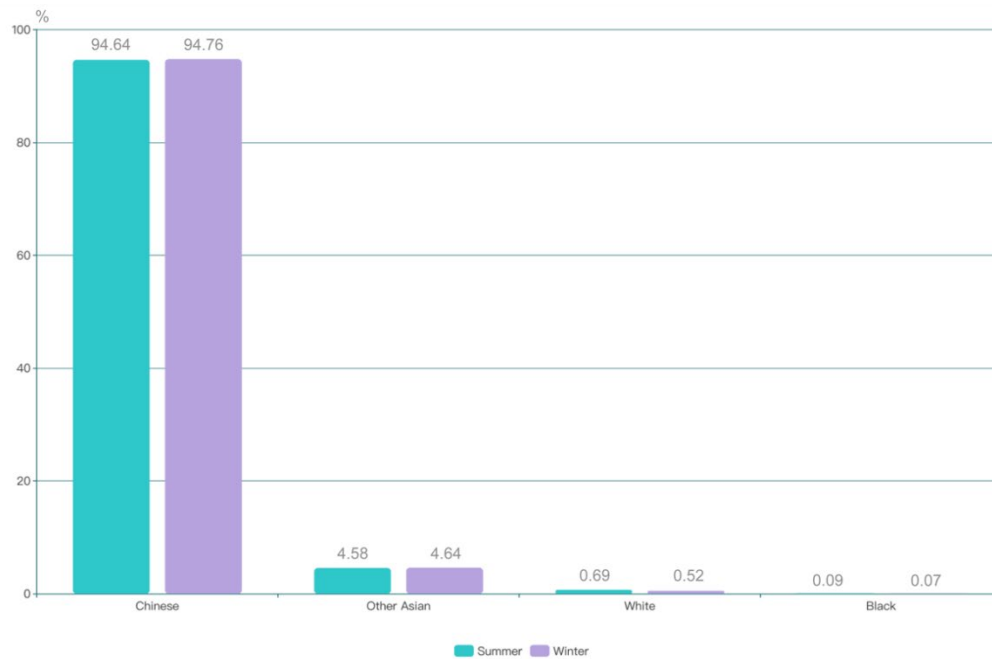


FIG.5.26 Ethnicity breakdown

The disability status (see Figure 5.27) shows that almost all participants have no disabilities. The proportion of disabled participants in summer and winter is 0.09 per cent and 0.07 per cent respectively, which reflects the serious underrepresentation of disabled people and emphasises the need for attention to the participation of disabled people and inclusive design.

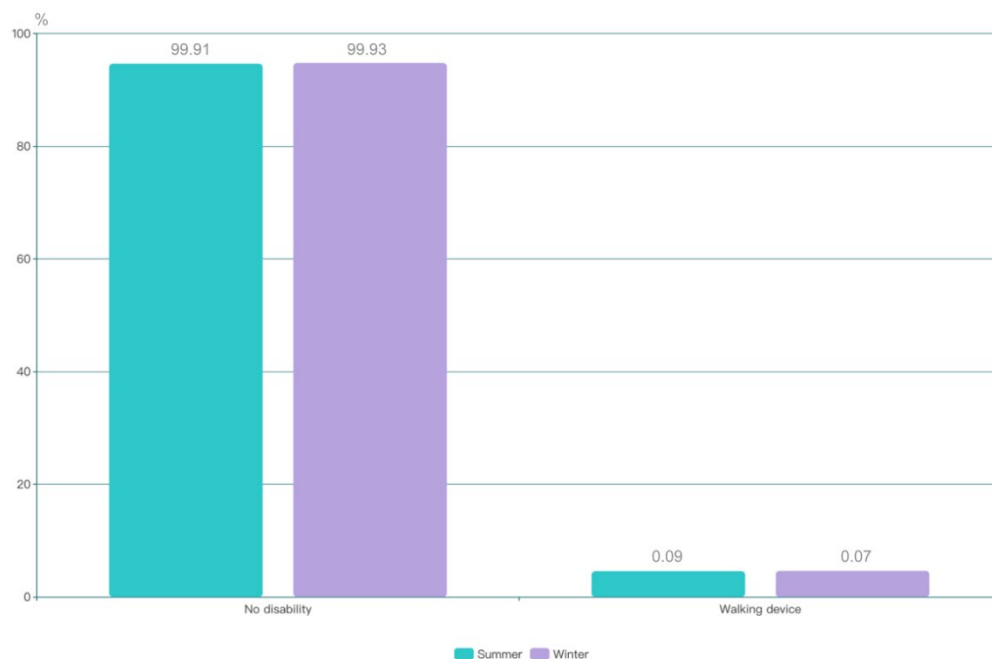


FIG.5.27 Disability status breakdown

5.3.3.2 Behavioural analysis based on demographic

Several significant trends were identified in analysing the behaviour of participants of different genders, ages, ethnicities and disabilities. Firstly, in both summer and winter, both male and female participants showed a high level of engagement in behaviour 8, with women showing a slightly higher level of engagement in behaviour 9. Specifically, in summer, the proportion of women in Behaviour 8 was 34.96 per cent, compared to 37.59 per cent for men, while in Behaviour 9, the proportion of women was 10.42 per cent, compared to 15.29 per cent for men. In winter, the participation of both genders in Behaviour 8 remained stable, and the participation of women in Behaviour 9 was more significant.

Age group analysis shows that adults dominated both summer and winter seasons for behaviours 8 and 9 with 36.31 per cent being performed by adults and 12.17 per cent by older people, respectively. Their sustained interest suggests stable participation patterns among this age group.

Ethnicity analysis indicates that Chinese participants dominated behaviours 8 and 9, accounting for 35.53 per cent and 11.56 per cent, respectively, during summertime periods and 29.83 per cent and 15.23 per cent during winter. This engagement reflects cultural preferences as the playground becomes an arena for intergenerational integration and parent-child interactions. Furthermore, their behaviour in the playground could be restricted socially causing adults to often pass the time by playing on their phones instead of engaging in playful interaction with children.

Regarding disability status, non-disabled participants demonstrated significant participation in behaviour 8 during summer; 35.71 per cent to be exact. A similar pattern was also evident during winter. On the other hand, participation among people with disabilities was severely limited beyond behaviour 8, suggesting an urgent need for inclusive activities to enrich participation experiences; concurrently this indicated potential accessibility issues that require designers to pay more attention to meeting wider accessibility needs.

5.3.3.3 Heatmap analysis

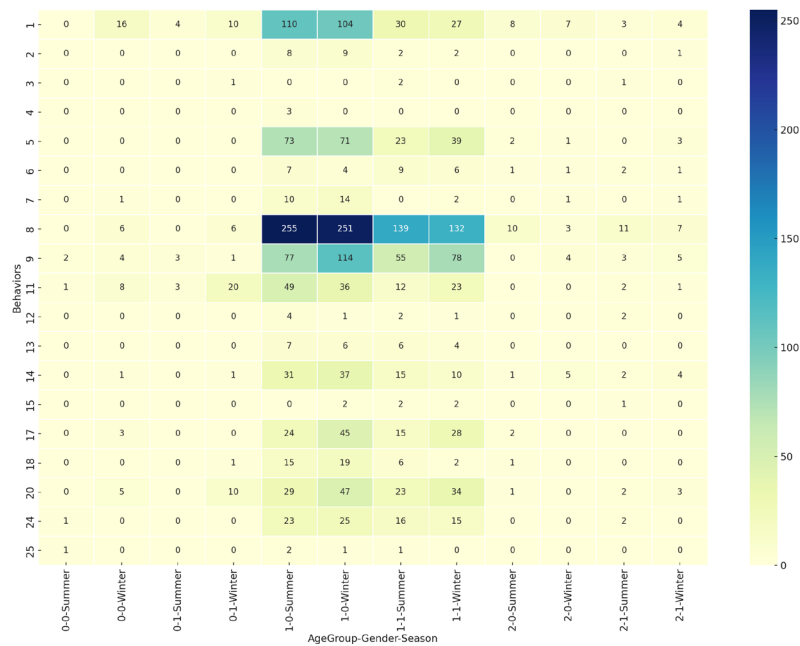


FIG.5.28 Behavioural differences by age group-gender- season

In this Figure 5.28, behaviour 8 shows a significant dominance, especially in the 1-0-summer group (255 times) and the 1-0-winter group (251 times), indicating that middle-aged individuals (age group 1) of both genders frequently engage in this behaviour. In addition, the 1-1-summer group (139 times) and the 1-1-winter group (132 times) also show significant activity of behaviour 8, further emphasising the universality of this behaviour among middle-aged people.

Seasonal changes significantly affect behavioural patterns, with specific behaviours often enhanced in winter. For example, behaviour nine was observed 114 times in the 1-0-winter group, compared with 77 times in the 1-0-summer group, indicating that the cold season may increase certain behaviours. Similarly, behaviour 20 also appeared more frequently in winter, with 47 occurrences in the 1-0-winter group and 29 occurrences in the 1-0-summer group, further suggesting that seasonal factors may influence participation in certain activities.

Among middle-aged people (age group 1), participation rates in behavioural activities showed consistency across seasons. Behaviour 8 remained highly active in summer (255 times) and

winter (251 times). In addition, behaviour 14 in this age group increased slightly from summer (31 times) to winter (37 times), suggesting that some behaviours become more frequent in winter.

In contrast, the behavioural activity of younger individuals (age group 0) and older individuals (age group 2) was generally lower. Behaviour 8 showed a significant decrease in frequency in both age groups, indicating that it is more common in middle-aged people. In terms of gender differences, men and women in age group 1 showed similar trends in their participation in behaviours 8 and 9. However, behaviour 20 appeared slightly less in the 1-1-winter group (34 times) than in the 1-0-winter group (47 times), indicating that the participation of a particular gender may be slightly higher within the same age group.

Finally, behaviours 12 and 25 showed consistently low activity across all age groups, sexes and seasons. Behaviour 12 had a maximum of 4 occurrences in the 1-0-summer group. In contrast, behaviour 25 was almost entirely absent, with only 1 or 2 occurrences recorded, indicating that these behaviours were rare and insignificant under the influence of the tracked factors.

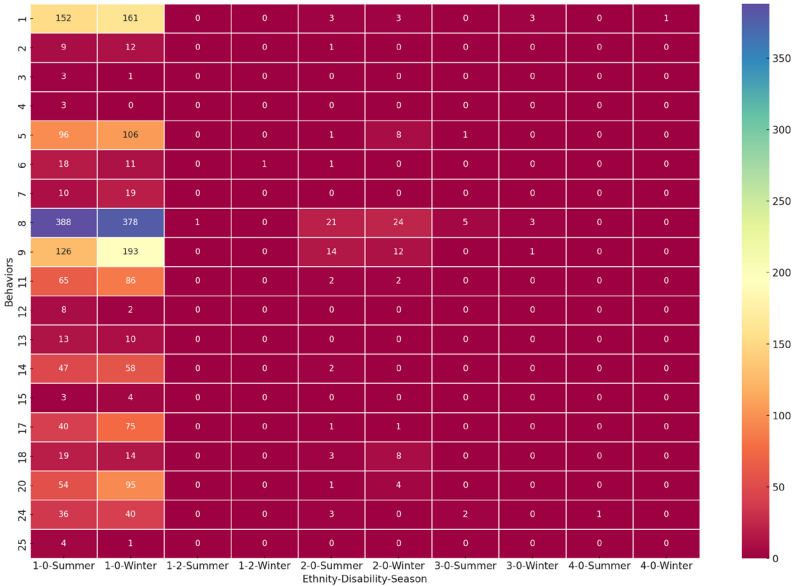


FIG.5.29 Behavioural differences by ethnicity-disability-season

In this Figure 5.29, behaviour 8 showed a significant dominance among ethnic 1 individual without disabilities, especially in the 1-0-winter group (378 times) and the 1-0-summer group (388 times), showing the importance of this behaviour in this group. Behaviour 9 also showed obvious seasonality, occurring 193 times in the 1-0-winter group compared to 126 times in the 1-0-summer group, indicating that the cold season promoted an increase in this behaviour.

In contrast, disabled individuals (labelled as groups ending in -2) and ethnic minority groups (e.g. 3-0 and 4-0) were relatively inactive in most behaviours. For example, in behaviour 8, these groups had almost no relevant participation, with only 5 counts in summer and 3 in winter. Behaviour 9 was almost non-existent in these groups, which may indicate that these behaviours are uncommon among disabled individuals and ethnic minority groups, or that these groups are underestimated in the dataset.

In terms of seasonal consistency, behaviour 5 showed relatively stable activity in group 1-0, with 96 times in summer and 106 times in winter, indicating that this behaviour is consistent across different seasons. Behaviour 11 also showed a similar trend, with 65 times recorded in 1-0-summer and 86 times in 1-0-winter, indicating stable participation in this behaviour throughout the year.

However, some behaviours, such as behaviour 12, behaviour 13 and behaviour 15, showed consistently low activity across all groups and seasons. For example, behaviour 12 was recorded only 8 times in 1-0-summer and only 2 times in 1-0-winter. In addition, behaviour 25 was almost completely absent, with only a few records, indicating that this behaviour is rare or not significantly affected by the factors tracked.

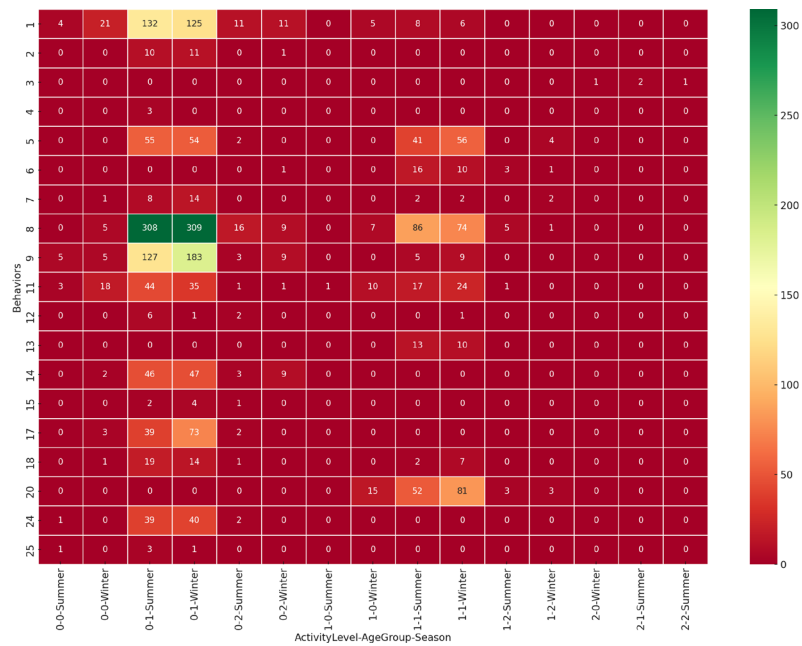


FIG.5.30 Behavioural differences by activity level-age group-season

In this Figure 5.30, behaviour 8 showed a clear dominance in multiple groups, especially in the 0-1-Winter (309 times) and 0-1-Summer (308 times) groups. This indicates that middle-aged individuals with low activity levels are highly inclined to engage in this behaviour and that their participation is almost equal in winter and summer. In contrast, 1-1 Summer showed significantly reduced participation - this shows how correlation between low activity levels and frequency of behaviours occurs.

Seasonal fluctuations were evident when looking at behaviour 9, as shown by its increased occurrences between 0-1-Winter and 127 in 0-1-Summer groups; suggesting winter may facilitate its use among middle-aged individuals with low activity levels. Also noteworthy is an increase from 52 in 1-1-Summer to 81 in 1-1-Winter groups which may indicate seasonal influences that influence it.

Individuals in age group 1 showed consistently high activity levels across behaviours and seasons, especially those with low activity levels—behaviours 8, 9 and 20 dominated in this group. For example, behaviour 14 was recorded 47 times in 0-1-winter and 46 times in 0-1-summer, showing stable participation between seasons.

In contrast, age group 0 (young individuals) was generally less active in most behaviours, with behaviour one only recorded 21 times in 0-0-winter and only four times in 0-0-summer, indicating much lower participation than age group 1. Behaviour 8 was also significantly less frequent in the younger group, further emphasising the dominance of middle-aged individuals in certain behaviours.

Finally, behaviours 12 and 13 showed consistently low activity across all age groups, activity levels and seasons, with behaviour 12 only recording a maximum of 6 times in 0-1-summer. Behaviour 25 was almost entirely absent in almost all groups, with a maximum of only three times recorded in 0-1-winter, indicating that this behaviour was sporadic or not significantly affected by the factors tracked.

5.3.4 Summary of key patterns from the three playgrounds' heatmap

The heatmaps (see Figures 5.21–5.30) reveal the consistent dominance of Behaviour 8 across all sites, particularly among middle-aged individuals (age group 1) with low activity levels and non-disabled participants from the first ethnic group. These users showed significantly higher engagement with Behaviour 8 in both summer and winter, reflecting the role of this behaviour as a socially and observationally dominant activity. In contrast, Behaviours 12, 13 and 25 remained consistently rare across all locations, suggesting their limited relevance to users' actual engagement patterns.

Seasonality emerged as a major factor, with colder months associated with increased participation in certain behaviours such as Behaviours 9 and 20. The increase in sedentary or static activities during winter (e.g., sitting, watching, low-mobility play) was particularly notable among older adults and individuals with low activity levels. Conversely, younger participants were generally more active during warmer months, engaging in physically demanding behaviours such as running, climbing or vigorous play.

Demographic dimensions—age, gender, ethnicity, and disability—significantly shaped behavioural patterns. While gender differences were modest overall, men were more frequently

observed in physically intensive activities, whereas women tended to show slightly higher involvement in social or observational behaviours. Age-related patterns were more distinct: middle-aged adults consistently represented the most active demographic across seasons and sites, whereas elderly and adolescent groups showed lower participation and greater sensitivity to seasonal variation.

Ethnic background also influenced engagement patterns. The first ethnic group (predominantly Chinese participants) exhibited high rates of interactional and observational behaviours, whereas minority ethnic groups and participants with disabilities were significantly underrepresented across all tracked behaviours. This under-participation may be due to cultural barriers, perceived lack of inclusion, or physical inaccessibility in the playground environment.

Disability status revealed the most substantial disparity. Individuals with disabilities demonstrated extremely low engagement in most tracked behaviours across all heatmaps, particularly Behaviours 8 and 9, which were dominant among able-bodied users. The limited participation of disabled individuals reflects structural barriers and highlights the urgent need for more inclusive, accessible playground design that accommodates diverse physical and sensory needs.

Activity levels correlated closely with seasonal and demographic factors. Middle-aged users with lower activity levels were the most active in Behaviours 8 and 9 during winter, while high activity-level groups showed more varied but less frequent engagement. The interaction between activity level and seasonal context shaped how and where people engaged with the space, especially in colder weather when opportunities for mobile play declined.

In summary, the heatmap data offers a nuanced view of stakeholder engagement in playgrounds, showing how **seasonal**, **demographic**, and **physical factors** interact to shape behaviour. The findings underscore the importance of designing multi-dimensional, inclusive spaces that respond to not only children's needs but also those of adult caregivers, elderly users,

and people with disabilities. Such an approach is essential to supporting equitable access and diverse use in public play environments.

5.3.5 Behaviours in public inclusive playgrounds

This study counted all the behaviours in three playgrounds in order to explore the most common behaviours in playgrounds.

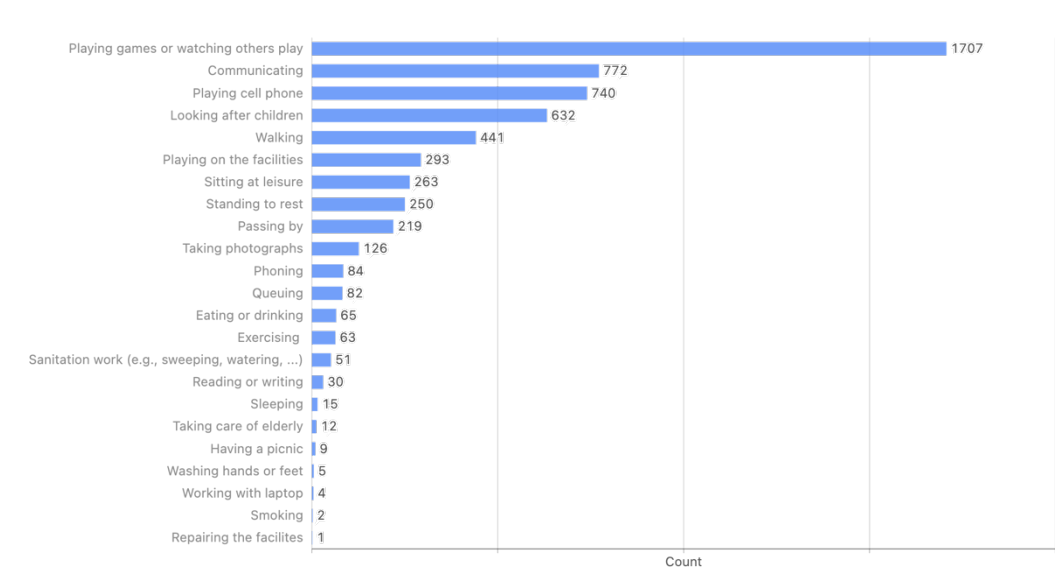


FIG.5.31 Most common behaviours and their frequency

According to the analysis results (see Figure 5.31), adults did not come to the playground primarily to take care of children. ‘Playing games or watching others play’ was the most common behaviour, occurring 1,707 times, indicating that this activity dominated among participants. Next, ‘communicating’ was also an expected behaviour, recorded 772 times, reflecting the importance of social interaction in the playground. The behaviour of ‘playing with mobile phones’ was recorded 740 times, showing the widespread use of mobile devices in the daily lives of participants. Although the behaviour of ‘childcare’ appeared 632 times, ranking fourth, participants seemed to prefer direct participation in playground activities rather than just accompanying and caring for children.

Regarding physical activity, the behaviour of ‘walking’ was recorded 441 times, indicating that participants had a certain degree of physical activity in the playground. These data show the relative importance of different activities among participants and help to gain a deeper understanding of behavioural patterns in public spaces in playgrounds.

To further analyse these behaviours, this study will use hierarchical clustering analysis of the playground data, as shown in Fig 5.32. According to the results of the data analysis, a total of 18 different behavioural clusters were found, each of which reflects the multidimensional behavioural characteristics of participants in the playground (see Table 5.8 for details).

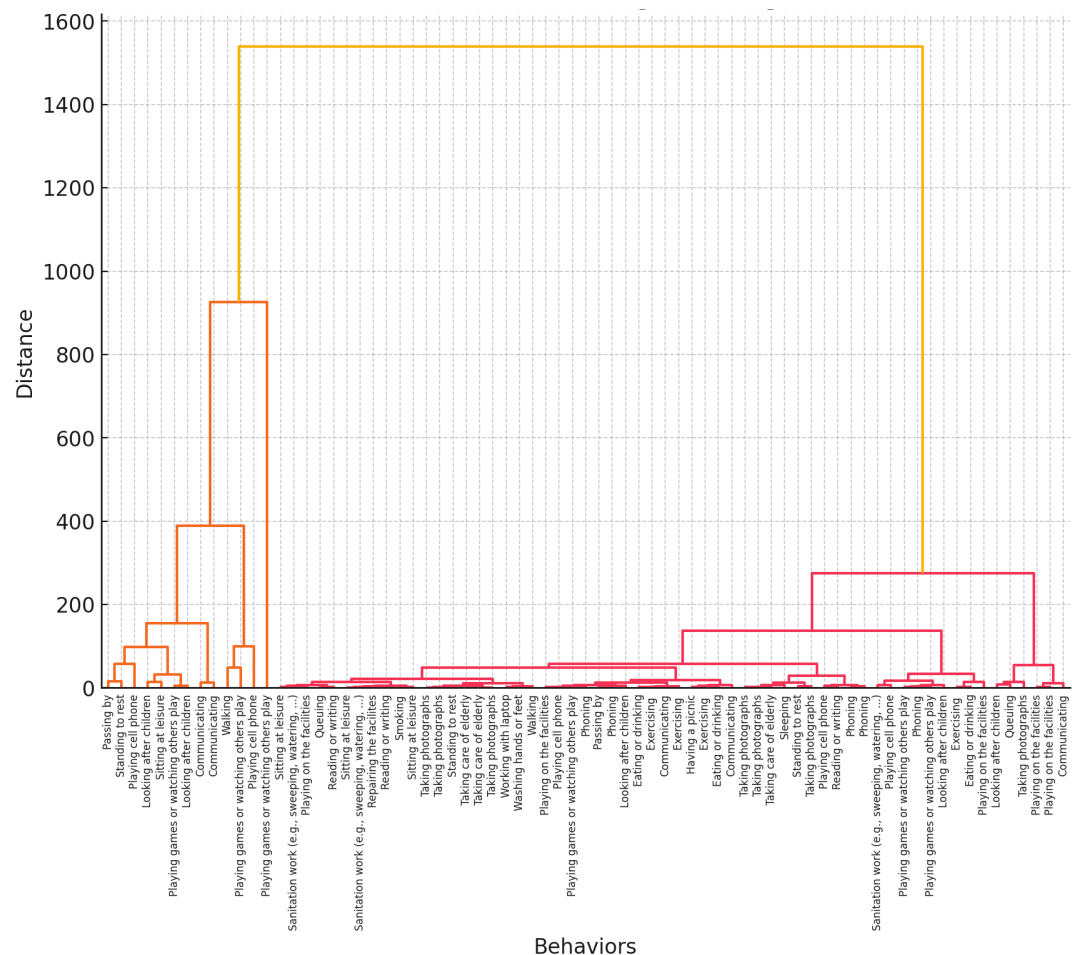


FIG.5.32 Hierarchical cluster dendrogram

TABLE 5.8 Behaviour clusters analysis

Clusters	Behaviours	Characteristics
Cluster 1: Social and	‘Playing on the facilities,’	Focuses on social interaction and recreation

Recreational Activities	‘Communicating,’ and ‘Playing games or watching others play.’	through group activities and games.
Cluster 2: Observational and Caretaking Tasks	‘Taking photographs,’ ‘Queuing,’ and ‘Looking after children.’	Involves passive activities, including caretaking, observation, or waiting.
Cluster 3: Mixed Leisure and Routine Activities	‘Playing on the facilities,’ ‘Eating or drinking,’ and ‘Playing games or watching others play.’	Combines casual social activities with routine tasks in versatile settings.
Cluster 4: Solitary and Task-Oriented Activities	‘Phoning,’ ‘Playing cell phone,’ and ‘Sanitation work.’	Focuses on individual, task-oriented activities often involving personal devices or specific tasks.
Cluster 5: Personal Engagement Activities	‘Phoning,’ ‘Reading or writing,’ and ‘Playing cell phone.’	Centres on individual tasks involving reading, writing, or device use.
Cluster 6: Maintenance and Practical Tasks	‘Sanitation work,’ ‘Repairing facilities,’ and ‘Working with laptop.’	Involves practical work tasks, focusing on maintenance or equipment repair.
Cluster 7: Movement-oriented Activities	‘Walking,’ ‘Passing by,’ and ‘Exercising.’	Involves physical movement, reflecting areas designed for active use.
Cluster 8: Communication and Interaction	‘Communicating,’ ‘Looking after children,’ and ‘Playing games or watching others play.’	Centres on interaction and supervision in social or caregiving contexts.
Cluster 9: Passive Observation and Rest	‘Standing to rest,’ and ‘Sitting at leisure.’	Involves passive observation and resting activities.
Cluster 10: Recreational Play	‘Playing games or watching others play,’ ‘Playing on the facilities,’ and ‘Having a picnic.’	Focuses on recreational group activities.
Cluster 11: Device-focused Engagement	‘Phoning,’ ‘Playing cell phone,’ and ‘Taking photographs.’	Revolves around device use, including phones and cameras.
Cluster 12: Focused Work and Study	‘Reading or writing,’ ‘Working with laptop,’ and ‘Repairing facilities.’	Includes concentrated work or study tasks, often requiring focus.
Cluster 13: Physical Maintenance	‘Sanitation work,’ ‘Repairing facilities,’ and ‘Washing hands or feet.’	Involves physical upkeep and maintenance activities.
Cluster 14: Family and Care Activities	‘Looking after children,’ ‘Playing on the facilities,’ and ‘Communicating.’	Centres on family-oriented activities involving care and interaction.
Cluster 15: Social Dining	‘Eating or drinking,’ ‘Having a picnic,’ and ‘Communicating.’	Combines social interaction with dining or casual gatherings.
Cluster 16: Quiet Contemplation	‘Sitting at leisure,’ ‘Standing to rest,’ and ‘Playing games or watching others play.’	Involves quiet, often solitary activities, focused on relaxation or reflection.
Cluster 17: Emergency or Urgent Activities	‘Exercising,’ ‘Phoning,’ and ‘Sanitation work.’	Reflects behaviours associated with urgency or emergencies, such as quick actions or calls.
Cluster 18: Group Play and Interaction	‘Playing games or watching others play,’ ‘Communicating,’ and ‘Looking after children.’	Focuses on group play and social interaction, particularly involving children.

Analysis of 18 behavioural clusters led to several conclusions. Firstly, each cluster revealed different environmental needs ranging from social and recreational areas to quiet contemplation spaces. Secondly, each cluster provided specific requirements for spatial design to ensure that the functionality of the space could maximise support for the corresponding behavioural activities. It suggests that design should be optimised according to different behavioural patterns to meet diverse usage needs.

In addition, some clusters emphasise the importance of multifunctional spaces, especially those catering to social and independent activities, further highlighting the need for flexible design. These findings support the theoretical framework for public space design and provide valuable guidance for spatial planning in practice, ensuring that designs can cater to diverse user groups and behaviour patterns.

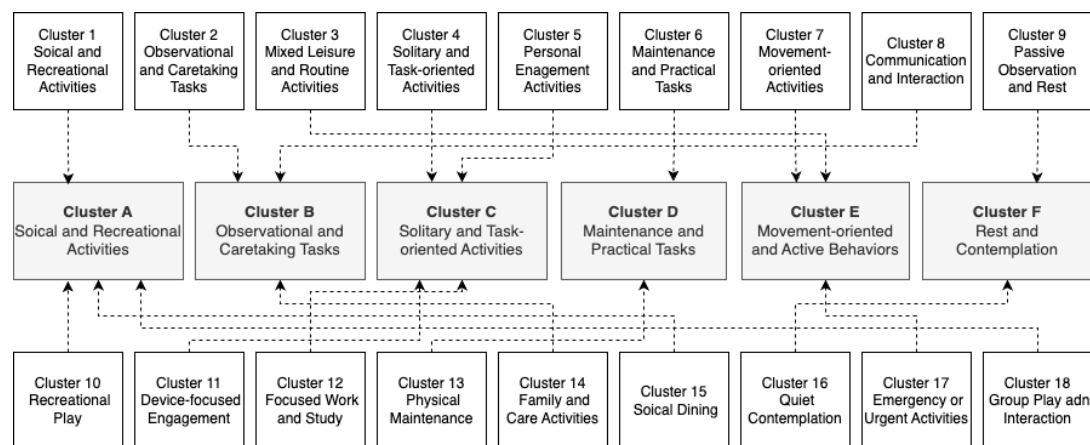


FIG.5.33 Six behaviour clusters

Six main behavioural clusters were identified through analysis of 18 behavioural clusters (see Figure 5.33). These reflect the individual users' behavioural traits in a playground setting and their spatial needs; these don't stem from physical design of any specific space but from observation and analysis of user behaviours, which lead to functional requirements related to them. Drawing upon these patterns can help playground design more precisely meet users' requirements thereby increasing inclusiveness and diversity on site.

TABLE 5.9 Analysis of six behaviour clusters

Clusters	Characteristics	Functional zones
Cluster A: Social and Recreational Activities	Focuses on social interaction, group play, and recreational activities.	Requires open, accessible spaces that promote group engagement, socializing, and play.
Cluster B: Observational and Caretaking Tasks	Involves passive observation, caretaking, and family interaction.	Needs spaces for supervision and care, where both children and adults can interact and safely engage.
Cluster C: Solitary and Task-Oriented Activities	Centres on solitary tasks like work or personal device use.	Requires quiet, private areas for focused tasks, free from interruptions.
Cluster D: Maintenance and Practical Tasks	Focuses on maintenance, repair, and upkeep.	Functional spaces for facility maintenance, with easy access and necessary tools for upkeep.
Cluster E: Movement-Oriented and Active Behaviours	Involves physical activity, running, or urgent tasks.	Spaces for exercise and physical activity, with clear emergency access such as running tracks, fitness zones, and marked exits.
Cluster F: Rest and Contemplation	Centres on rest, relaxation, and passive activities.	Tranquil, serene areas designed for relaxation and contemplation, visually calming and peaceful.

First, **social and recreational activities cluster** is a prominent behavioural cluster. Frequent behaviours in this cluster, such as ‘participating in group games’ and ‘social communication’, indicate that participants in playgrounds rely heavily on social interaction. Analysis of these behaviours shows that there is a particularly strong demand for open, interactive spaces. This demand reflects participants’ desire to connect with others and engage in recreational activities together in a space. Playground design should strive to support such behaviours, enabling participants of all ages to interact in an interconnected and inclusive environment.

Meanwhile, **observational and caretaking tasks** form another major cluster. Behavioural analysis shows that the core behaviours of guardians and parents in playgrounds are ‘childcare’ and ‘family interaction’. These behaviours reflect the high demand for safe spaces from family groups. Parents want to be able to carry out activities in a place that can ensure the safety of children while also promoting social interaction among adults. Playground design should focus on the planning of safe areas for children to ensure that parents can easily participate in other social activities while supervising their children. Accessibility is also key in this type of space,

so that all family members, especially those using a stroller or wheelchair, can enter and use the space smoothly.

The cluster of **solitary and task-oriented activities** reveals the need for solitude and privacy in the playground. These behaviours include ‘reading’, ‘using personal devices’ and ‘quiet contemplation’, which show that participants want to relax and rest in an environment away from the hustle and bustle and suitable for personal activities. Observing this type of behaviour shows that people also crave personal time in public spaces. This suggests that designers should provide appropriate private spaces when planning playgrounds, creating a quiet area that is relatively isolated from the surrounding environment for those seeking solitude or contemplation.

In the cluster of **maintenance and practical tasks**, the frequent occurrence of behaviours such as ‘equipment maintenance’ and ‘facility cleaning’ reflects another aspect of the playground as a functional public space. Although playgrounds are primarily used for recreation and socialising, they are also spaces that require constant maintenance and management. The good condition of the facilities is crucial to the user experience, so it is particularly important to provide functional support facilities for maintenance personnel and equipment. The design of the playground should not ignore this need, especially when maintenance and management work need to be carried out frequently. Reasonable equipment storage space and convenient operating paths are particularly important.

The cluster **movement-oriented and active behaviours** further demonstrate the need for physical activity and emergency response. Behaviours such as ‘running’ and ‘emergency evacuation’ indicate that some areas of the playground must support highly active activities. This requires not only suitable facilities and safety for physical activity, but also the ability to evacuate quickly and effectively in an emergency. Clear emergency exit signs and easy-to-use evacuation routes are therefore central to this need. In addition, designs that encourage physical activity, such as shock-absorbing surfaces or fitness equipment, not only meet children’s exercise needs, but also attract adults.

Finally, common behaviours in the **rest and observe** behaviour cluster, such as ‘rest’ and ‘observe others’ activities’, indicate that people also have a need to relax, recover and enjoy the environment in playgrounds. Comfortable seating and shade are key to meeting this need. Some areas of the playground should be designed to be quiet and comfortable enough for people who want to engage in low-intensity activities or just relax. This design not only enhances the experience of using the site, but also makes people feel more pleasure in this space by optimising the visual landscape and creating a comfortable atmosphere.

The analysis of these six main behavioural clusters shows that playground design should be based on behavioural needs to ensure that the space can meet the diverse needs of users. This behaviour-based design approach will help the playground to better support multi-dimensional behavioural activities, further enhancing its inclusiveness and functionality. Research shows that design not only needs to provide spatial functions that support specific behaviours, but also a deep understanding of the needs of different users to ensure that all users can have a rich and fulfilling experience in this public space.

In the following, this study will further explore how to optimise the configuration of these functional areas in combination with BMAT data. By analysing behavioural data, the spatial distribution characteristics of various activities can be analysed to ensure that the functional areas are reasonably and effectively divided to meet actual needs. The focus will then be on how to reasonably plan these functional areas in the design to achieve an efficient and inclusive playground design.

5.4 BMAT Results and analysis

5.4.1 Basemap preparation

This study is based on the Hong Kong Lands Department’s iB1000 map, satellite map, and on-site videos and photos. The three playgrounds were mapped and processed to remove unnecessary features that may increase the complexity of observation. The maps of the three

playgrounds drawn mainly include boundaries, entrances, paths, play equipment, green areas, leisure areas, and washing facilities. The following is a detailed description of the site maps of these three playgrounds:

(1) Kowloon Park Children Playground (KLNP)

As shown in Figure 5.34, the **sheltered seating areas** are marked in light teal, providing users with protection from sunlight and rain. The **verge**, shown in light orange, denotes transitional buffer zones along the edge of planted areas. **Play equipment**, represented in red orange, is centrally clustered and includes climbing frames, slides, and similar features. The **playground boundary** is defined by a pink dotted line, indicating the designated children's activity zone.

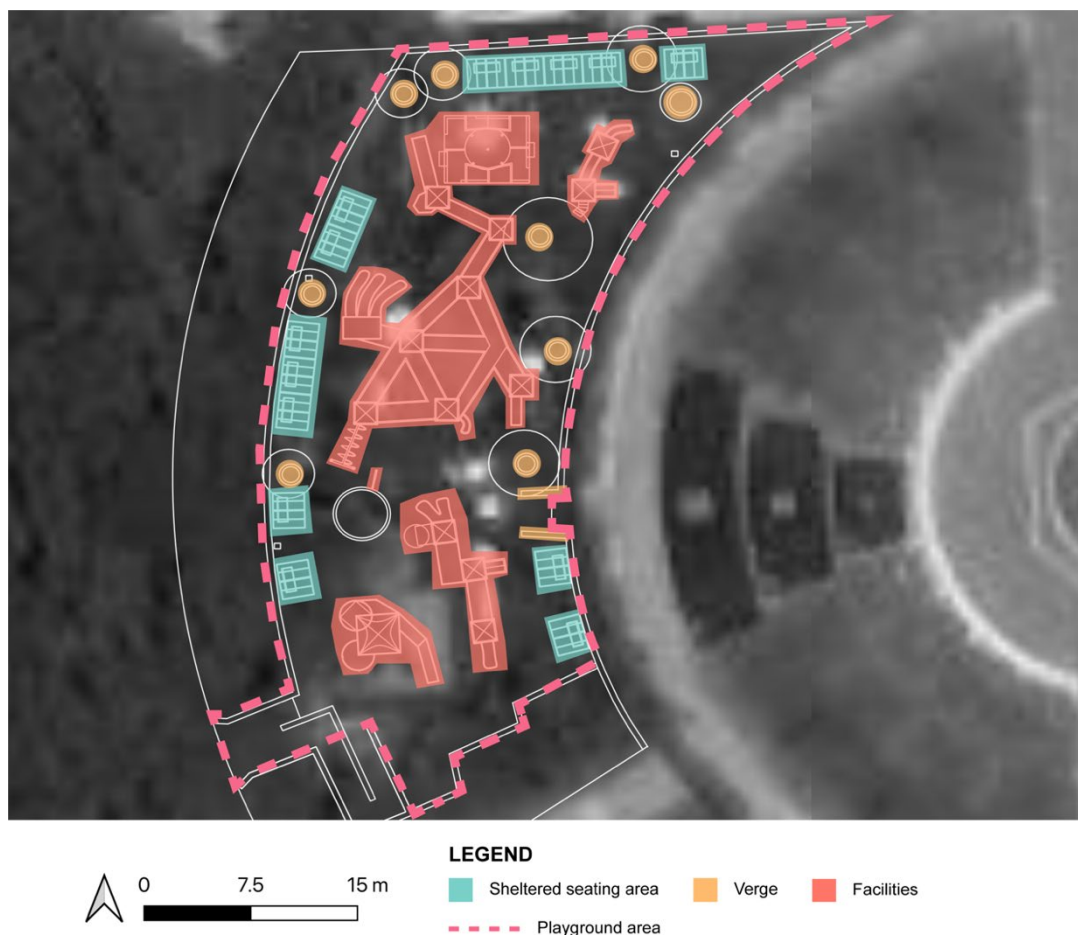


FIG.5.34 Basemap of KLNP

(2) Quarry Bay Park Children Playground (QUBP)

As shown in Figure 5.35, the **shaded seating areas** are also marked in light teal. These areas provide visitors with shaded resting spaces to protect them from direct sunlight or rain. The **verge** is marked in light orange and represents the transition zone between the green area and the flower bed. The **play equipment** is marked in red-orange and concentrated in the playground's centre, including climbing frames, slides, swings, etc. The **entire playground area** is outlined by a pink dotted line, representing the area for children's recreational activities.

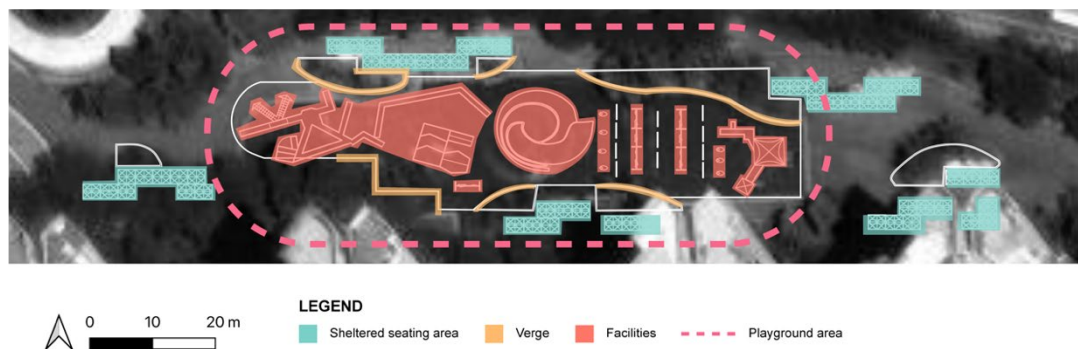


FIG.5.35 Basemap of QUBP

(3) Tuen Mun Park Children Playground (TMP)

As shown in Figure 5.36, **shaded seating areas** are indicated by light teal, indicating that these areas provide sheltered seating for visitors. **Open seating areas** are indicated in blue. **Play facilities** are still indicated by red orange, concentrated in the centre of the playground, including climbing frames, slides, and swings. **Hand-washing facilities** are indicated in purple, allowing the public to wash their hands and feet. **The playground boundary** is circled by a pink dashed line, indicating the activity area for children to play. **Verge** is indicated by yellow, marking the edge of a small lawn or green area that may be located along a path or near a playground.

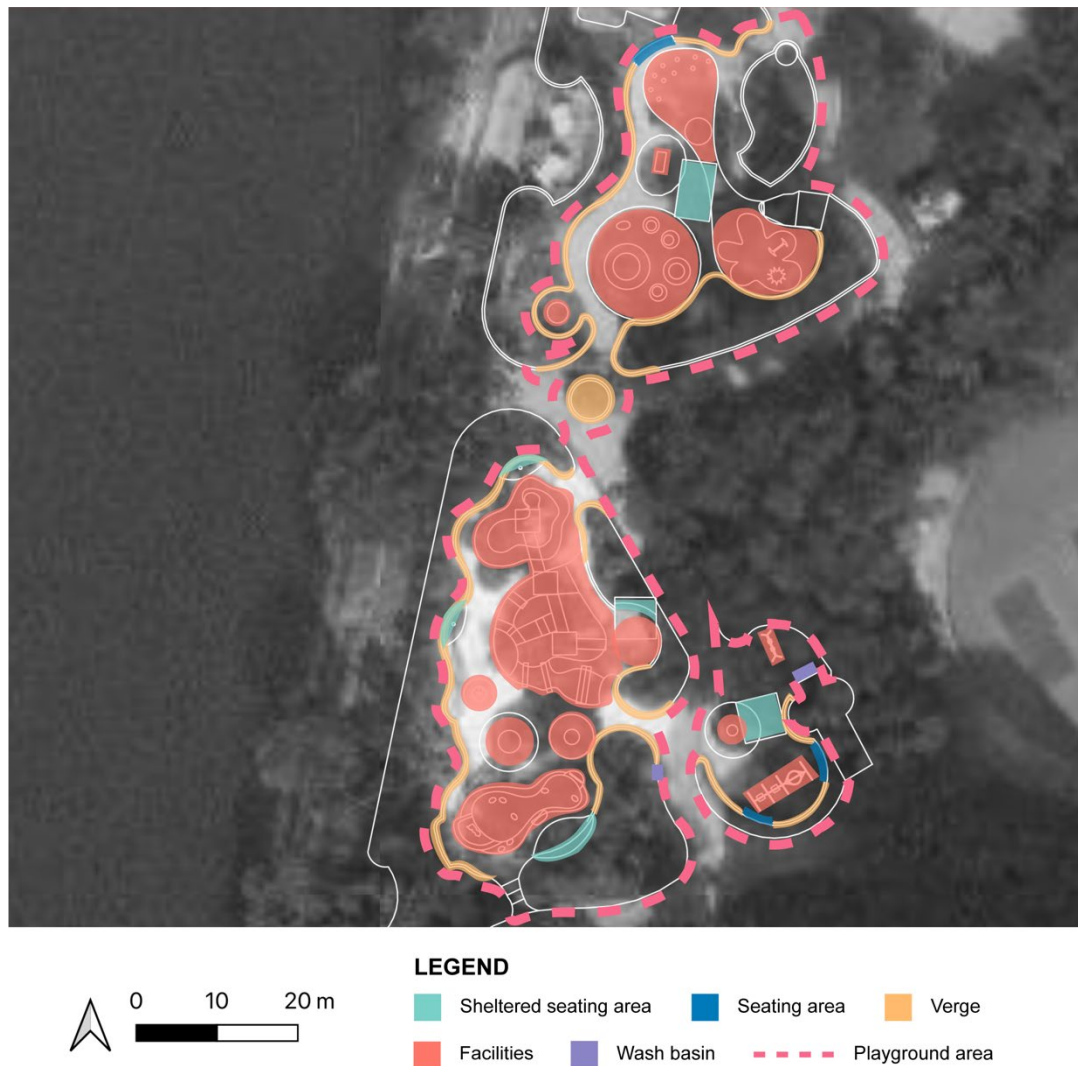


FIG.5.36 Basemap of TMP

5.4.2 Isolating parts of the data by different attributes

In QGIS software, by loading all data points and using the attribute filtering function, different types of behaviours can be spatially visualized to obtain an overall spatial distribution impression. Since this study is based on the SOPARC coding system, the use of playgrounds can be further explored through segmented data such as gender, age, ethnicity, disability status, physical condition, behaviour, and activity level. This study is focused on examining the types and locations of activities carried out at BMAT venues, with recommendations to enhance its design in order to meet diverse needs and enhance inclusivity.

5.4.2.1 Cluster A: Social and recreational activities

The behavioural cluster of social interaction usually involves direct interaction between people or participation in a social activity. It mainly includes ‘communicating’, ‘having a picnic’, ‘looking after children’, ‘playing games or watching other play’, ‘taking care of elderly’ and ‘queuing’. Communicating is a typical social interaction behaviour that directly involves dialogue and communication between people. Having a picnic is usually a group activity that involves interaction with family or friends. In the behaviour of looking after children, there is interaction between parents or guardians and children, and they may also communicate with other guardians. Playing games or watching others play Playing games usually involves interaction with other people, and watching may also involve interaction or communication with others. Taking care of elderly involves interaction with older people and may also include interaction with other carers. Queuing, although not a typical social activity, people sometimes interact and communicate with other people in line.

As shown in Figure 5.37, the ‘communicating’ behaviour in the KLNP is concentrated in the shaded seating areas, reflecting the importance of shade and seating provision for social interaction. The ‘having a picnic’ activities are more dispersed but mainly located near the children’s play equipment, indicating that families tend to carry out leisure activities nearby while keeping an eye on their children. The ‘looking after the child(ren)’ behaviour is concentrated around the equipment, directly reflecting the close connection between the guardians and the active areas. In addition, the behaviour of ‘playing games or watching others play’ is also concentrated in the critical areas of the playground, indicating high-frequency use of the space. The activity of ‘taking care of the elderly’ is relatively sparse and mainly distributed in the peripheral areas, providing a relatively comfortable environment for the elderly. These distribution characteristics show that active interactions dominate the core areas of the playground, while the peripheral areas provide space for leisure and relaxation activities.

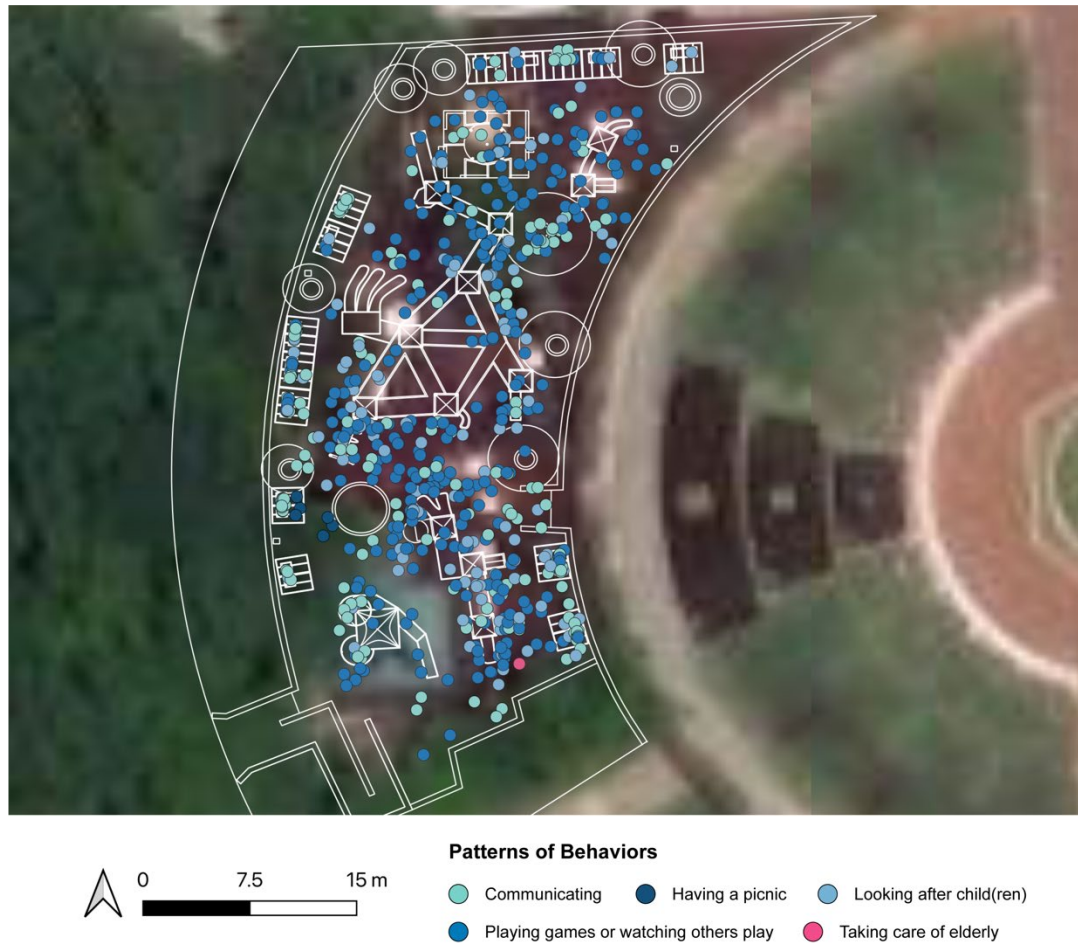


FIG.5.37 Spatial location of 'social and recreational activities behaviour cluster

In the QUBP (see Figure 5.38), 'communicating' activities mainly occurred in sheltered seating areas away from active areas, while 'looking after child(ren)' and 'playing games or watching others play' were similar, both concentrated in the central area near the facilities, reflecting parents' efforts to ensure the safety of children while also effectively using the facilities through design. The behaviour of 'taking care of elderly' is concentrated in the edge area of the park, which shows that these areas are quieter and suitable for settling and resting. Overall, the distribution of social and recreational activities in QUBP reflects how seating and shade facilities promote social interaction and how the design of children's activity areas makes them attractive for family use.

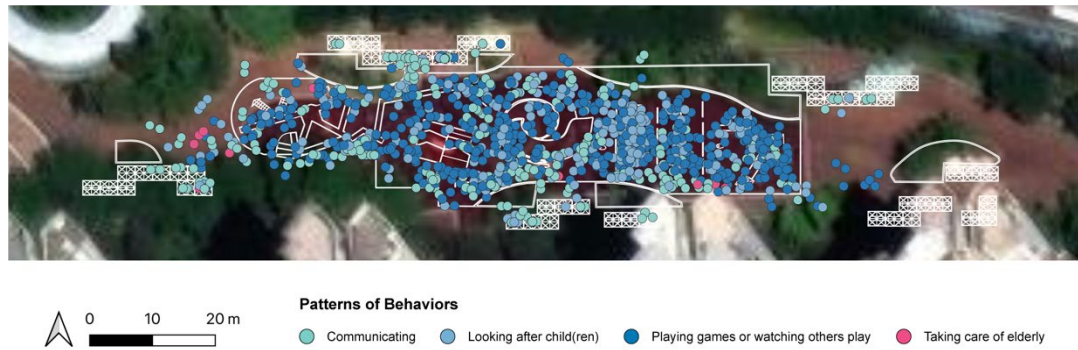


FIG.5.38 Spatial location of 'social and recreational activities'

TMP has a similar activity distribution to the two previous playgrounds (see Figure 5.39). The 'communicating' behaviour is concentrated at the park entrance and in areas with more seats, while the 'having a picnic' activity is more common in the green belt near the playground, where the view is comprehensive and convenient for family activities. The 'Looking after child(ren)' behaviour covers almost the entire playground, especially the area around the equipment, indicating that these facilities have successfully attracted family use. The 'Playing games or watching others play' behaviour is concentrated in areas with dense facilities, indicating that the design supports game activities. The 'queuing' behaviour in the park is concentrated near popular facilities such as swings, reflecting the peak demand for facility use.

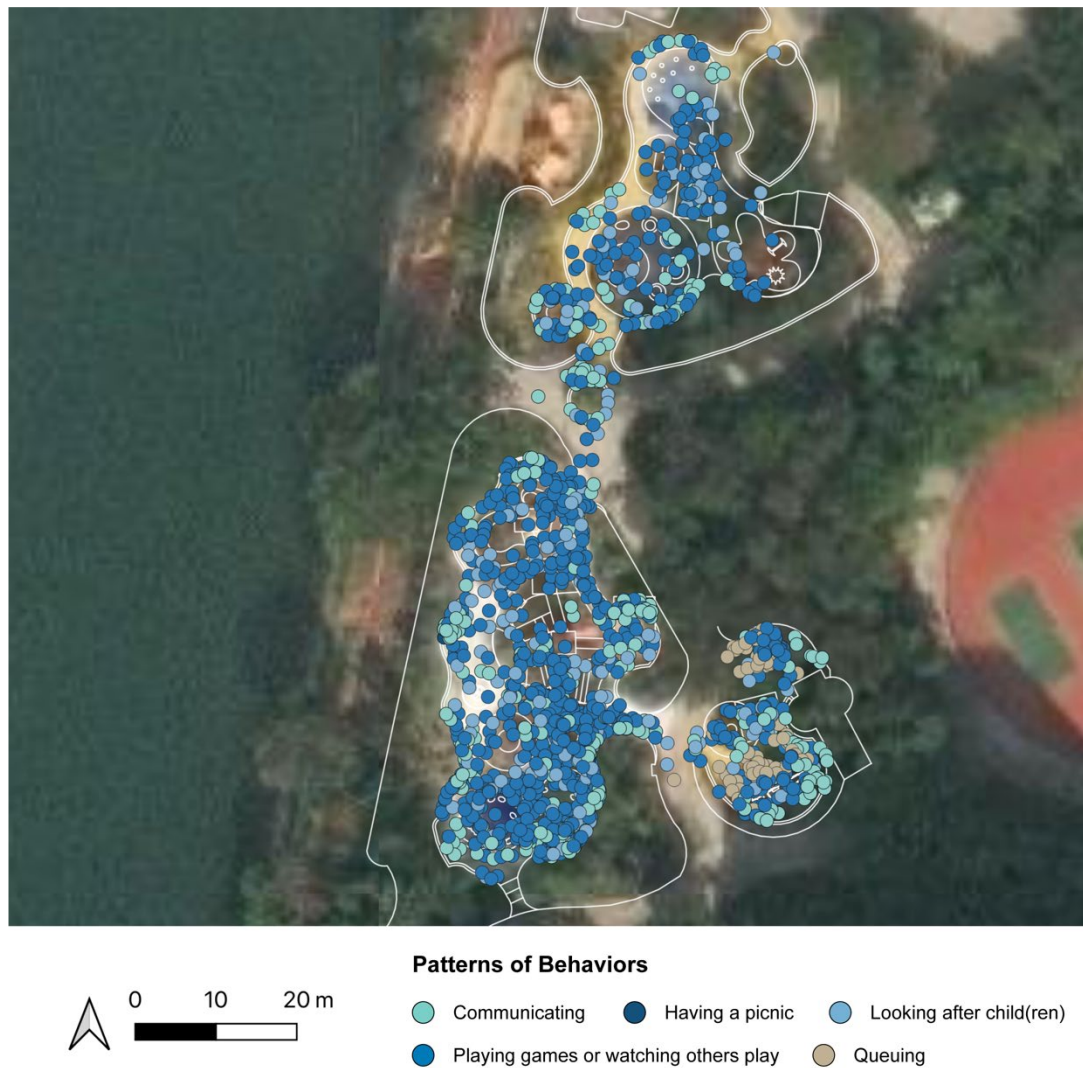


FIG.5.39 Spatial location of 'social and recreational activities'

In summary, the spatial distribution of different social and recreational activities in social interaction behaviour clusters in various parks has significant hierarchical characteristics. Active games and entertainment activities are primarily concentrated in amusement facilities, while social activities tend to occur in peripheral seating areas. The 'Looking after child(ren)' activities are concentrated around the equipment, indicating that the design of these areas effectively meets the needs of families and children, while the 'Taking care of elderly' activities are concentrated in quiet and comfortable edge areas. These spatial distribution characteristics provide helpful reference for future playground design; that is, while improving the activity of the facilities, appropriate social and leisure spaces should also be provided for different groups to achieve the space's inclusive design goal.

5.4.2.2 Cluster B: Observational and caretaking tasks

Visual analysis of the spatial distribution of behavioural clusters of observational and caretaking tasks through QGIS revealed the distribution characteristics of custodial behaviour, observational behaviour and elderly care behaviour in different parks. Observational and caretaking tasks mainly include ‘looking after the child(ren)’, ‘playing games or watching others play’, ‘taking care of the elderly’, and ‘taking photographs’, closely related to various amusement facilities and spatial layouts.

In the KLNK (see Figure 5.40), the activity of ‘looking after the child(ren)’ is concentrated around the play equipment, reflecting the important attraction of these facilities for parents and guardians. In addition, this type of behaviour is often found near sheltered seating areas, indicating that comfortable seating and a shady environment provide ideal conditions for guardianship. The activity of ‘playing games or watching others play’ is also concentrated in open areas and around the equipment, reflecting the balanced layout of participatory and spectator activities in the playground. This distribution not only shows the adaptability of the space to different needs, but also highlights the inclusive design of the facilities. In addition, the behaviour of ‘taking photographs’ is mostly concentrated in areas that can capture the full view of the rides, reflecting the needs of parents to record family moments. The activity of ‘taking care of the elderly’ mainly occurs at the edges of the site, indicating that these quiet areas are more suitable for rest and care.

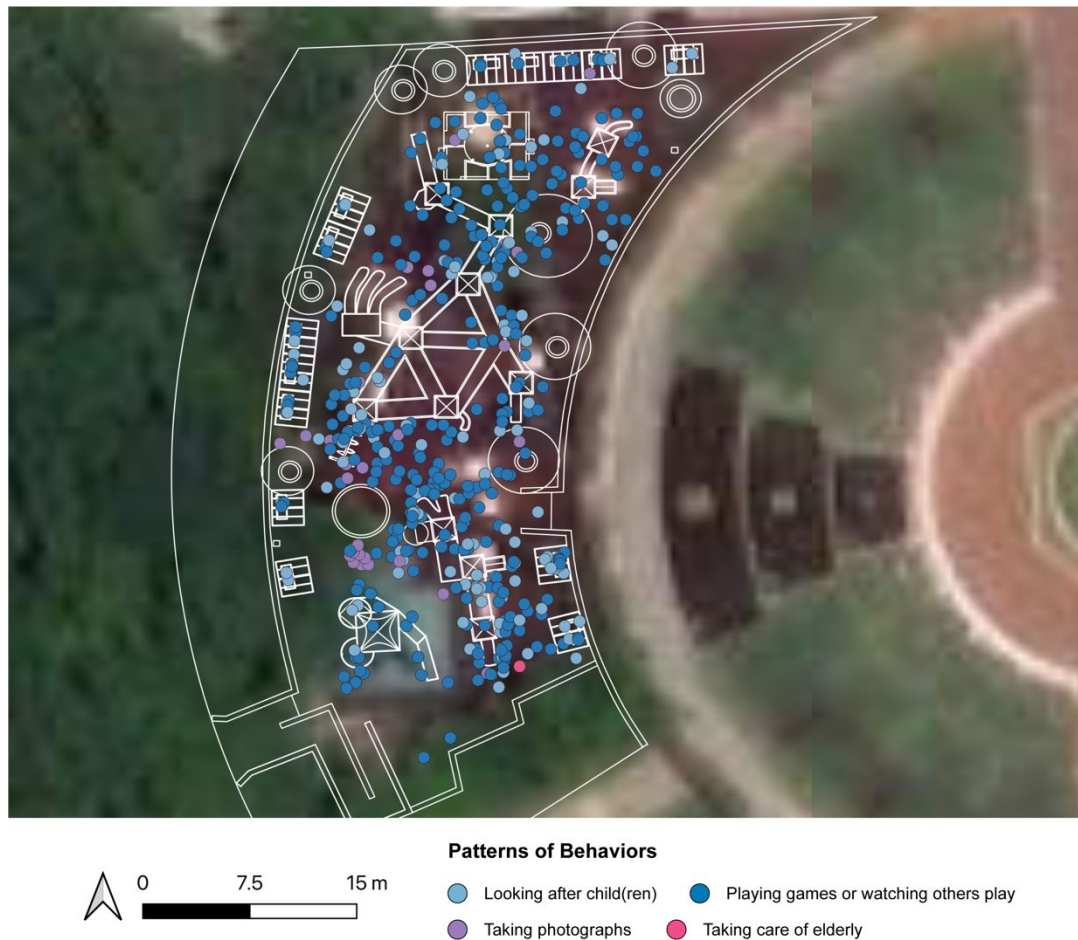


FIG.5.40 Spatial location of 'observational and caretaking tasks'

In the QUBP (see Figure 5.41), the activities of 'looking after the child(ren)' and 'playing games or watching others play' are highly concentrated in the core area of the amusement facilities, further indicating that these areas are the main places for family and children's activities. The 'taking photographs' activity is relatively rare and distributed around the facilities, especially next to key activity areas. This shows visitors' preference for specific areas, which may be related to these locations' landscape advantages or spatial design. The behaviour of 'taking care of elderly' is more common in the quieter areas at the edges of the site and in seating areas, indicating that these areas provide comfortable resting spaces suitable for extended stays.



FIG.5.41 Spatial location of 'observational and caretaking tasks'

The distribution of activities in the TMP (see Figure 5.42) showed a similar pattern to the above parks. The behaviour of 'looking after child(ren)' was mainly concentrated near the amusement facilities, indicating the critical role of amusement facilities in attracting family activities. The activity of 'playing games or watching others play' was almost spread throughout the facility area, indicating that this area is the most active part of the park. The behaviour of 'taking photographs' was concentrated near the open play areas, which provided children with opportunities for play and became an ideal place for parents to record beautiful moments.

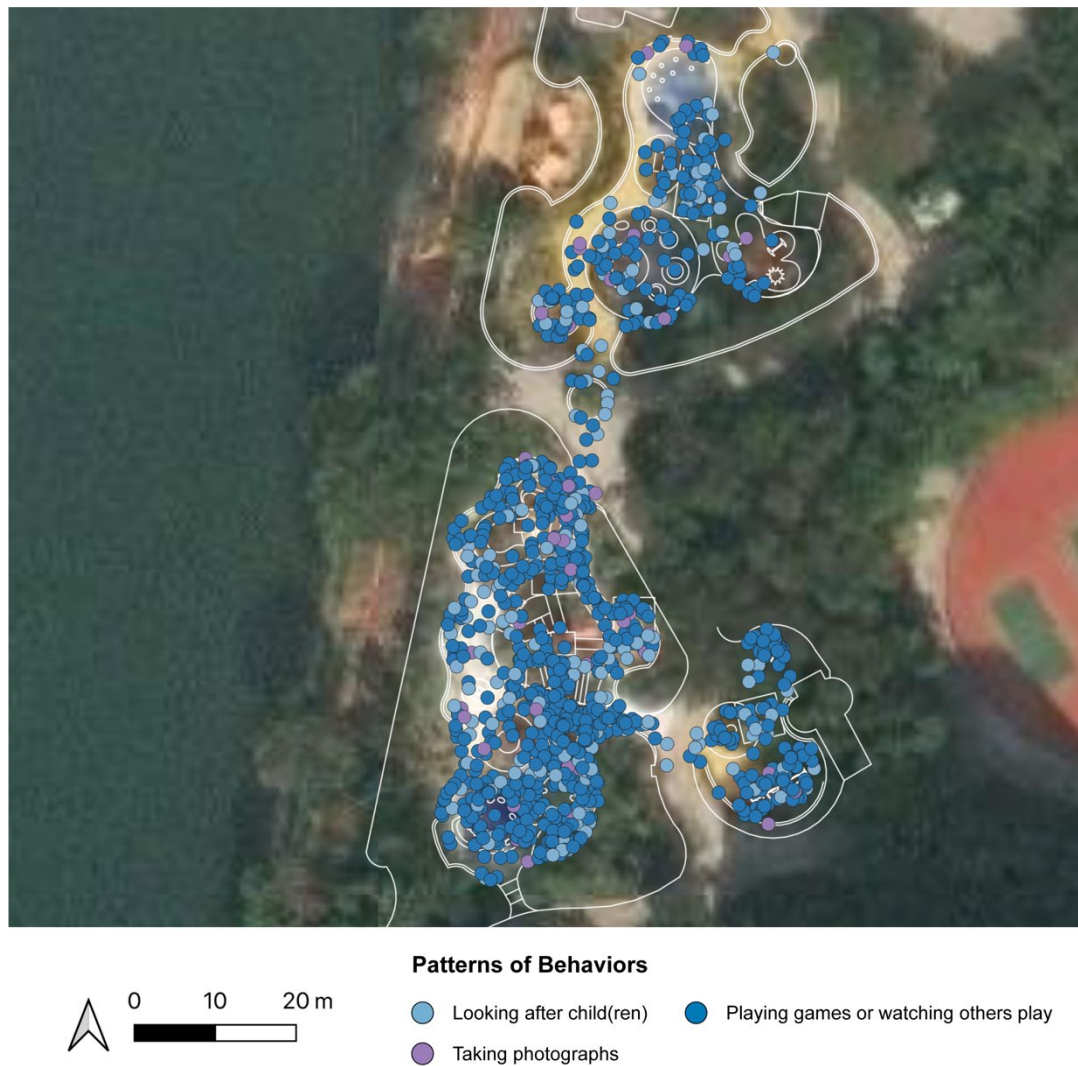


FIG.5.42 Spatial location of 'observational and caretaking tasks'

Based on the behavioural distribution of the three parks, the following conclusions can be drawn: the recreational facilities area is the core of family activities, attracting a large number of children and parents to participate in or supervise activities here. The care behaviour and the spatial layout of the facilities are highly overlapped, indicating that the design of these facilities not only meets the entertainment needs of children, but also fully considers the interactivity of family activities. The peripheral area is mainly used for leisure, caring for the elderly and filming, providing a quiet environment different from the core area. Through the observation of these behavioural patterns, designers should focus on the versatility of facilities when planning playgrounds in the future, ensuring that they can serve the diverse needs of families,

children and the elderly at the same time, so as to achieve the inclusiveness and social goals of the space.

5.4.2.3 Cluster C: Solitary and task-oriented activities

The spatial distribution of behaviours in the Solitary and Task-oriented Activities cluster is usually concentrated in the moments of solitude, with high privacy, involving behaviours such as ‘eating or drinking’, ‘phoning’, ‘playing cell phone’, ‘reading or writing’, etc. When compared with more interactive activities such as parties and entertainment facilities, such behaviours provide individuals with a tranquil space that promotes mental clarity.

In the KLNP (see Figure 5.43), ‘eating or drinking’ activities were concentrated in the covered seating areas, indicating that people prefer to eat in these areas that provide comfortable conditions. Such activities are away from the leading play equipment, reflecting visitors’ demand for a quiet and relatively secluded environment. The behaviour of ‘playing cell phone’ was more widely distributed, with a particular concentration in the seating areas. This indicates that people usually use their phones while supervising their children or passively entertaining themselves, taking care of their children and themselves. The behaviour of ‘phoning’ is more scattered, mainly occurring in seating areas and near walkways, reflecting people’s tendency to walk or briefly stop in relatively open environments when talking on the phone. ‘Reading or writing’ is relatively rare, mainly concentrated in sheltered seating areas. These areas provide an ideal environment for solitude and allow individuals to focus on their tasks.

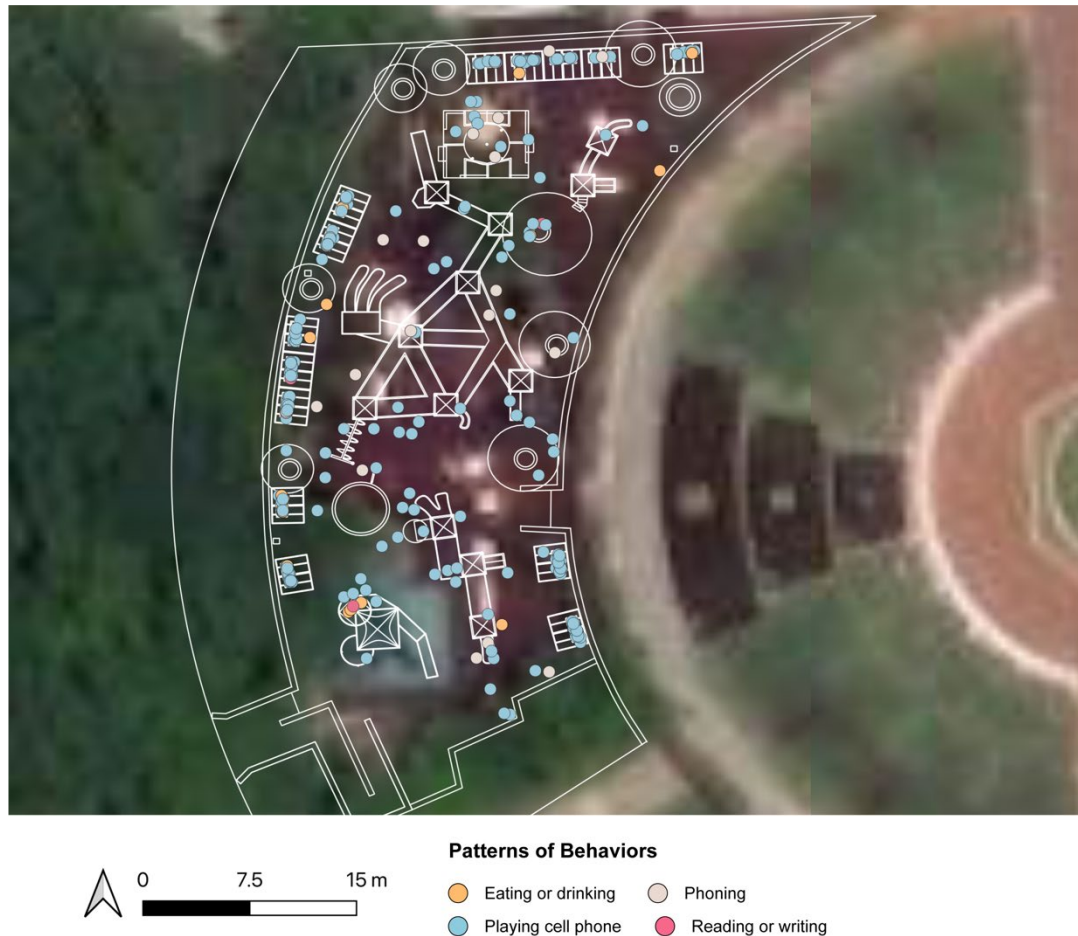


FIG.5.43 Spatial location of 'solitary and task-oriented activities'

In the QUBP (see Figure 5.44), the 'eating or drinking' behaviour is concentrated at the site's edges and in the sheltered seating areas. These quiet areas provide visitors with a good eating environment, away from the hustle and bustle of the rides. 'Phoning' activities are widely distributed around the site's periphery, where visitors conduct phone conversations in these relatively quiet areas to avoid excessive interference. 'Playing cell phone' behaviour is distributed in various peripheral areas of the site, indicating that people often use their phones while resting or watching. 'Reading or writing' mainly occurred in sheltered seating areas, which were located away from the central entertainment facilities and provided a suitable environment for quiet contemplation or concentration. Overall, sheltered seating areas became important for visitors to engage in quiet, private activities. These areas provided a comfortable environment for eating, drinking, reading, and mobile phone use. The activity of 'phoning'

occurred mainly in the peripheral areas of the site, indicating that visitors tended to choose places where they could make calls without being disturbed.



FIG.5.44 Spatial location of 'solitary and task-oriented activities'

In the TMP (see Figure 5.45), 'eating or drinking' activities were concentrated in the areas near the entrance and in the central area, which were close to seating or shaded areas and provided good conditions for dining. The behaviour of 'phoning' was widely distributed in the central and entrance areas of the park, which indicates that visitors communicated in these spaces, possibly because the seating and facilities here provided convenient conditions for staying. The behaviour of 'playing cell phone' covered almost the entire park, concentrating on the seating and shaded areas. This indicates that visitors used their phones for socialising, entertainment or task processing in their spare time. The behaviour of 'reading or writing' is relatively rare and is mainly concentrated near the entrances. These areas are relatively quiet and suitable for concentrating on writing or reading.

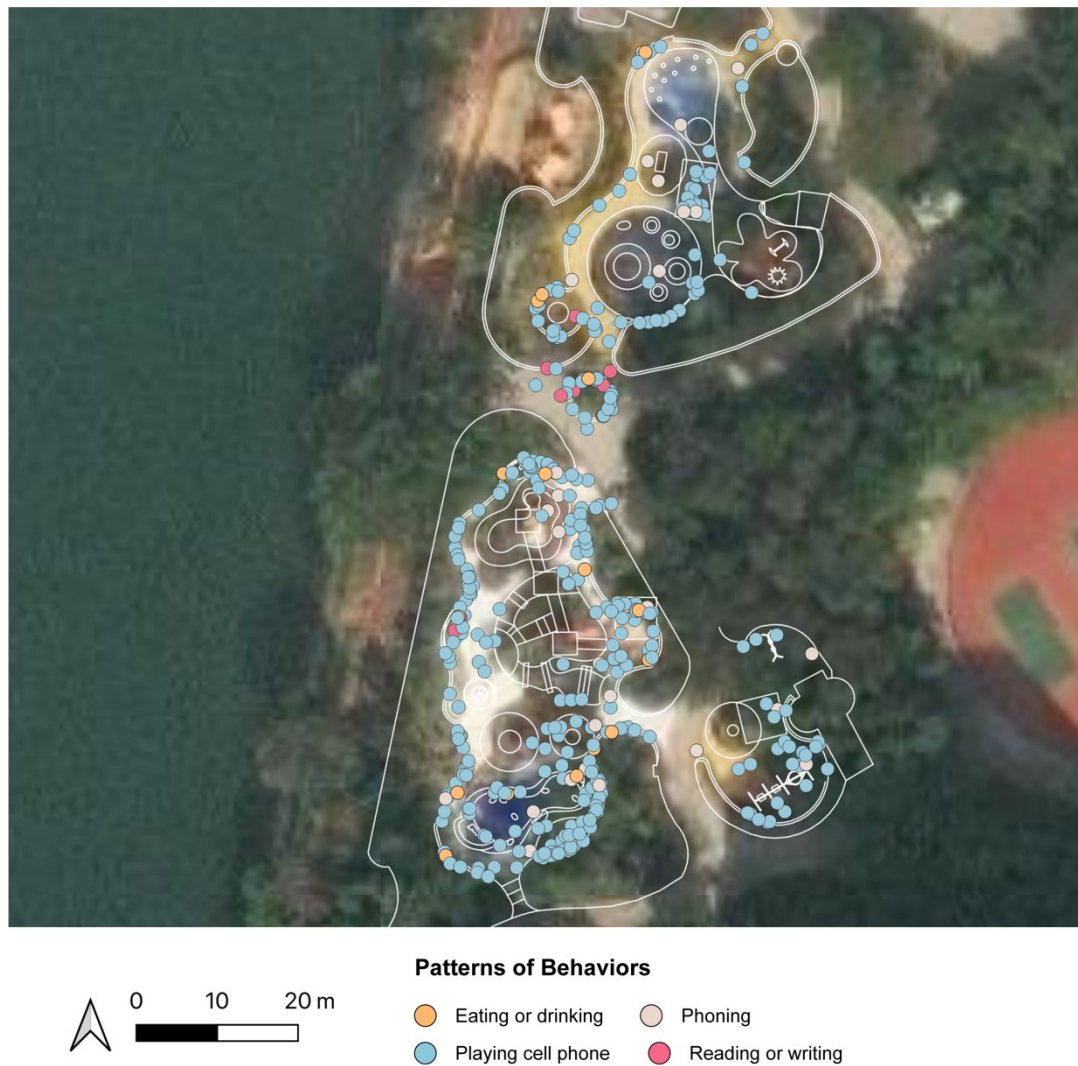


FIG.5.45 Spatial location of 'solitary and task-oriented activities'

From these observations, the distribution of solitary and task-oriented activities in different parks has similar patterns. The behaviour of 'eating or drinking' is concentrated in areas with comfortable facilities. At the same time, the activities of 'phoning' and 'playing cell phone' are widely distributed in seating areas and peripheral areas. Focused activities such as 'reading or writing' occur in more secluded and quiet places, indicating that visitors have a high demand for privacy in public spaces. The park's design should consider the spatial needs of these individual behaviours and provide quiet, comfortable areas to meet people's needs for solitude while providing a suitable environment for task-oriented activities. By designing with this user experience in mind, this approach increases functionality and inclusivity of public spaces.

5.4.2.4 Cluster D: Maintenance and practical tasks

The behaviours of the maintenance and practical tasks cluster in the park are manifested as a series of tasks closely related to space or equipment, such as ‘sanitation work’, ‘repairing facilities’, ‘washing hands or feet’, ‘queuing’, etc. These behaviours usually rely on specific infrastructure support and are concentrated in high-traffic areas.

In the KLNP (see Figure 5.46), the main distribution of ‘sanitation work’ is concentrated in areas with high traffic, especially around seats and amusement facilities. Due to the high frequency of use, these areas are more needed for cleaning, and maintenance staff conduct regular cleaning here to ensure the cleanliness and safety of public spaces. In addition, the central area of the playground, close to the main facilities and equipment, shows a higher density of cleaning activities. This distribution shows that these places are not only the centre of visitor activities but also require frequent maintenance to cope with the environmental pressure caused by heavy use. Another part of the maintenance work is concentrated at the entrances and exits and the edge areas of the site, especially near the trails, which also require continuous cleaning to maintain the overall hygiene and visual beauty of the environment. It can be seen that the cleaning tasks not only focus on the core areas but also cover less-used venues, reflecting a comprehensive cleaning strategy.

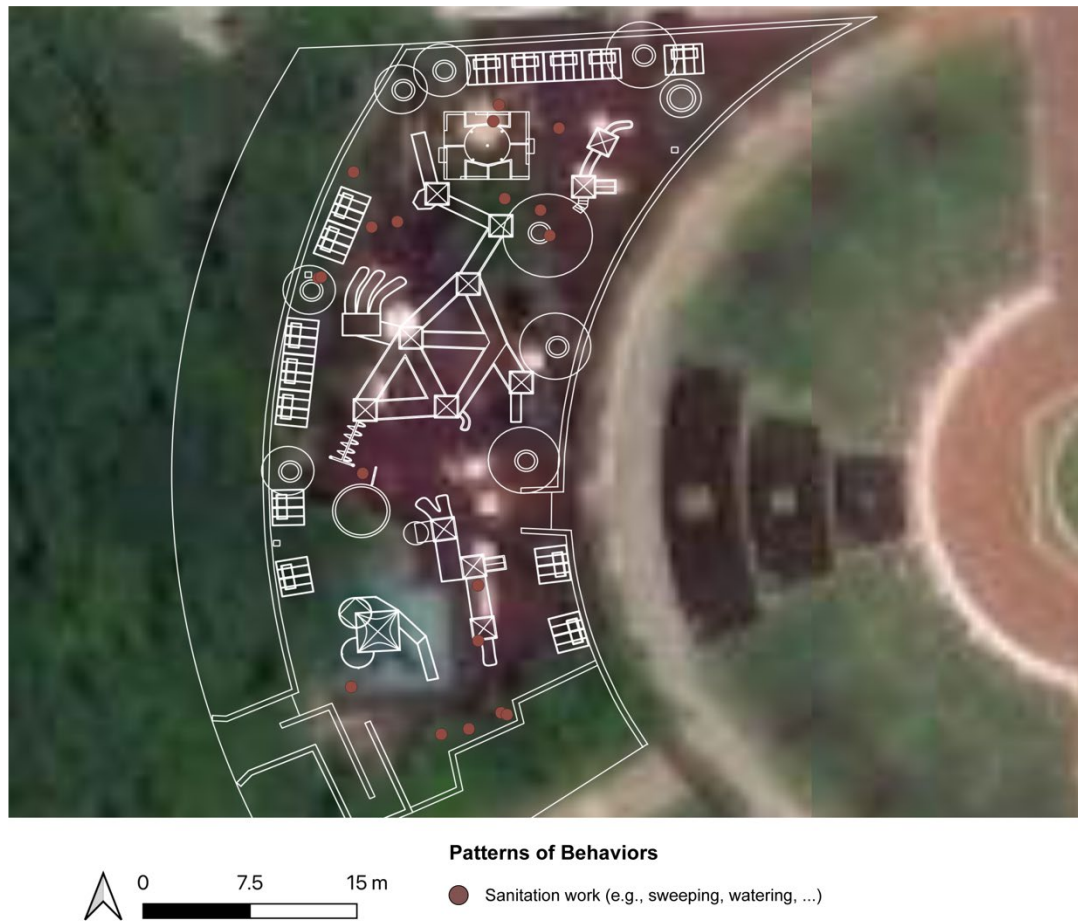


FIG.5.46 Spatial location of 'maintenance and practical tasks'

The distribution of 'sanitation work' in the QUBP (see Figure 5.47) also shows a similar pattern, with a concentration in peripheral areas and aisle areas, which are usually the focus of cleaning efforts. Facility maintenance is sparse but mainly concentrated around play equipment, indicating that these facilities require regular inspection and maintenance to ensure safety and proper functioning. Peripheral areas and aisles are the focus of cleaning efforts, where maintenance staff carry out garbage removal, floor sweeping, and plant maintenance to ensure that these passageways are tidy and orderly. Cleaning activities on the site are closely related to the high frequency of use of the facilities, especially in the core areas around the rides, where maintenance work is more frequent. The distribution of 'repairing facilities' is concentrated around the equipment and infrastructure, especially in the amusement equipment area, to ensure that these critical facilities are always in good working condition.

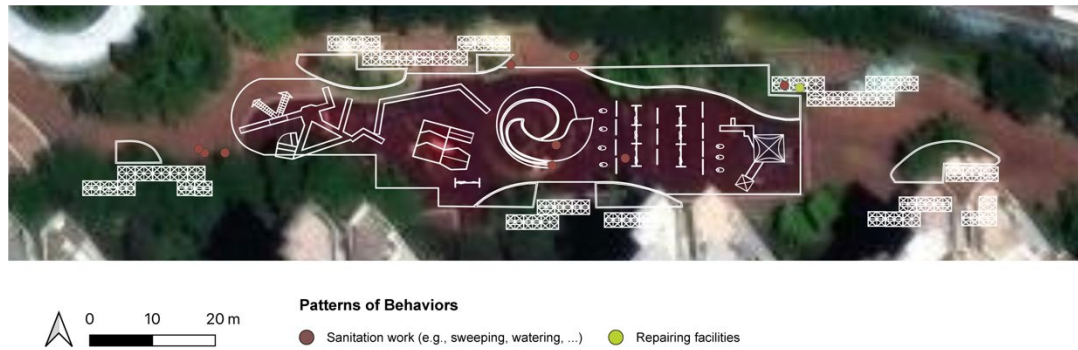


FIG.5.47 Spatial location of ‘maintenance and practical tasks’

In the TMP (see Figure 5.48), sanitation works are heavily concentrated at major rides and seating areas, particularly those located in the southern and south-eastern corners. These areas are hubs of visitor activity and therefore require regular cleaning, known as sanitation work, in order to maintain a hygienic and comfortable atmosphere for their users. The ‘washing hands or feet’ behaviour in the park is concentrated mainly in the southern area, indicating that the park provides convenient handwashing facilities to serve visitors’ needs after outdoor activities. Queuing behaviours demonstrate high demand for these facilities and indicate they require greater care in spatial management or facility design in order to minimise waiting times and enhance experiences.



FIG.5.48 Spatial location of 'maintenance and practical tasks'

Overall, park sanitation work and facility repairs reflect the functional needs of various areas in a park. Maintenance staff focus on cleaning high-use areas around rides and seats to maintain cleanliness and ensure public space safety. Repairs on amusement equipment represent an ongoing commitment to ensure their safety and durability, with queueing action directly related to facility layout. Spatial planning of these areas must be optimised in order to reduce overcrowding and enhance visitors' experiences. A sensible layout not only ensures daily operation of a park but also considers different user needs—creating an efficient yet inclusive public space.

5.4.2.5 Cluster E: Movement-oriented and active behaviours

The movement-oriented and active behaviours cluster generally involves body movement and interaction, and is primarily manifested in ‘exercising’, ‘playing games or watching others play’, ‘playing on facilities’, ‘walking’, and ‘passing by’.

In the KLNK (see Figure 5.49), the ‘exercising’ activities are primarily concentrated in the peripheral areas of the playground, away from the core play equipment. This spatial distribution shows that exercising behaviour favours quiet, open areas where visitors exercise with low levels of disturbance. In contrast, ‘playing on facilities’ is concentrated in the central areas of the playground, especially near the main facilities, reflecting that facility use and interactive play activities are the core active areas of the playground. The behaviour of ‘playing games or watching others play’ is also concentrated in these areas, which means that even visitors who are not participating in activities also choose to stay here, creating a place that combines dynamics and static. The activity of ‘walking’ is relatively scattered throughout the site, with a higher concentration on the trails and edges, indicating that walking is the primary behaviour for moving within and outside the site. The behaviour of ‘passing by’ is concentrated around the entrances, exits, and trails, reflecting visitors’ use of the park as a passageway.

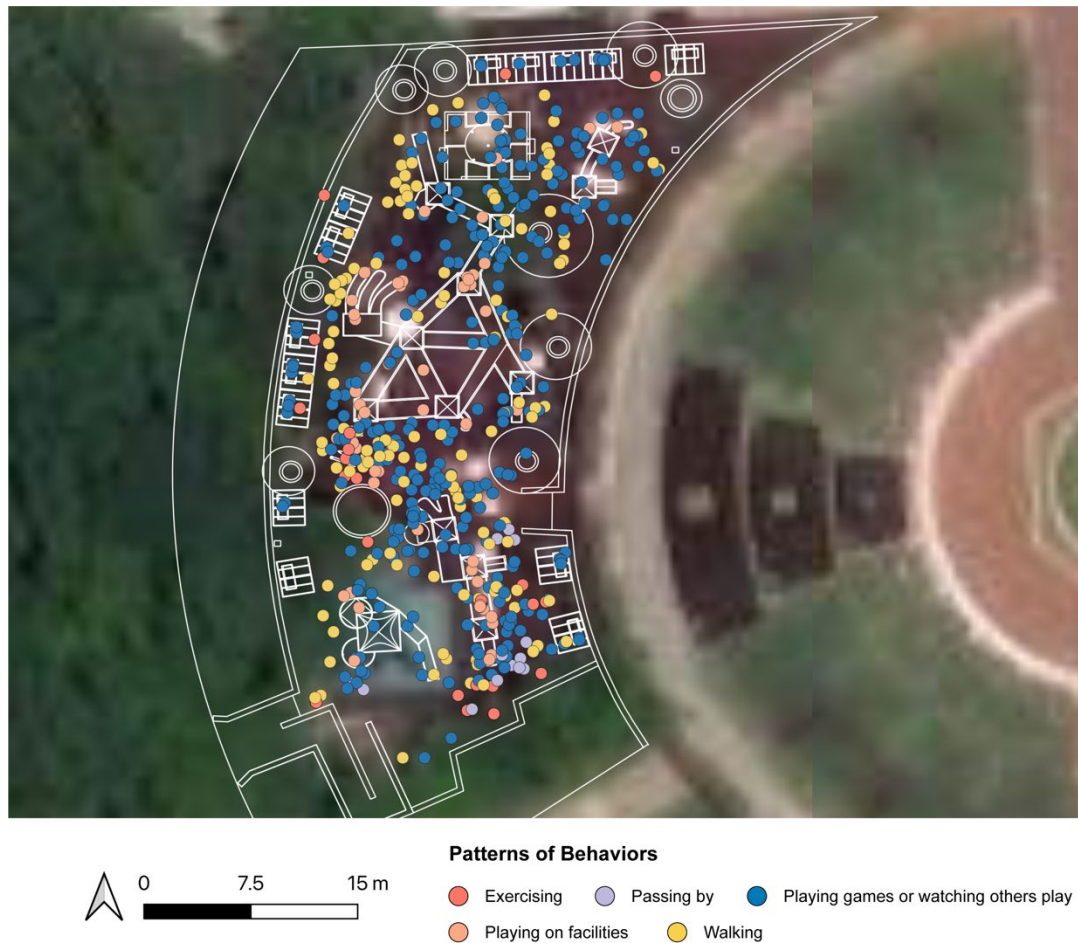


FIG.5.49 Spatial location of 'movement-oriented and active behaviours'

Figure 5.50 demonstrated a similar distribution of movement behaviours at QUBP. Exerting-type activities were concentrated around the edge of the site, indicating these spaces were for physical activities. The 'passing by' behaviour was widely distributed in various passages in the park, especially on the paths connecting different areas, reflecting that these areas are the main routes for visitors to pass through. The 'playing games or watching others play' activities were highly concentrated in the centre of the facility area, which is the most active social interaction area. The 'playing on facilities' behaviour was mainly distributed around these facilities, reflecting that these equipment are the main attractions for visitors. The 'walking' activity was widely distributed on the peripheral paths of the site, especially on the trails surrounding the facilities, indicating that visitors relax and stroll here, away from the main recreational areas.



FIG.5.50 Spatial location of ‘movement-oriented and active behaviours’

The spatial distribution of the TMP’s exercise and active behaviours is similar to that of the previous park (Figure 5.51). The ‘exercising’ behaviour is concentrated in the open areas in the south and centre, indicating that these places provide visitors with suitable spaces for exercise. The ‘passing by’ behaviour is mainly found on the trails in the centre and north, reflecting that these passages serve as the main routes for visitors to traverse the park. The ‘playing on facilities’ and ‘playing games or watching others play’ behaviours are concentrated around the play equipment, which become the core places for children and families to interact. The behaviour of ‘walking’ is spread throughout the park’s trail system, and visitors use these paths for easy walking activities. In particular, walking is most frequent on the main paths that connect different functional areas.



FIG.5.51 Spatial location of ‘movement-oriented and active behaviours’

Overall, the movement-oriented and active behaviours in the park show a clear spatial division. The ‘exercising’ behaviours are concentrated in the open edge areas of the site, ensuring that these areas can accommodate quieter and more independent. By studying and analysing these behaviours in more detail, designers were able to optimize its layout further while creating spatial harmony among different activity types, giving visitors a rich and enjoyable experience.

5.4.2.6 Cluster F: Rest and contemplation

Rest and contemplation behaviours are mainly low-intensity, static activities involving individuals or groups resting, thinking and recovering their strength. They usually include

behaviours such as 'sitting at leisure', 'sleeping', 'squatting to rest', 'standing to rest', 'reading or writing', 'eating or drinking' and 'phoning'. These behaviours often take place in quiet, comfortable areas, away from the active areas of the park, to meet the needs of visitors for quiet and rest.

In the KLNK (see Figure 5.52), 'eating or drinking' was mainly concentrated in areas with seating and shelter, especially away from dynamic rides. It indicates that visitors prefer comfortable and quiet environments for eating, where they can find suitable seating and shade, which effectively enhances their comfort. The 'sitting at leisure' activity was also concentrated in seating areas near the rides, indicating that many visitors were observing their surroundings while taking a break, especially parents supervising their children. These areas were the main places to rest and the core areas for socialising and interacting. The behaviour of 'phoning' is more scattered, but it occurs more often near seats and walkways, reflecting visitors' tendency to communicate on the phone while moving or making short stops. The behaviour of 'reading or writing' is relatively rare and mainly concentrated in sheltered seating areas. These areas provide an excellent quiet environment for individuals to focus on writing or thinking. The behaviour of 'standing to rest' is mainly seen around walkways and seating areas, especially when visitors pass by or wait. These areas become an ideal place for them to make short stops and observe.

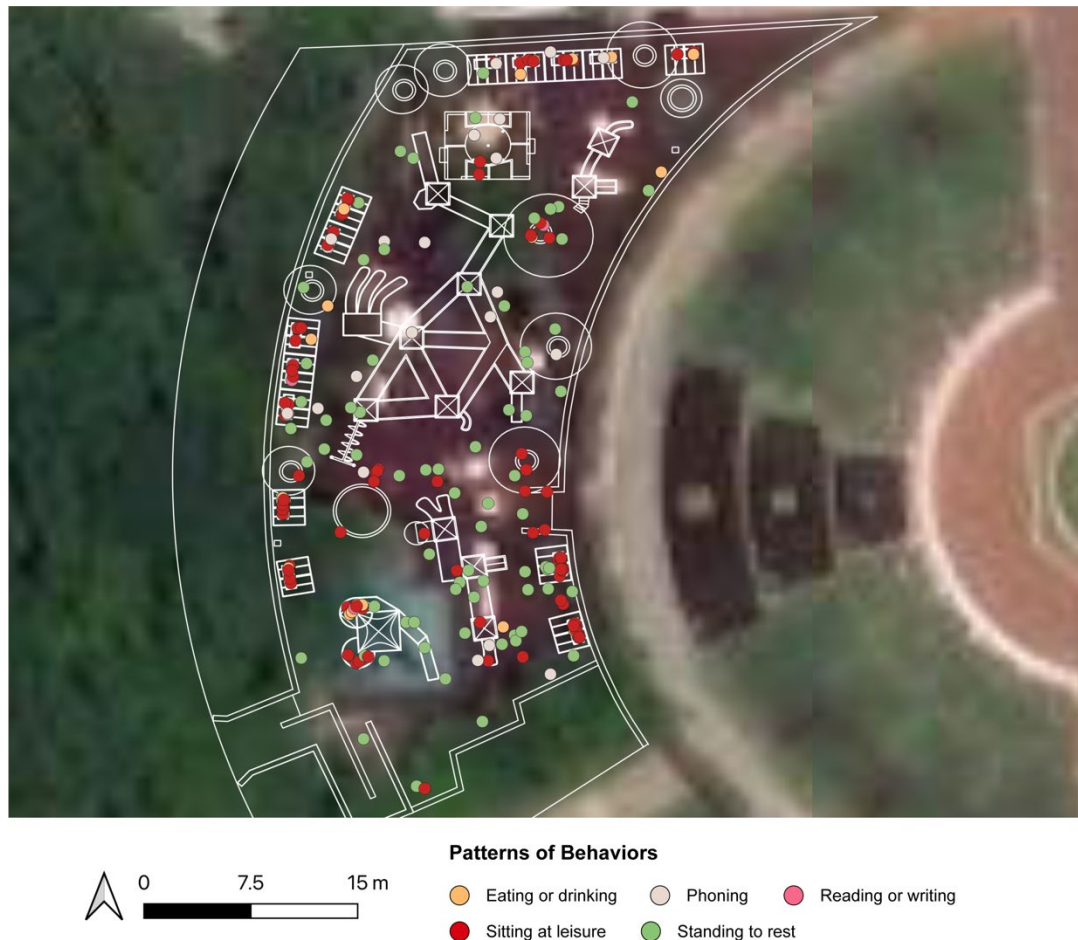


FIG.5.52 Spatial location of 'rest and contemplation'

In the QUBP (see Figure 5.53), the eating and drinking behaviour of 'eating or drinking' was primarily distributed in the shaded seating and peripheral areas, indicating that these places provide visitors with a quiet environment away from the main activity areas, which is very suitable for rest and eating. The behaviour of 'phoning' was more concentrated in the peripheral areas and passages, showing that visitors chose relatively quiet places for telephone communication to avoid disturbing others. The behaviour of 'reading or writing' was concentrated in the shaded seating area, and these quiet areas were suitable for visitors to focus on reading or writing activities for a long time. The behaviour of 'sitting at leisure' was widely distributed in many seating areas of the venue, especially those close to greenery and shelters, indicating that these places were considered ideal for long periods of rest and relaxation. In addition, the behaviour of 'sleeping' was relatively rare and mainly concentrated in isolated seating areas, which provided privacy and a quiet environment suitable for short naps.



FIG.5.53 Spatial location of 'rest and contemplation'

In the TMP (see Figure 5.54), the distribution of relaxing behaviours is similar to that in the park described above. The concentration of 'eating or drinking' behaviours near seating and facilities, especially sheltered seating areas, suggests that visitors tend to choose these areas for rest and eating. The concentration of 'reading or writing' behaviours in quiet seating areas in the south and centre of the park, away from the main activity areas, suggests that these relatively quiet places are suitable for long periods of focused activity. The behaviour of 'sitting at leisure' was widely distributed, especially near facilities and in rest areas, reflecting the fact that visitors spent more time in these areas, perhaps to relax or observe the activities around them. The behaviour of 'standing to rest' was concentrated mainly in walkways and circulation areas, especially at intersections connecting various functional areas, indicating that these places are the main locations for visitors to stop for a short time. The behaviour of 'sleeping' was less common, concentrated in secluded and quiet areas, suitable for short periods of relaxation and rest.

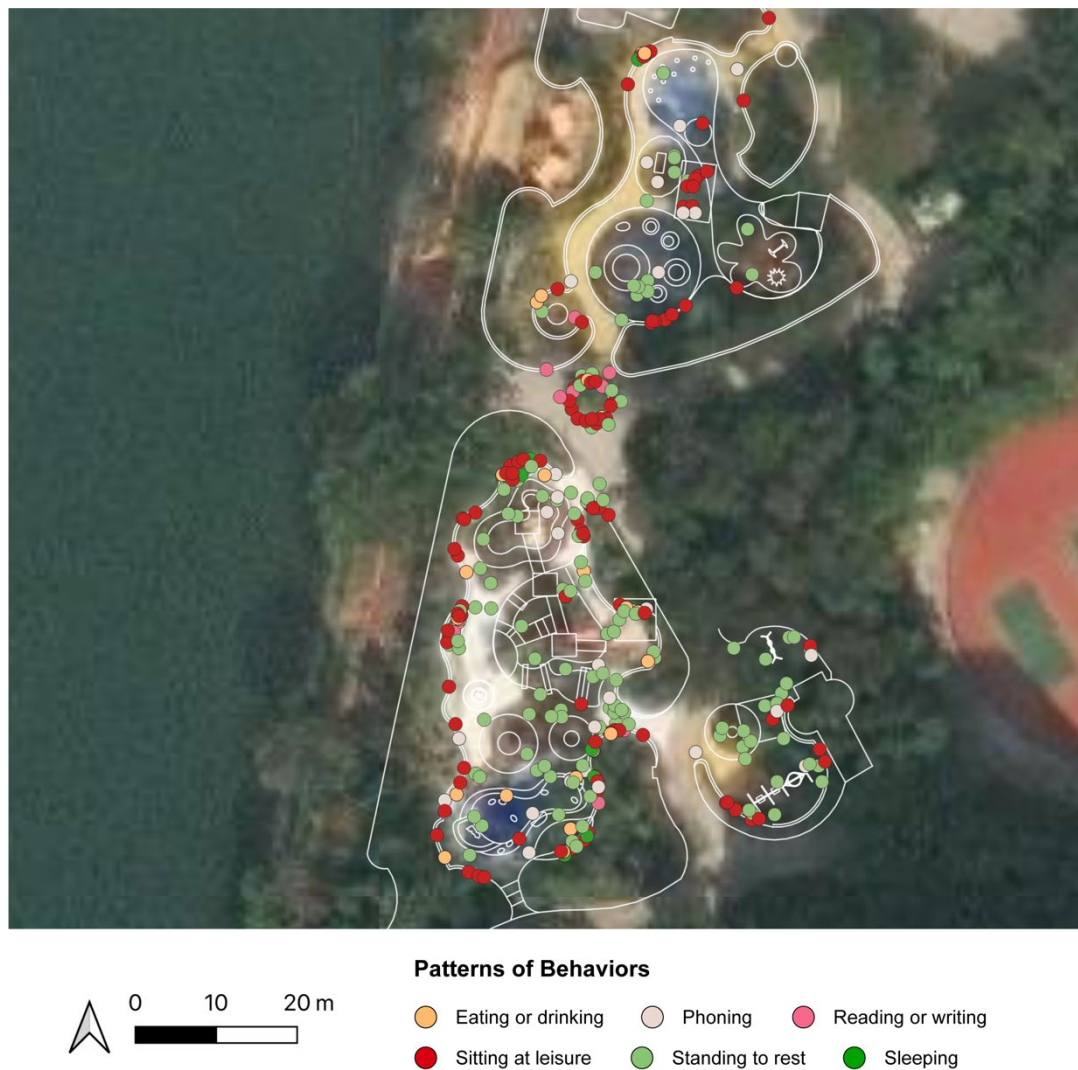


FIG.5.54 Spatial location of 'rest and contemplation'

Overall, the behaviour of resting and contemplation in the park shows the distribution characteristics of different functional areas. The behaviour of 'eating or drinking' is concentrated in sheltered and peripheral areas, reflecting visitors' preference for eating away from the main activity facilities. The behaviour of 'reading or writing' is concentrated in quieter areas, which provide an ideal environment for long periods of focused activity. The behaviour of 'sitting at leisure' is widely distributed in many areas, especially near the facilities, showing that these places attract visitors to stay for a long time. The behaviour of 'standing to rest' is mainly found in walkways and passageways, reflecting that these places are the central locations for visitors to stop and rest for a short time. The concentrated areas of the behaviour 'sleeping' are mostly hidden corners, providing a quiet and private resting environment.

Through the analysis of these behaviours, a more detailed reference basis can be provided for park design, and the layout of different functional areas can be optimised to meet the diverse needs of visitors for leisure, contemplation and relaxation.

5.4.3 Discussion of key findings

After an in-depth analysis of the spatial distribution of six different types of behaviour clusters in three playgrounds, the effectiveness of playground design in functionality and inclusiveness is revealed. It is reflected not only in the relatively balanced satisfaction of the needs of different groups but also in the excellent compatibility and spatial interaction between multiple activities. These findings help to understand better how playground design can meet various users' needs and provide guidance for future inclusive design.

(1) Coexistence of active and static behaviours

The core area of the playground (i.e. the playground equipment area) concentrates many active behaviours, such as children playing and guardians supervising and participating. The concentration of these behaviours in the main equipment area shows that well-designed recreational facilities attract children and their families and reflect their demand for family or multi-person cooperative play equipment. The high usage rate of the core area not only needs to adapt to the recreational needs of children but also to meet the needs of guardians so that they can easily participate in or observe their children's activities. The peripheral areas and sheltered seating areas focus more on static behaviours such as sitting down to rest, looking after the elderly and other activities (such as communicating, playing cell phone, etc.). Spatial functional differentiation helps ensure that different users, such as children, caregivers and older people can enjoy their activities uninterrupted by each other, thus increasing the efficiency of space use and making playgrounds an ideal venue for multigenerational participation.

(2) Social interaction and facility layout

The layout of playground facilities has a profound influence on social interaction, particularly through peripheral areas and seating areas where social activities take place. These seats provide guardians and other adults a comfortable place to rest as well as a platform for socialization among parents. Seating areas near entrances and facilities are essential, providing accessible spaces that promote communication among parents and older individuals. The core entertainment area serves not only to meet children's activity needs but also allows parents and guardians to interact. This highlights that playground design not only meets children's activity needs but provides opportunities for guardians and children alike to participate and interact together, thus contributing to building strong communities among multiple generations. Do not undervalue its role in encouraging social connections among different age groups.

(3) Integration of care and play behaviour

A playground's high degree of integration between care activities and play activities makes it a vital place for family entertainment and interaction. Care behaviour within the core area of a facility demonstrates how attentive guardians are towards children's activities; children often engage in active play to complement these care behaviours. When planning playgrounds, designers should consider closely integrating the sightline needs of caregivers with the activity areas for children so that caregivers can both observe from an appropriate distance while simultaneously participating. Activity focused on providing special care for older people or other groups are often concentrated in quiet peripheral areas designed to meet the needs of inactive users. Integrating caretaking behaviours and recreational activities not only adds inclusiveness to a playground site, but it can also accommodate users of differing ages and activity needs at once.

(4) Task-oriented behaviours and rest areas

Task-oriented behaviours (such as making phone calls, reading, writing, etc.) are concentrated in sheltered seating and quiet peripheral areas. The distribution of these activities indicates that people not only engage in social and recreational activities in playgrounds but also carry out personal tasks and independent activities, especially when these areas provide comfort and

shade. Mobile tasks, like the use of cell phones or phone calls, tend to be scattered along trails and peripheral areas - reflecting people's tendency to perform such activities on the move. The spatial design of playgrounds should consider the needs of visitors to carry out multi-task activities, providing quiet and convenient places for short stays to meet the multi-tasking needs of people in modern society.

(5) Maintenance and practical task spatial planning

The distribution of maintenance and cleaning tasks demonstrates the relationship between playground design and functional maintenance requirements. Maintenance tasks are concentrated in areas with high usage frequency, such as play equipment, seating areas and entrances. Cleaning and facility maintenance in these spaces are vital for maintaining regular operations of any site as high-intensity use can produce litter as well as wear-and-tear damage to facilities. As play equipment areas are so vital to child safety, they require regular inspection and maintenance. Furthermore, this can serve as a handy reference point when it comes to finding public rubbish bins. At the same time, peripheral areas and passageways must also be cleaned and maintained effectively to ensure the overall cleanliness and hygiene of their environment. Playground design must consider users' needs while providing for easy daily maintenance tasks to enhance long-term sustainability of a site.

(6) Potential and challenges of inclusive design

Analysis of a playground's spatial distribution and behavioural analyses has illuminated both potential benefits and difficulties associated with inclusive design. Playgrounds provide effective support to users of various ages and activity needs through clearly delineated functional areas. However, there may be problems with space utilisation in some specific areas (such as the peripheral elderly care area and quiet personal activity area), which suggests that designers need to optimise the design of these areas further to improve their attractiveness and utilisation. The inclusive design also needs to consider balancing the allocation of space resources among different types of users to ensure that each group can have an equal experience.

The results of the BMAT data analysis reveal a close relationship between the spatial distribution and behavioural patterns in playground design. Through appropriate zoning and layout, playgrounds successfully meet the recreational needs of children while also providing suitable spaces for parents, older people and other task-oriented users. The significant spatial zoning of different types of social, recreational, care and solitary behaviours shows that the design of playgrounds should consider the needs of multiple users, especially the establishment of a functional transition between the core recreational area and the peripheral rest area, to promote the coexistence and interaction of different users. In addition, the spatial zoning for solitary and task-oriented behaviours also demonstrates the adaptability of playgrounds in meeting individual needs.

A well-designed public playground should be highly functional and inclusive, supporting multiple generations, behaviours and needs. Through the rational division of activity spaces, the scientific layout of facilities and the comprehensive maintenance work management, the park effectively enhances the user experience and meets different visitors' social, recreational, care and solitude needs. This sensitivity to different user needs and refined design processing provides valuable experience and reference for future inclusive public space design.

5.5 Conclusion

This chapter comprehensively analyses the use of inclusive playgrounds in Hong Kong through questionnaire surveys, informal interviews, and behavioural observations. It aims to explore the acceptance of inclusive playground designs among different stakeholders and their improvement needs.

Questionnaire survey results show that the primary users of playgrounds include children and their caregivers. It is worth noting that the needs of caregivers are not limited to the safety and entertainment of children; their comfort, participation and social needs also need to be considered in the design. In addition, the diversity of existing playground facilities needs to be improved to meet the needs of different age groups and roles fully. In particular, there are significant areas for improvement in multi-generational living and intergenerational

interaction. In the survey, respondents generally believed that the main target of playgrounds is children, but some opinions pointed out that adults also need more facilities and space support.

Interview analysis revealed that safety, facility adaptability, environmental comfort, and social opportunities were core elements of caregiver concern. Caregivers have high expectations for the diversity and fun of existing facilities and believe there is still room for improvement in the design of playgrounds in promoting parent-child interaction, social development and safety. For example, the interestingness of the facility, children's willingness to participate, and physical limitations are all key factors that influence adult-child interactions. Interviews with staff revealed the practical challenges faced in daily management, such as equipment maintenance, cleaning and emergency response, and proposed corresponding improvement measures.

SOPARC's observation and analysis system has allowed us to further verify the impact of different seasons, gender, age and other variables on behavioural patterns. Analysis of behavioural data highlights various groups' patterns and spatial distribution when using playgrounds - providing valuable guidance for future playground designs.

In summary, this chapter provides data support for further improvements in inclusive playground design, aiming better to meet the diverse needs of children through multi-generational design, increasing interactive facilities, improving environmental comfort, and strengthening management—usage requirements. In the next chapter, we will further improve public playgrounds' inclusiveness and user experience through scientific and reasonable design and management based on data analysis results.

Chapter 6 Design strategies for the public inclusive playground

6.1 Analysis of behaviours and needs in the playground

Based on the R-I-N-G user needs research method framework, the first two chapters examined all possible stakeholders in the space and provided initial insights into the behaviours and needs of critical stakeholders through surveys and informal interviews. Subsequently, observational methods were used to collect and identify the behavioural patterns of various stakeholders that may appear in the space further. By screening and synthesizing the data, six main behavioural clusters were formed, which not only integrate findings from surveys and interviews but also represent the core spatial use logics in inclusive playgrounds. Designers can gain insight into user needs and formulate realistic design solutions (see Figure 6.1).

To ensure the clarity and operability of design strategies, this chapter adopts a matrix-based structure that maps the six behavioural clusters onto five key spatial zones of the playground. This structure will be introduced in the following sections to clarify how each strategy responds to specific behavioural needs in particular spatial contexts.

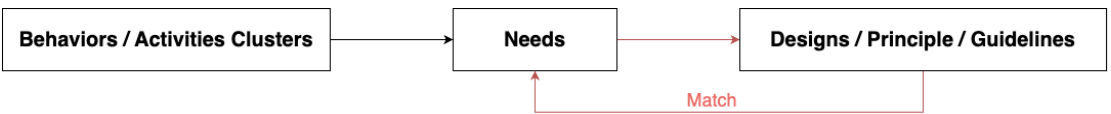


FIG.6.1 ‘R-I-N-G’: generating ideas for design solutions

The survey data from the study show that the caregiver group is one of the leading players on the playground and usually includes parents, grandparents and family assistants. As adults who accompany children, caregivers need to supervise children’s safety and are often involved in social interactions. A playground has become an activity space that serves both children and families by offering opportunities for interaction between generations. Caregivers often need an area where they can care for children while engaging in personal activities. Therefore,

playgrounds must provide both recreational facilities for the kids and relaxing spaces for adults to socialise or rest comfortably. The survey results show that adult caregivers need comfortable seating, shade, and convenient, sanitary facilities, which will help them complete their tasks more comfortably while caring for children and enabling them to interact socially with other adults.

Interviews show that caregivers generally believe that existing playground facilities are relatively monotonous and need more equipment that promotes children's social interaction and cooperation, resulting in children mostly playing alone and needing more opportunities to practice social skills and teamwork. Caregivers hope that playgrounds can add group play facilities that promote children's social interaction, helping children learn cooperation and social skills through play. At the same time, they also pointed out the need for a more comfortable environment so that while supervising children, they can also participate in family interactions. Therefore, the playground design should add interactive facilities suitable for families to participate together and improve overall safety and comfort.

Interviews with staff revealed their work pressures during peak hours, including site cleaning, equipment maintenance and security management. They need more efficient cleaning tools and security facilities to ensure work efficiency and site safety during peak hours. In addition, to better care for groups with special needs, staff suggested designing special training and support mechanisms to improve emergency response capabilities and communication skills. The site design should consider reasonable crowd control, functional zoning and a transparent signage system to improve site management efficiency and safety.

The behavioural clustering analysis of observational data confirmed the emergence of six dominant behavioural types in the inclusive playground setting.

- ⑩ **Social and recreational activities**, mainly involving group games and intergenerational play.

- ⑩ **Observational and caretaking tasks**, including monitoring children while engaging in family conversations or light social exchanges.
- ⑩ **Solitary and task-oriented activities**, such as phone use, reading, or quiet observation.
- ⑩ **Maintenance and practical tasks**, largely carried out by site staff including cleaning and maintenance.
- ⑩ **Movement-oriented and active behaviours**, encompassing running, walking, and occasional emergency responses.
- ⑩ **Rest and contemplation**, referring to static, low-intensity activities that require environmental comfort.

Each of these behavioural types implies specific spatial and design requirements. In later sections, the chapter will discuss how these behavioural clusters align with five spatial zones of the playground — entrance area, active play area, quiet resting zone, circulation paths, and multifunctional nodes — and how targeted design strategies are proposed accordingly. This structure ensures that strategies are both differentiated and responsive to context-specific behavioural needs.

6.2 ‘Behaviour-needs-oriented’ playground design strategies

Playgrounds should be designed not only to meet children’s recreational needs but also to consider the social and supervisory needs of caregivers, the work efficiency of staff, and the management safety of the site. By analysing different users’ behavioural patterns and needs, designers can develop more inclusive design solutions to enhance the overall experience of using the playground. Aligned with the ‘Generating’ stage of the R-I-N-G framework, this section transforms observed behaviour clusters into spatial strategies grounded in stakeholder-specific needs. To operationalize this, the study establishes a behaviour-based logic that

connects user activities, latent needs, and responsive design strategies through a progressive framework (see Figure 6.2 and Figure 6.3).

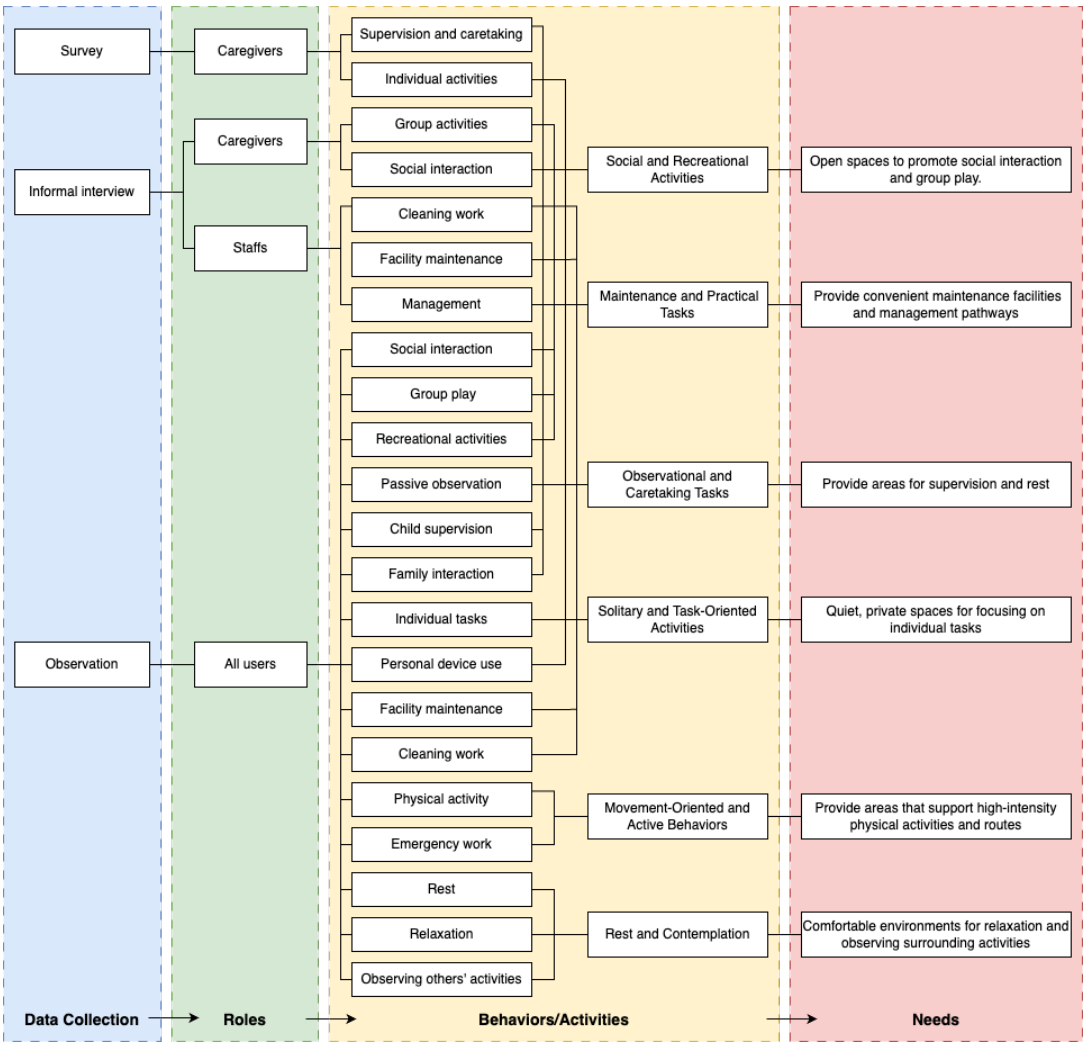


FIG.6.2 Mapping behaviour clusters to user needs: a behavioural basis for inclusive design strategies

(a) Social and recreational activities

Social and recreational activities are among the main behaviours observed in playgrounds, covering group games, informal conversations, and intergenerational interaction. These behaviours require open, flexible spaces that support spontaneous participation and group cohesion. The design should include large open areas and diverse group-oriented play equipment to facilitate interaction. Play structures should prioritise inclusivity across age groups, encouraging shared use by children, parents, and grandparents.

This aligns with Figure 6.3, where social and recreational behaviours are linked to needs for open, multigenerational engagement zones. Cluster A in 5.4.2.1, where social and recreational activities were concentrated in central amusement zones. Users across age groups prefer inclusive, open spaces for group engagement. Moreover, the survey (5.1.4) explicitly suggests the need for multi-generational design, with features enabling grandparents, parents, and children to interact around shared facilities. These insights support spatial strategies that enhance collective play and intergenerational social bonding.

(b) Observation and caretaking tasks

Observation and caretaking tasks centre on child supervision, intergenerational presence, and family interaction. These behaviours call for resting zones with clear sightlines, where caregivers can monitor play while engaging in light social interaction. Seating areas should be ergonomic, shaded, and strategically placed at the edges of play zones. Sun protection is another essential design feature, providing adults with a restful place during lengthy caregiving responsibilities.

As showed in Figure 6.3, these behaviours correspond with needs for shaded, ergonomic resting points situated at visual thresholds between play and rest areas. Caregiver interviews (5.2.3) identified six categories of needs; among these, ‘comfort and environmental management’ and ‘social and family engagement’ are highly relevant here. Cluster B in 5.4.2.2 also demonstrates that core recreational zones attract both children and parents, and require spaces with overlapping caregiving and interaction functions. Design should provide ergonomic, shaded resting points that enable multi-role behaviour.

(c) Solitary and task-oriented activities

The design needs to provide quiet and private spaces for solitary and task-oriented activities, such as using personal electric devices, reading, or engaging in solitary activities. These users benefit from semi-enclosed seating areas located in peripheral or transitional zones, with shade

and minimal visual disturbance. Such spaces offer psychological withdrawal while maintaining visual connection to the playground.

As shown in Figure 6.3, this behavioural cluster corresponds to needs for secluded quiet areas, ample seating and shade located in peripheral or transitional spatial zones. SOPARC results (5.4.2.3, Cluster C) indicate that task-based activities like phoning, reading, or eating are concentrated in quiet, peripheral or semi-sheltered zones. Interview data (5.2.3) further supports the need for psychological and physical withdrawal spaces, especially for older caregivers. Therefore, these quiet zones should feature semi-screened sightlines and allow passive observation without interruption. Design should ensure comfort, discretion, and opportunities for passive observation.

(d) Maintenance and operational activities

Maintenance and practical tasks involve cleaning playground equipment regularly and efficiently. Staff require adequate facilities and efficient management pathways in order to perform their daily work effectively. To support these tasks, playgrounds must include clearly zoned service routes, dedicated storage areas, and maintenance-friendly layouts that minimise disruption to users. Space allocation should ensure workflow continuity while maintaining spatial clarity.

Figure 6.3 clearly aligns these behaviours with the need for well-planned maintenance zones and easy-to-manage layouts. This corresponds to Cluster D in 5.4.2.4, which shows maintenance behaviours cluster around high-use nodes and key circulation routes. According to staff interviews in 5.2.4, staff also require storage, route accessibility, and zoning support. Designs should consider separate operational pathways and visually signposted storage units to reduce interference with user experience.

(e) Movement-oriented and active behaviours

Movement-oriented and active behaviours, such as sports and emergency evacuation or daily access routes, require special spatial support from designers. To meet these needs, the design

should include running areas and fitness equipment to meet the physical activity needs of users. At the same time, to ensure safe evacuation in an emergency, clear emergency exits, and evacuation routes must be provided to ensure rapid and effective emergency response.

As illustrated in Figure 6.3, such behaviours call for clear signature/guidance, running tracks and fitness zones. In Cluster E (5.4.2.5), active movement behaviours such as exercising and brisk walking appear in edge zones. Staff also note the importance of functional evacuation signage (5.2.4). Spatial designs must incorporate dual-use walking trails and clear emergency routing, with surface materials and signage that signal their secondary function. Spatial layouts should ensure accessibility, continuity, and visual guidance across movement-intensive areas.

(f) Rest and contemplation behaviours

Rest and contemplation behaviours represent patterns of behaviour where users sit, rest, relax and observe the activities of others. To support these behaviours, playgrounds should provide shaded, comfortable seating in visually open yet buffered areas. These settings enable low-intensity use while maintaining connection to nearby activities.

Cluster F (5.4.2.6) shows that contemplative behaviours like sitting, standing, or resting often occur in shaded, transitional areas. Combined with the survey's call for demographic-specific rest environments (5.1.4) and caregiver concern for environmental comfort (5.2.3), this indicates a need for buffered peripheral areas with visual openness and environmental quality. As shown in Figure 6.3, strategies such as integrating soft landscaping and providing contemplative visual corridors can enhance spatial quality and usability.

By systematically mapping the behaviours observed and reported in Chapter 5 onto practical design recommendations, this section ensures that each spatial intervention is rooted in stakeholder data. It bridges the 'Narrowing' and 'Generating' phases of the R-I-N-G framework, transforming clustered needs into differentiated spatial strategies. The alignment of SOPARC behavioural clusters, interview insights, and survey summaries allows the design to address the

differentiated expectations of caregivers, staff, and peripheral users in a functionally responsive manner.

To ensure that the proposed design strategies are directly grounded in empirical findings, this study integrates insights from three primary data sources—questionnaire surveys (Chapter 5.1), informal interviews with caregivers and staff (Chapter 5.2), and SOPARC-based behavioural observation (Chapter 5.4). This triangulated foundation enhances the validity of each proposed spatial response, reflecting the full spectrum of stakeholder realities.

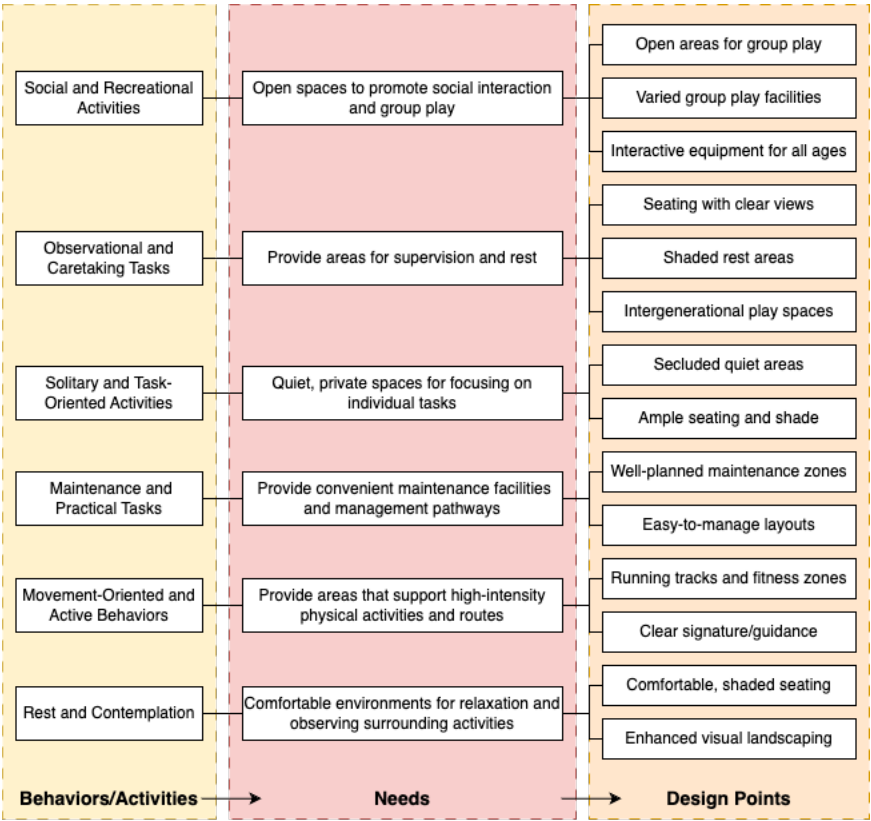


FIG.6.3 Mapping Play Space Behaviours to Needs and Design Responses

Figure 6.3 illustrates the structured transformation logic from observed behaviours to inferred needs and ultimately to spatial strategies. This logic reinforces that inclusive playground design must derive not from universal templates but from situated, empirical mappings of use and experience.

Understanding these categories enables designers to implement effective design strategies for inclusive and multifunctional playgrounds that meet the diverse needs of a variety of users, including carers, family members and staff—ultimately increasing the potential for social interaction and connection between all users.

6.3 Inclusive playground design principles

To consolidate the translation from behaviour-based needs to systematic spatial guidance, the previous section has identified six core behavioural patterns derived from SOPARC observation, survey feedback, and stakeholder interviews. These patterns—ranging from social interaction to solitary retreat, from care responsibilities to maintenance operations—have been mapped to their corresponding spatial needs and design strategies.

However, in order to ensure that these strategies are not fragmented or case-specific, they must be further synthesised into a higher-level conceptual framework. To bridge the gap between specific spatial tactics and overarching design logic, this section distils key spatial responses into five core design principles: multifunctionality, inclusivity, flexibility, safety, and comfort. These principles serve as normative guidelines grounded in empirical evidence and contextual behaviour mapping, forming a robust framework for inclusive playground planning (see Figure 6.4).

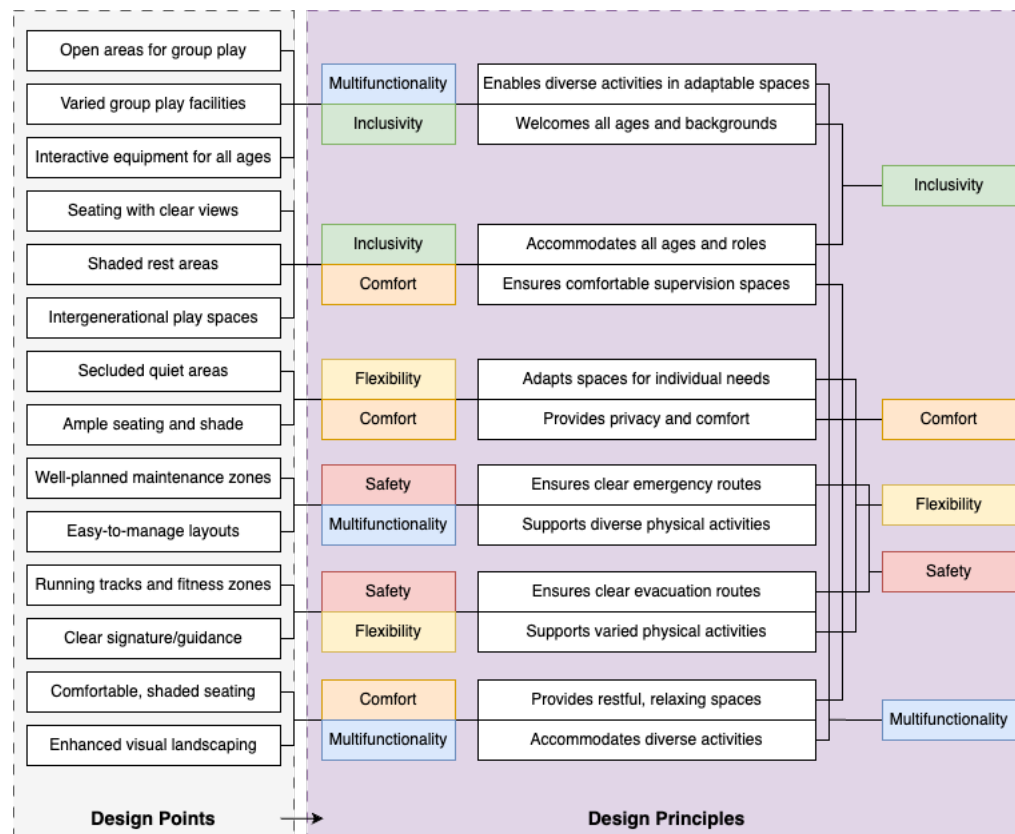


FIG.6.4 From Design Points to Design Principles: Extracting Core Strategies from Behaviour-Based Needs

Multifunctionality is a cornerstone of inclusive design. To be effective, an inclusive playground must meet both specific needs of certain groups while also providing an environment adaptable for users of various ages, backgrounds and abilities. Playgrounds must provide adaptable spaces for various behaviours and activities and cater for solitary activities and social interactions by introducing diverse interactive play equipment. Zoning must support activity compatibility, avoiding interference between behaviours. Modular and movable facilities provide the possibility of flexible adjustment to different times or changes in user needs, further enhancing the space's functionality (see Figure 6.5). This principle is supported by 5.1.4 survey findings on the importance of 'multi-generational design' and addressing age-specific needs. SOPARC Cluster A (5.4.2.1) and Cluster C (5.4.2.3) reveal distinct behaviour types—group interaction versus solitary use—requiring versatile spatial zoning and multifunctional equipment layouts.

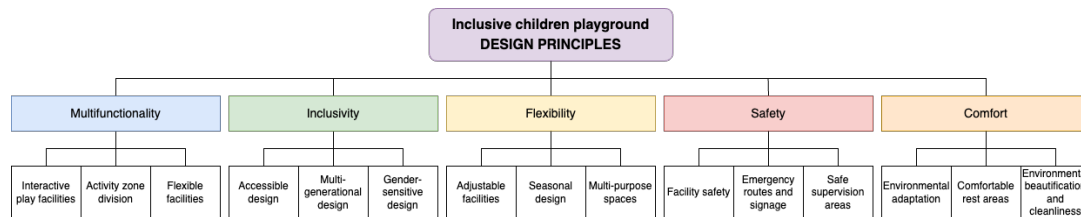


FIG.6.5 Five design principles of inclusive playground design

Inclusivity ensures that all users – regardless of age, ability, gender or cultural identity - can access, engage with, and benefit from playground spaces and services. Barrier-free design is key in achieving inclusiveness. All areas should provide wheelchair-accessible circulation, tactile guidance surfaces, and low-threshold entries. Inclusive design should also promote intergenerational interaction by providing facilities suitable for different age groups, such as comfortable seating, shaded areas and age-appropriate shared fitness equipment. Cultural and gender responsiveness – such as enclosed breastfeeding corners or women-priority shaded seats – should be embedded in spatial layouts. These concerns directly respond to 5.1.4, which identified current playgrounds as overly child-centric and lacking support for caregivers and older adults. Caregiver interviews in 5.2.3 emphasise culturally sensitive spatial provision and the need for gender-aware environments. Behaviour Cluster B (5.4.2.2) further evidences spatial overlap between care behaviours and core play areas, indicating a need for co-usage inclusivity.

Flexibility requires designs that can adjust to changing user needs and environmental conditions. A versatile playground design should adapt to changes in time and activity type as well as meet diverse user needs. By providing adjustable facilities, the space once used as a children's playground during the day can become a community gathering spot at night, making the most out of every square inch on site. Seasonal design elements also improve this year-round adaptability by providing shade in summer and wind protection in winter. In addition, the multi-functional design of some areas allows a site to be used for individual and group games or community activities. Flexibility also means temporal and operational responsiveness—allowing for shift-based use, emergency repurposing, and maintenance rerouting. Interviews with both caregivers (5.2.3) and staff (5.2.4) highlighted the need for

spaces that adapt to family rhythms, weather conditions and operational maintenance patterns. SOPARC Cluster D (5.4.2.4) points to staff needing predictable, low-conflict access routes, while caregivers' value temporal programming and shading systems that adapt to weather and time of day.

Safety is an indispensable essential condition in playground design. Physical safety requires that all facilities comply with international safety standards and avoid potential hazards, such as sharp edges or slippery floor materials. Regular maintenance and inspections are necessary to ensure the physical safety of facilities, while psychological safety provides users with a stress-free environment. In particular, rest areas for parents and carers should be designed with an open view so that they can easily monitor children's activities. In addition, the design should also incorporate clear emergency exits and evacuation routes equipped with all necessary safety signs, safety equipment (first aid kits and call buttons) as well as first responder equipment ensuring fast responses in an emergency situation. As shown in Figure 6.5, safety includes both facility-level (equipment) and layout-level (route signage, visibility) considerations. This principle aligns with 5.2.3 caregivers' top priority— 'health and safety management'—and with staff needs in 5.2.4 regarding emergency response and incident handling. Behaviour Cluster E (5.4.2.5) shows that high-mobility users gravitate toward open, edge zones, further validating the need for well-demarcated, non-interfering circulation and clear egress routes.

Comfort directly affects the user experience and length of stay at the playground. The design should enhance comfort in terms of aesthetics, climate adaptability, seating layout and space cleanliness. Depending on the local climate, the design should consider sun and rain protection to ensure the playground remains attractive in different weather conditions. Ergonomically designed seats and suitable shade structures can effectively enhance the comfort of caregivers. At the same time, beautification and regular cleaning and maintenance of the environment are equally important. Figure 6.5 integrates comfort with aesthetic design, thermal control, and environmental management—factors repeatedly mentioned in surveys and interviews. Introducing natural elements such as greenery and water features can increase the visual appeal of the site and provide a relaxing atmosphere for users. Caregivers interviewed in 5.2.3

repeatedly mentioned ‘comfort and environmental management’ as a key determinant for longer stay. This is corroborated by SOPARC Cluster F (5.4.2.6), where activities like resting, observing, and short-term waiting clustered around shaded, peripheral, and visually buffered zones. Survey data in 5.1.4 also reinforces the aesthetic and climatic quality needs of diverse users.

In summary, the design of an inclusive playground must integrate functionality, inclusivity, flexibility, safety, and comfort as interdependent pillars of spatial quality. These five principles form a synthesis of empirical needs, behavioural evidence, and normative design values. Not only do they serve the entertainment needs of children, but they also respond to the needs of different generations, genders and ability groups, fostering interaction, dignity, and inclusion. Importantly, these principles are grounded in empirical data: survey insights on demographic needs (5.1.4), caregiver and staff interviews (5.2.3–5.2.4), and behavioural clusters (5.4). Together, they provide an evidence-based foundation for inclusive playground design.

6.4 Design exploration of behaviour and spatial distribution

According to the BMAT’s spatial distribution of various social activities in the playground, the study found that different behavioural activities are concentrated in specific areas, and the design of these areas should meet the specific needs of these activities. To operationalise this mapping, this section translates clustered behaviour patterns into differentiated spatial design zones. Through a refined spatial layout, designers can create more inclusive playgrounds that meet the diverse needs of different user groups (see Figure 6.6).

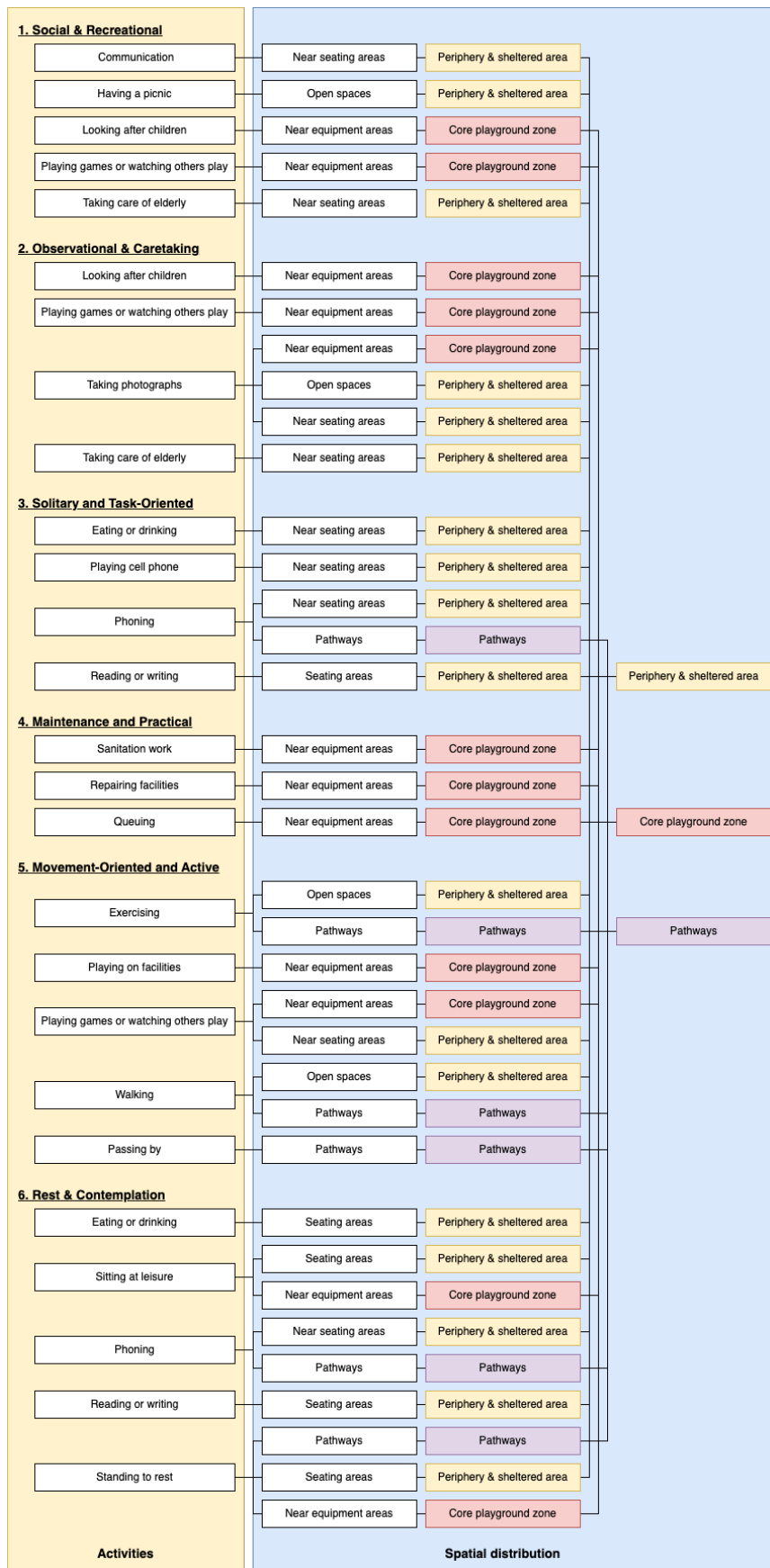


FIG.6.6 Mapping User Behaviours to Spatial Distribution: Derived from SOPARC Cluster Analysis

This figure integrates findings from SOPARC observations (Chapter 5.4), mapping six clusters of behaviour to three core spatial zones—**Core Playground Zone**, **Periphery & Sheltered Area**, and **Pathways**. It serves as a visual framework linking micro-level activities to macro-level spatial configuration, supporting a design logic that is both empirical and operational.

Social and recreational activities (Cluster A) tend to cluster around sheltered seating areas and play equipment, where parents and children interact through play equipment. To foster intergenerational interaction and parallel play experiences, the core zone must feature group-oriented play elements flanked by resting nodes. Playground layouts should provide convenient seating with clear sightlines, enabling multigenerational supervision and informal socialisation. Furthermore, accessibility of facilities promotes broader social participation. As shown in Cluster A of Figure 6.6 and confirmed by the 5.1.4 survey results, multi-generational use demands co-location of play and resting facilities to enable intergenerational interaction.

Observation and caretaking tasks (Cluster B) are concentrated in the core play area. Parents can supervise their children's activities while engaging in social interactions. Meanwhile, care activities for older people are mainly distributed in the quieter peripheral areas, usually equipped with shade structures and comfortable seating. This dual spatial logic—simultaneously central and peripheral—must be supported through ergonomic seating, edge buffers, and climate protection measures. This reflects Cluster B (5.4) and relates to caregivers' concern for safety and comfort as identified in interview data (5.2.3). Spaces must support both active monitoring and quieter caregiving roles.

Solitary and task-oriented activities (Cluster C) are mainly distributed in the peripheral areas away from the play equipment. These areas provide visitors with relatively private spaces suitable for activities such as using mobile phones, reading or resting. The design should offer semi-enclosed but visually open resting environments with benches, shading, and psychological buffers. Spatial openness should enable both solitude and safety, avoiding isolation while ensuring visual connectivity. This corresponds to Cluster C and reflects a common demand for psychological safety, especially for women and elderly users (5.2.3), who prefer semi-open but less exposed rest points.

Maintenance and practical tasks (Cluster D) are concentrated in areas with high usage frequency, such as play equipment and seating areas. To ensure the cleanliness and safety of the site, these areas require regular maintenance, and the facilities should be designed to facilitate efficient operation and maintenance tasks for cleaning staff. In addition, queuing behaviour is concentrated around popular facilities, indicating high demand for these facilities. This necessitates unobstructed back-of-house circulation, zoned sanitation cores, and visual clarity of queuing routes. As Figure 6.6 shows (Cluster D), the clustering of queuing and sanitation work underscores the need for spatial support for staff. Interviews (5.2.4) suggest layout clarity and access control as operational design priorities.

Movement-oriented and active behaviours (Cluster E) tend to focus on core play equipment that attracts children and families, with walking and passing occurring throughout the site's pathways and edge areas - not only meeting visitors' circulation needs but also offering great places for strolling and relaxing. An optimal playground design should maximise dual-purpose flow design, enabling pathways to serve as logistics corridors, fitness routes, and emergency egress channels. This aligns with Cluster E (Figure 6.6), where active and transitional movement overlaps with cleaning and emergency flows—pointing to the dual function of pathways as both leisure and logistical channels (5.2.4).

Resting and contemplation behaviours (Cluster F) mainly occur in peripheral and well-sheltered areas. These spaces are located away from the leading play equipment and offer a quiet, comfortable environment for more extended stays. Designers should integrate landscape buffers, thermal comfort strategies, and multi-orientation seating to foster long-term stay and observation. Cluster F data supports this, revealing long-duration behaviour clustering in shaded seating areas. Caregiver interviews (5.2.3) and survey responses (5.1.4) highlight comfort as key to stay length.

Together, the behavioural clusters reveal a patterned alignment with three primary spatial domains:

1. **Core Playground Zones** for active, interactive, and supervision-intensive behaviours.

2. **Peripheral & Sheltered Areas** for rest, observation, and solitude.
3. **Pathways** for circulation, passive use, and operational access.

This structure guides an inclusive layout logic. For example, core zones should prioritise intergenerational play and observational supervision; peripheral areas should provide climatic comfort and privacy; pathways must balance accessibility and flow management. This logic is further extended in Figure 6.7, which maps behaviourally-informed spatial zones to design elements and infrastructure strategies.

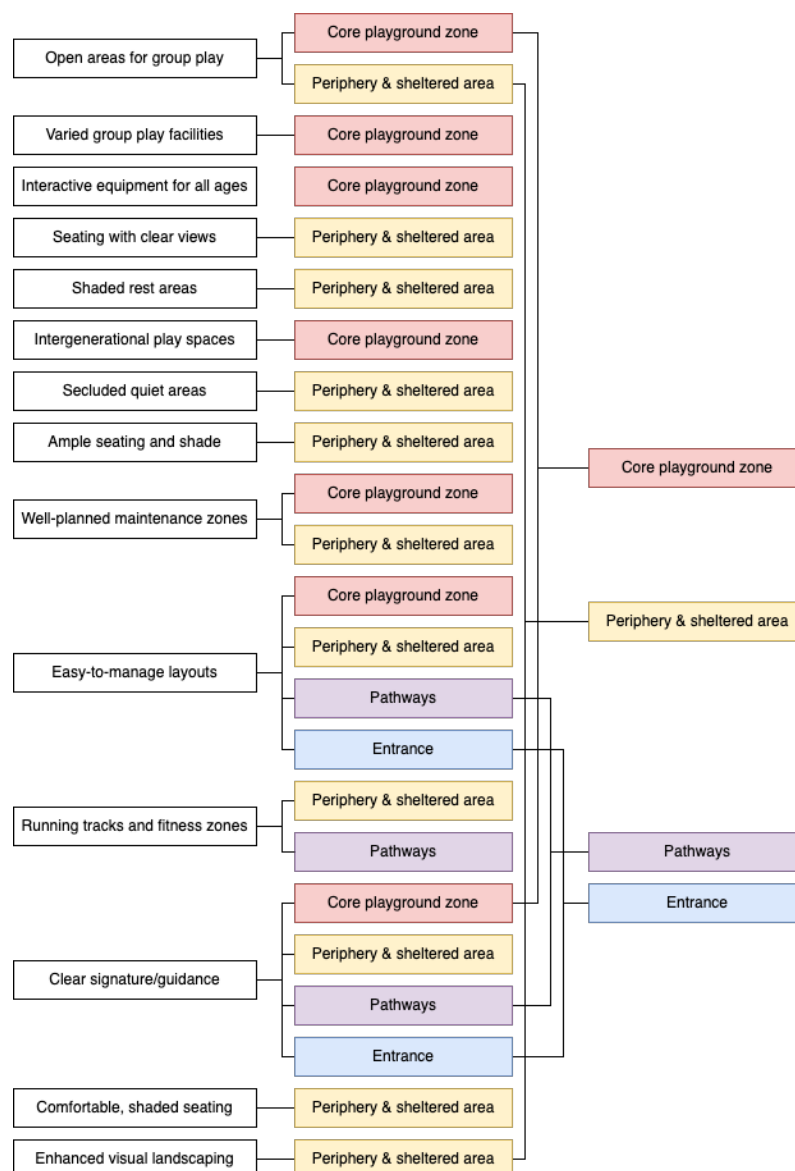


FIG.6.7 Mapping Design Elements to Spatial Zones: Translating Behavioural Needs into Design Responses

This diagram translates the spatial logic of behaviour clustering into infrastructure planning and architectural detail, identifying the key functional focus for each spatial domain. It also aligns design elements with user flows, supervision needs, and transition patterns.

- ⑩ **Core Playground Zone:** Emphasis on co-located play equipment, shaded seating with clear views, multigenerational interaction nodes, and high-clarity orientation signage.
- ⑩ **Periphery & Sheltered Area:** Includes rest zones, scenic buffers, fitness loops, informal seating areas, and transitional semi-enclosures for solitude and quiet interaction.
- ⑩ **Pathways:** Prioritises seamless circulation, emergency routing, staff access, and sensory continuity (e.g., tactile cues, directional signage).
- ⑩ **Entrance Area:** Centres on controlled access, information display, and immediate visibility for newcomers and staff operations. These spatial–functional pairings complete the behaviour → space → design logic chain, establishing a foundation for localised customisation and iterative refinement. They also form the basis for evaluating inclusiveness in future design assessments.

By presenting these interrelationships in a diagram, designers can further explore spatial synergy and optimise user experience. This process enables abstraction from site-specific constraints to a transferable model of inclusive spatial logic. Future playground designs can adapt and adjust these principles according to site context, user demographics, and operational priorities.

This user-centred design approach not only improves playground functionality but also ensures spatial equity and inclusive access. In line with the principles defined in Section 6.3, this analysis operationalises inclusivity at the spatial configuration level.

6.5 Design optimisation of inclusive playgrounds

In the design of playgrounds, the reasonable allocation of facilities and the optimal layout of space significantly impact the user experience and safety. The different functional areas of the playground need to meet the needs of children of different ages and provide comfortable spaces for caregivers and other stakeholders to rest and interact. To implement behaviour-based zoning into coherent spatial experience, this section explores optimisation strategies across five key domains: the core play area, open spaces, edge and shelter areas, entrance area, and circulation paths. These correspond to real behavioural patterns mapped in Section 6.4 and are spatialised in Figure 6.8.

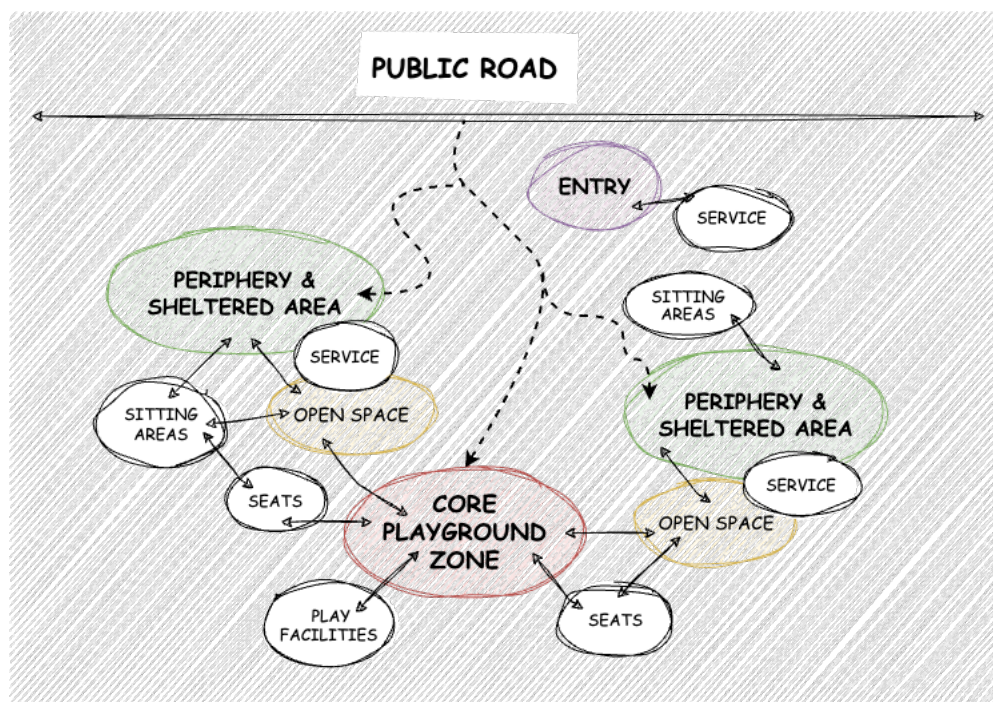


FIG.6.8 Design optimization strategy of Inclusive playground: zoning logic based on observed behaviours

(1) Multifunctional design of the core play area

The core play area is the most active zone in the playground, accommodating children, adolescents, and even adults who accompany them. To support a broad range of activity types, this space should feature modular play structures, climbing equipment, and digital or sensory installations that can be co-used by different age groups. Facilities should support both

individual exploration and intergenerational co-play, with layered difficulty levels and multisensory affordances.

Caregivers' needs must also be explicitly addressed. Seats should be oriented to provide unobstructed views of the play area, shaded by awnings or trees, and spaced to avoid congestion. These arrangements enable caregivers to supervise without hovering and to rest without disengaging. Inclusion is reinforced when caregivers can remain spatially proximate but socially autonomous. To support smoother age integration during peak hours, designated 'inclusive play volunteers' or part-time facilitators—such as trained youth or local seniors—could assist in guiding use and resolving inter-age conflicts. These soft service mechanisms extend spatial inclusivity into social practice.

(2) Mobility and interactive design of open spaces

Open spaces function as connective zones between high-intensity and quieter areas, and they benefit from being both flexible and activating. These areas should remain largely unobstructed to accommodate movement, while semi-open pavilions, landscape contours, or soft mounds can introduce natural transitions between activity types.

Interactive installations in these spaces—such as musical stepping pads, shadow games, or co-use seesaws—can facilitate casual engagement among strangers and family members alike. On weekends, these zones might transform into picnic areas where families gather under shade sails. Spatial surfaces should support quick role transitions—from rest to play, from passive use to active interaction.

To improve everyday usability, low-intensity service infrastructure such as drinking fountains, movable mats, or community-led 'booking boards' for birthday setups or group games could be embedded. These lightweight services embed adaptability without spatial disruption.

(3) Multifunctionality of edge and shelter areas

The edge and shelter areas of a playground offer refuge and recovery. Often preferred by elderly visitors, solitary users, or off-duty caregivers, these zones should provide calm, visually connected rest environments. Visual permeability is critical: users must feel secluded but not isolated. Landscape design can be used to buffer noise while maintaining permeability for safety.

Seating should be ergonomic, varied in height, and spaced to accommodate both group and solo use. A grandmother quietly reading while occasionally glancing toward the play area exemplifies the kind of use these spaces support. To meet these needs, clusters of benches should face in both parallel and inward-facing orientations, with planter dividers or pergolas offering soft thresholds between subzones.

These areas are also ideal for integrating soft programming—such as tai chi mornings, storytelling sessions, or quiet reflective time—hosted by local volunteers or supported by neighbourhood service organisations. This allows physical space to be rhythmically activated, offering a flexible ‘third zone’ between play and withdrawal.

(4) Basic service facilities in the entrance area

Entrance areas must manage foot traffic, orientation, and arrival comfort. A clearly defined entry plaza, shaded and easily visible, helps users of all abilities feel welcomed. Alongside waste collection points and site maps, the entrance can also offer service kiosks or welcome stands.

For example, on busy days such as weekends or during school holidays, a staffed information point could distribute maps, sunhats, or basic first-aid supplies. This temporary ‘playground concierge’ could also assist lost children, monitor crowding, or facilitate inclusive access for users with special needs.

Signage systems should be layered and inclusive—combining universal icons, tactile materials, and culturally resonant illustrations. This promotes navigational dignity for users across perceptual and language differences.

(5) Trail design and barrier-free access optimisation

Footpaths are the nervous system of the playground, enabling flow, rest, and accessibility. Paths must be flat, well-drained, and gently sloped to ensure access by wheelchairs, strollers, and maintenance carts. Materials should be slip-resistant and comfortably wide to accommodate side-by-side walking.

In practice, caregivers might stroll a loop with a child in a pram while stopping every 20 metres at rest stations. These should include shaded benches, low guardrails, and optional leaning rails for older adults. Where possible, paths should also embed storytelling elements—such as floor inlays with nature facts or community art—to turn transit into engagement.

For night-time and operational safety, smart trail infrastructure—solar-powered sensors, adaptive lighting, or real-time directional signs—can be introduced as non-invasive service enhancements. These remain hidden yet responsive to needs.

(6) Overall layout of an inclusive playground

A well-structured layout harmonises active, passive, and support spaces into a readable whole. Functional zoning—play, rest, movement—should be visually legible through changes in material, planting, or level. Key transitions must be intuitive, with natural wayfinding guiding users from one zone to another.

To support long-term use, high-frequency areas such as benches, play equipment, and toilets should use durable materials and be included in cyclical maintenance schedules. A networked reporting system—for example, QR codes on equipment linked to a digital feedback portal—can involve users in upkeep and reduce facility degradation.

Beyond physical design, social stewardship mechanisms are crucial. Community co-management initiatives—such as parent duty rosters, intergenerational storytelling circles, or elder-in-residence programmes—can sustain spatial quality through local engagement.

6.6 Systemic design framework: macro–meso–micro integration

Although previous chapters have identified diverse user needs through activity clusters and mapped these needs onto spatial zones to clarify design focuses, a genuinely inclusive playground should not be considered an isolated intervention. Instead, it must be understood as part of a multi-layered urban governance system. Thus, this section proposes a systemic design framework comprising macro (urban systems and policy coordination), meso (community system and governance mechanism), and micro (spatial interfaces and user experiences) levels, synthesizing prior findings into a practical multi-scale strategic approach (Figure 6.9).

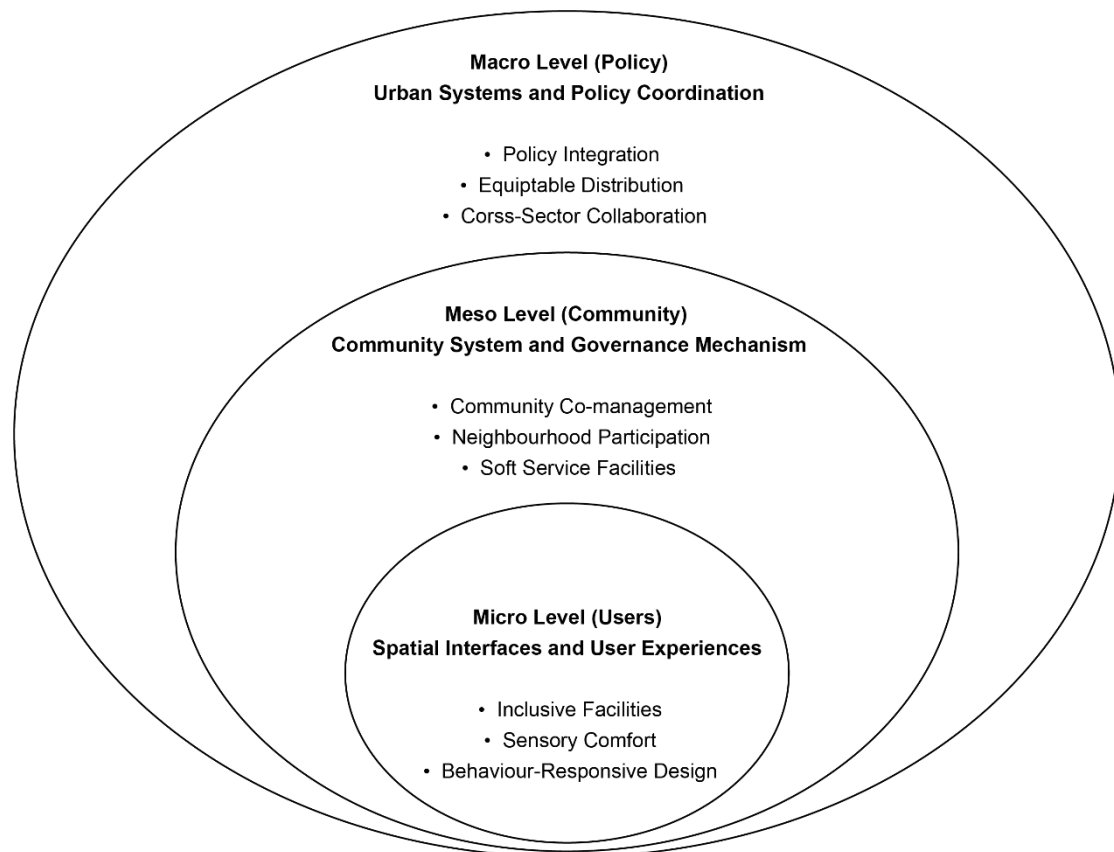


FIG. 6.9 Systemic Design Framework for Inclusive Playgrounds

This multi-tiered framework also serves as a bridge between academic research and practical implementation, offering design, management, and policy communities a set of actionable strategies across institutional, communal, and experiential domains.

(1) Macro Level: Urban Systems and Policy Coordination

At the macro level, inclusive playgrounds should be integrated into broader urban planning and policy frameworks as essential components of a city's public space system. This level primarily addresses equitable spatial distribution, accessibility, and operational sustainability of play facilities through city-wide planning guidance, resource allocation, and institutional arrangements. A truly 'inclusive city' does not merely focus on a few exemplary playgrounds but strives for a balanced, equitable, and easily maintainable distribution of play spaces across all communities, ensuring their long-term functionality through institutionalized mechanisms.

Specific strategies include:

- ⑩ Establishing a distributed network of playgrounds to ensure equitable access to recreational and social spaces within reasonable distances for all children and residents.
- ⑩ Integrating the site selection and resource allocation of inclusive playgrounds into urban land-use planning, transportation networks, and social service policies, thereby forming a people-centred resource distribution logic.
- ⑩ Promoting cross-departmental collaboration to dismantle traditional administrative barriers and facilitate integrated, multifunctional development and use of public spaces.

In practice, this macro-level direction supports policy documents such as *China's Children's Development Outline (2021-2030)* and Hong Kong's *Transformation of Public Play Spaces*, and offers a referential model for cities across Asia that seek to operationalise equity and play justice in their urban plans.

This macro-level foundation is supported by earlier analyses in this research, such as the equitable spatial distribution identified through activity clusters in Section 6.2, and discussions on facility maintenance and digital feedback systems in Section 6.5. Hence, macro-level strategies establish a critical institutional and strategic foundation for subsequent meso- and micro-level implementations.

(2) Meso Level: Community Systems and Governance Mechanisms

At the meso level, playgrounds are viewed beyond their role as physical infrastructures, becoming vital platforms for daily community interactions and social engagement. This level emphasizes sustained community use and empowerment through local institutional arrangements, collaboration, and routine operations. Thus, meso-level strategies revolve around a ‘co-construction, co-management, and co-utilization’ philosophy, ensuring playgrounds transition from mere facilities to vibrant social spaces.

Specific strategies include:

- ⑩ Developing flexible and clearly structured community management mechanisms, such as parent-led rotational supervision, neighbourhood interaction programs, and youth volunteer guides, to enhance mutual support within communities and alleviate individual family burdens.
- ⑩ Utilizing peripheral and sheltered spaces for low-disruption community activities, activating their potential social functions.
- ⑩ Embedding ‘soft service facilities’ like information boards, borrowing stations, and multilingual signage, which strengthen the community’s ability for autonomous updates and reduce usage barriers.

Meso-level practices also suggest new routines for district-based councils, LCSD divisions, and NGOs to collaboratively manage playground environments through participatory service loops, soft infrastructure design, and inclusive signage systems.

These meso-level strategies are exemplified in various spatial design proposals in Section 6.5, including flexible facility arrangements, small-scale community activities, and embedded soft services. By empowering community agency and enhancing spatial efficiency, meso-level strategies achieve meaningful social integration beyond physical accessibility.

(3) Micro Level: Spatial Interfaces and User Experiences

The micro level focuses explicitly on user experiences, being the most immediate and closely related to physical interactions and sensory engagement. Designs at this level directly address human-scale interactions with facilities, emphasizing tangible outcomes and detailed user experiences.

Specific strategies include:

- ⑩ Designing facilities to accommodate diverse user needs precisely, such as multi-age play equipment, visually supportive seating arrangements, interactive water features, and lighting installations.
- ⑩ Optimising pathways and informational systems by integrating intelligent lighting, accessible ramps, and graphical signage into route networks, allowing independent and safe navigation for diverse users.
- ⑩ Enhancing psychological safety and sensory comfort through semi-enclosed rest areas, multilingual visual guidance, and tactile-friendly materials to minimize cognitive and social barriers.

These design proposals not only translate inclusivity into embodied experiences but also provide a set of replicable models for landscape architects, designers, and product developers tasked with upgrading existing facilities or initiating new co-designed interventions.

Micro-level strategies thus translate institutional inclusivity into palpable experiences, integrating macro-level policies and meso-level mechanisms into daily use scenarios, ultimately achieving genuine spatial inclusivity.

Through the macro, meso, and micro levels of the systemic design framework, this research systematically transitions inclusive playground strategies from abstract institutional policies

down to concrete user experiences, facilitating comprehensive integration from urban governance to everyday usability.

6.7 Conclusion

Building upon questionnaire surveys, behavioural observations, and interview data, this chapter addresses the central question of how spatial design can respond to diverse behavioural and stakeholder needs. A design framework for inclusive playgrounds has been constructed, using behaviour clusters as the foundation and spatial zoning as the structure. The content progresses logically from user behavioural needs to spatial principles, then moves to detailed regional layouts and facility configurations, ultimately forming an integrated framework that spans strategic levels, design scales, and governance structures.

Section 6.1 identified six typical behavioural patterns, establishing the logical foundation for the chapter's subsequent design strategies. Section 6.2 systematically linked these behavioural patterns with spatial needs, forming a responsive pathway centred around 'behaviour–need–strategy'. Section 6.3 distilled five core design principles from these insights, addressing the diverse attributes and value objectives of inclusive play spaces. Section 6.4 used behaviour distribution hotspots to translate strategic logic into concrete spatial zoning, emphasizing responsiveness to regional differences. Section 6.5 provided detailed and practical strategies by addressing five critical spatial zones, focusing on facility arrangements, behavioural support, social interaction mechanisms, and service systems to enhance the adaptability and operational effectiveness of the design.

Further, Section 6.6 introduced a comprehensive systemic design framework structured around macro, meso, and micro levels, highlighting that inclusive design should extend beyond isolated nodes or facilities. Instead, it should integrate urban spatial policies, community governance structures, and user sensory experiences into a coordinated multi-level system. This framework enhanced the coherence and completeness of the strategy system and underscored the multiple roles of inclusive playgrounds as essential social infrastructure.

In summary, this chapter systematically translated user behaviours into spatial design strategies, resulting in a clearly structured, logically integrated, and scale-coordinated inclusive design framework. This addresses the primary research questions and provides a solid foundation for synthesizing the research findings across the entire thesis.

Chapter 7 Conclusions and suggestions for future research

In the following chapters, the findings and main arguments of this study are summarized, mainly around the research question and the sub-questions answered on how to further optimize existing inclusive public playgrounds that can meet the needs of both children and other urban users. Additionally, several important limitations in the analysis are discussed, and reflections are given on inclusive design and where this study contributes to research, and my development as a scholar more broadly. Finally, I propose future research directions based on the challenges in the study.

7.1 Summary of key findings

This section will provide a comprehensive overview of the research, drawing upon previous findings to systematically address each sub-question and research question.

Sub-question 1: Do the current inclusive playgrounds in Hong Kong truly meet the ‘child-centred’ design principle?

Hong Kong’s inclusive playgrounds have implemented the principle of child-centred design to some extent but have not fully achieved this goal. The playgrounds were not originally designed specifically for children but rather to address social issues such as juvenile delinquency and maintaining public order (Fan, 2021). However, with increasing social awareness of children’s rights, playgrounds have gradually evolved towards a focus on children’s needs. Especially after the 1980s, playgrounds in Hong Kong began to provide age-appropriate activities for children of different ages, such as slides, climbing frames and swings. These designs do respond to the needs of children of different ages and superficially reflect the ‘child-centred’ design concept.

Although existing playgrounds differentiate facilities by age group (typically for children aged 2–5 and 5–12), they often overlook the interdependencies between children and their surrounding support systems. The current configurations still tend to ‘mainly serve children’ in

isolation, without sufficiently integrating the needs of other users. For instance, many playgrounds lack multifunctional facilities and adequate social spaces, which not only restrict adult presence and comfort but also indirectly limit children's autonomy and safe exploration. This is paradoxical given that most playgrounds explicitly require 'adult supervision,' highlighting that adults—especially parents and caregivers—play a vital role in enabling children's play experiences.

This study thus proposes a broader interpretation of child-centredness—one that recognises children not as isolated users but as embedded within dynamic care networks. A truly child-centred playground must also address the spatial, emotional, and social needs of caregivers, peers, and community members who co-shape children lived experiences. This study also emphasises the importance of addressing children's developmental needs beyond physical access, including their emotional security, social exploration, and sensory engagement dimensions.

Empirical evidence from behavioural mapping (see Chapter 5) confirms that children's engagement patterns are highly mediated by caregiver mobility, visual supervision capacity, and opportunities for interaction. Playground atmosphere, sensory richness, and opportunities for self-directed play were also found to significantly influence children's subjective willingness to engage. These findings suggest that child-centredness cannot be reduced to age segmentation or equipment provision alone. Instead, it must account for the interplay of relational, emotional, and environmental variables.

Accordingly, the design strategies outlined in Chapter 6 adopt a 'behaviour-cluster × spatial zone' approach. This enables flexible responses to both developmental and relational needs of children. By embedding sensory diversity, intergenerational interaction potential, and situational safety cues, these strategies go beyond basic age-appropriate segmentation and enact a more holistic form of child-centred design. In sum, this thesis argues that 'child-centred' should not mean 'child-only'. A more inclusive, behaviourally grounded, and context-sensitive framework is essential to realise the full promise of child-centredness in complex, multi-user public environments like those in Hong Kong.

Sub-question 2: Who are the key stakeholders of public playgrounds other than children?

According to the R-I-N-G user needs research framework proposed in this study, the first step, 'Reviewing,' involves a comprehensive analysis of all potential stakeholders in the target space, including both direct and indirect users. Through literature review and empirical investigation, this study initially identified 15 categories of stakeholders—ranging from children, parents, and caregivers to teenagers, domestic workers, community residents, and playground staff. These categories were both theoretically derived and empirically validated through structured on-site observations, SOPARC data, and informal interviews, leading to the identification of a core stakeholder group. These key users form the empirical basis for the behavioural mapping and strategic design responses detailed in Chapters 5 and 6.

The main stakeholders identified are outlined below:

(1) Parents and primary caregivers

Parents and family caregivers—including grandparents and other relatives—typically accompany children to playgrounds. Their needs often centre around ease of supervision, proximity to their children, and access to rest areas. They also value opportunities to socialise with peers during downtime. Therefore, playgrounds must offer amenities like benches, shelters, and toilets that support both child supervision and adult well-being.

(2) Domestic assistants and professional nannies

In Hong Kong's dual-income households, domestic workers and nannies often play a central role in child supervision. These caregivers are particularly attentive to safety, visibility, and accessibility of facilities. They also use playgrounds as informal social hubs, making the presence of shaded sitting areas and resting zones critical to their experience.

(3) Community residents

Public playgrounds are integral to the neighbourhood fabric and are regularly visited by adults without accompanying children. These users seek leisure, socialisation, or simply proximity to a vibrant public space. If the design excludes them—by lack of resting points or by promoting an overly child-exclusive atmosphere—they may perceive themselves as outsiders. Hence, inclusive playgrounds should provide peripheral or multi-use zones where community residents feel welcome and not intrusive.

(4) Cleaning and security staff

These functional users play essential roles in maintaining hygiene and safety. Cleaning staff focus on waste removal and surface hygiene, while security staff deal with crowd control and incident response. Designing for these users requires considering logistical access (e.g., path widths, storage), durable materials, and clear sightlines to ensure they can perform their duties effectively without obstructing user flow.

Together, these stakeholder groups represent a diverse spectrum of spatial expectations and behavioural patterns. The identification of these stakeholders provided not only an empirical reference for classification, but also a foundation for spatial analysis and behavioural clustering in the subsequent design strategy development (see Chapter 6). Addressing their often-overlooked needs contributes to transforming playgrounds from child-exclusive spaces into inclusive public environments responsive to all users.

Sub-questions 3-4: Do the existing inclusive playgrounds address the needs of these stakeholders? If not, what are the expectations and visions of these stakeholders for future inclusive playgrounds?

During the data collection process of this study, many interviewees believed that the current inclusive playgrounds in Hong Kong partially meet the needs of children—especially in terms of accessibility and diverse play equipment. However, the needs of other stakeholders, particularly parents, caregivers, community members, and staff, have received varying degrees of neglect in current design practice. These stakeholder experiences were further corroborated

by spatial behaviour data. Behavioural mapping revealed that caregivers and community members tend to cluster in shaded edge zones or near circulation paths, while cleaning staff activity concentrates near high-use zones such as entry points and seating areas. These empirical findings highlight spatial mismatches between design intentions and actual use.

From informal interviews and surveys, many caregivers indicated that while playgrounds support children's safety and diversity, they neglect adult comfort—particularly in seating, shading, and visibility—compromising both supervision and rest. Parents and carers emphasised the importance of spaces where they can both relax and maintain visual contact with their children. The absence of such infrastructure limits their experience and indirectly restricts children's autonomy and quality of play.

Community residents and other adults expressed a sense of marginalisation. Many playgrounds reinforce a 'children-only' identity, which discourages intergenerational presence and makes unaccompanied adults feel uncomfortable and marginalised. This exclusion undermines the playground's potential as a public space. For example, the case of Mr A (see Chapter 1) illustrates how adult users without children often avoid staying in playgrounds due to perceived inappropriateness or lack of facilities.

Cleaning and security staff pointed out operational issues. Functional zoning is often unclear, complicating both safety management and crowd control. Staff suggested that high-risk areas (e.g., climbing structures) should be distinguished from general zones, and circulation routes should be better planned to manage crowd flow and reduce congestion. These insights underscore the need for integrating spatial planning with operational logic.

Caregivers of children with disabilities also voiced dissatisfaction with existing barrier-free facilities. While some inclusive features are present, these are often generic or technically compliant but not user-friendly. For example, ramps may be present but lack handrails, or equipment may not suit children with specific physical or cognitive needs. As a result, many families with disabled members are underrepresented in playground usage.

Summarising across all groups, stakeholders' expectations for future playgrounds converge around three priorities: (1) enhanced resting and supervision amenities; (2) socially inclusive zones for multi-generational and inter-stakeholder interaction; and (3) more humane and responsive barrier-free design. They envision public playgrounds not only as safe environments for children but also as shared community assets that support dignity, interaction, and inclusion for all.

In response, the design strategies proposed in Chapter 6 integrate these needs into a spatialised 'behaviour–demand–zone' logic, aligning empirical findings with actionable design directions. This enables playgrounds to evolve from child-centred islands into inclusive public infrastructures responsive to the full spectrum of urban users.

Research question: How can inclusive public playgrounds be designed not only to support children's play but also to accommodate the spatial, behavioural, and relational needs of other urban users?

This study argues that to design an inclusive public playground that meets the needs of children and other urban users, it is necessary to consider the diverse needs of different users from multiple perspectives, such as behavioural needs, facility settings, and spatial layouts. Therefore, this study proposes a 'behaviour-demand' oriented design strategy. By analysing the behaviours of different stakeholders in the playground, activity clusters are obtained through induction and summary. Then, their needs are analysed based on the activity clusters and the spatial distribution of their activities. Based on the needs and spatial distribution, the design scheme of an inclusive playground is optimised. The spatial strategies follow a 'behaviour-cluster × spatial zone' logic to ensure each user group is matched with a corresponding functional area, reducing behavioural conflict and enhancing interaction.

As a public space for complex social interaction and recreation, public playgrounds must provide an environment suitable for various behaviours. Social and recreational activities are among the most common behaviours of children and adults and usually require open spaces to promote interaction. Therefore, their design should provide wide open areas that foster greater

opportunities for socialisation as well as recreational facilities suitable for users of all ages. Interactive installations designed specifically to cater for different age groups can boost intergenerational participation while further enriching overall social environments. Relational needs—such as supervision, intergenerational interaction, and spontaneous encounters—must also be considered as part of inclusive spatial planning.

Parents and caregivers play an essential role in playground design. Therefore, the design should include seats with an unobstructed view and adequate shade so that adults can rest while easily monitoring children's activities. Family members need independent activity spaces and shared activity areas to promote interaction between them. Playgrounds can better serve family groups and enhance interaction and bonding among members by providing shared facilities suitable for participation by people of different ages.

In addition, users who seek solitude or focus—such as teenagers, older adults, or off-duty caregivers—also need quiet zones. These areas should be away from the main recreational facilities and equipped with comfortable seats and appropriate shade devices to ensure that users can get the necessary privacy and focus in public spaces. This type of design not only helps to meet the needs of people who want to be alone but also provides other urban users with a space for relaxation and contemplation.

The design of the playground should also consider the maintenance and management needs of the staff. A well-planned area for facilities and management paths can effectively improve the efficiency of maintenance work. The layout of the facilities should consider the convenience of daily maintenance by staff, providing adequate storage space and easy operating paths to ensure that the daily operation of the playground is not disrupted. Clear functional zoning and a reasonable layout of facilities will help reduce work pressure and ensure the site is always in good condition. Crowd circulation and risk zoning should also be planned to aid in emergency management and staff responsiveness.

The need for physical activity is also an essential consideration in the design of playgrounds. Playgrounds are not just places for children to play; they are also spaces for urban dwellers to

engage in physical activity and fitness daily. Therefore, the design should provide users with facilities suitable for sports, such as running paths and fitness equipment. In addition, to ensure safe evacuation in case of emergency, playgrounds need to be designed with clear emergency exits and evacuation routes to ensure quick response in the event of an emergency. This is not only a requirement for physical safety but also for psychological safety. In particular, providing parents and caregivers with a safe and controllable environment is important.

The rest and relaxation function of the playground should be met by designing a comfortable environment. Users are not just in the playground for entertainment; they also need a place to relax and observe the activities of others. Therefore, designers should provide comfortable seating, good views and adequate shade for these behaviours to enhance the environmental attractiveness of the playground and create a leisure space that is both aesthetically pleasing and functional. Visual openness also supports relational needs such as supervision, observation, and informal social interaction.

In short, an inclusive public playground that meets the needs of children and other urban users should follow the five design principles of **multifunctionality**, **inclusivity**, **flexibility**, **safety** and **comfort**. Multifunctionality requires that a playground serve not only one population, but also meet various behavioural needs through reasonable space division and facility design, without interfering with social interactions or disrupting individual activities. Inclusivity can be understood in terms of equal care for all users. All areas should be equipped with barrier-free access and facilities suitable for people with mobility impairments to ensure everyone can enjoy the playground's fun. Flexible design can respond to changes in time and usage needs. For example, through modular facilities, the playground can be a paradise for children during the day and transformed into a community gathering place in the evening. Safety refers not only to physical security but also psychological safety—an essential consideration for designers. Caregivers must have space to supervise children effectively and clear emergency evacuation routes. Furthermore, comfort directly influences user satisfaction. Playgrounds should enhance user satisfaction and prolong their stay through appropriate shading design, seating layout and the introduction of natural landscapes.

Through the spatial distribution analysis of these six activity clusters, it can be found that these behaviours are mainly concentrated in five key zones of the playground: **the core play area, the peripheral shaded area, the circulation path, the open interaction area, and the entrance/service area**. Design each area according to specific behavioural needs in order to provide an inclusive experience for visitors of varying ages and activity requirements. At its core, play areas should provide multifunctional activity spaces to encourage children of various ages to participate in suitable games. Meanwhile, peripheral shaded areas are designed more for rest and social interactions, providing parents and older people with comfortable seating and shade.

To optimise the overall spatial distribution of a playground, the core play area and peripheral sheltered area should be connected through open areas for easier spatial distribution. An entrance area manages entry/exit flows and offers essential services, making the layout of the entire playground more complete while assuring comfortable and safe play environments for users throughout its lifespan. These spatial zones, grounded in behavioural mapping, support both child-centric activities and the broader demands of inclusive, relational public space.

7.2 Research limitations

This study has limitations, including sampling, longitudinal timeline, survey guide, and respondent biases. Fortunately, through my current research on public playgrounds, many of these limitations can be easily overcome in future research. Below, I will address each limitation, accordingly, consider its impact on my analysis, and suggest how it can be addressed in future research.

7.2.1 Sampling

During the research process, the sample mainly had the following problems. First, during the survey phase, due to uneven visit times among the 40 playgrounds included in the LCSD inclusive playground list covered by the survey, some playgrounds had more respondents. In

contrast, some playgrounds did not have any respondents. This results in some playgrounds needing to be covered more effectively.

In addition, some multiple-choice questions in some questionnaires were mistakenly filled out by respondents as single-choice questions, which may impact the results. During the questionnaire distribution process, some respondents needed help concentrating throughout the entire process, requiring the researcher to dictate the questions and guide the responses, which increased the risk that the respondents would miss specific options or be guided by the researcher.

During the data collection and analysis process, it can be found that during the survey and interview stages. However, the data was mainly focused on child caregivers (caregivers), the proportion of female respondents was significantly higher than that of male respondents. The proportion of Chinese respondents was significantly higher than that of male respondents—other races. In addition, since the three playgrounds selected during the observation stage are all located in Chinese communities, the proportion of samples from other ethnic groups is small, making it difficult to fully reflect the behavioural characteristics of different ethnic groups in public playgrounds.

Otherwise, the sample selection was limited to LCSD's past inclusive public playgrounds. Since 2019, the Hong Kong government has planned to transform more than 170 public play spaces under LCSD in the next five years to promote the widespread application of inclusive design. Until the end of 2023 and the beginning of 2024, multiple new children's playgrounds have been built in various districts. For example, the three newly established children's playgrounds in Kai Tak added special play facilities and introduced more diversified and innovative designs. Although these new playground facilities' design and interaction patterns have not yet been fully incorporated into this study, their construction marks a further development in inclusive design.

Although the geographical and racial imbalance in the sample did not significantly affect the final analysis of this study, it did result in a paucity of documentation of the behaviour of other

ethnic groups in public playgrounds. Therefore, behavioural clustering and interview conclusions are more inclined to the behavioural habits and need the expression of Chinese people. Although this study stripped away the participants' social roles, culture, and background attributes and discussed it from a behavioural perspective, the possible impact of ethnic background on behaviour still needs to be considered. As new inclusive play structures increasingly consider parent-child interactions in play areas, future research may require broader and more diverse samples to explore different groups' needs fully.

7.2.2 Longitudinal timeline

The second limitation of this study is the limitation of observation time. Although different seasons were selected to observe the three playgrounds due to the impact of climate change and to avoid the adverse effects of extreme weather (such as high temperatures in summer), some observations could not be carried out under extreme weather conditions. However, in extreme weather, many users still use playgrounds. Their behavioural characteristics and the reasons they choose to go to public playgrounds in bad weather are of great value to research. This part of users' needs and behaviours may differ from those of users under normal weather conditions, which deserves further in-depth discussion.

In addition, due to the limited number of researchers, it is impossible to observe multiple playgrounds simultaneously, so they can only visit the playgrounds individually. In addition, August to October is the typhoon season, which extended the collection time of summer data. This time delay may cause some behavioural patterns or changes in traffic volume to be not captured in time, especially the potential impact of extreme weather on people's use of playgrounds.

Although the data in the observation phase are mainly used to supplement the findings in the survey and interviews and have no significant impact on the overall analysis, it cannot be ruled out that some special behaviours or usage patterns are omitted. For example, individuals choosing playgrounds under adverse weather conditions may exhibit specific needs and behaviours which go undetected, thus impairing our overall understanding of inclusive design.

Future research should include long-term observations with varied climate conditions over various timeframes in order to guarantee comprehensiveness and diversity of data that helps uncover users' behavioural patterns and needs more completely.

7.2.3 Survey guide

In this study, the survey questionnaire was designed based on collective discussions among members of the GRF project team, with the primary purpose of exploring the behaviours and needs of caregivers in children's playgrounds. Therefore, when using parts of the questionnaire as a structured interview, the focus was on an in-depth exploration of the interaction between caregivers and children and related needs. This means the research data needed to be fully tailored to my research questions, presenting limitations and advantages.

The limitations were that the questionnaire design focused more on the core issues of the GRF project, especially the interaction between caregivers and children and caregivers' expectations of inclusive playgrounds. Although the research was conducted in the form of a structured interview, the limitations of the interview options needed to fully cover the broader patterns of behaviour and needs of caregivers. In addition, although we tried to guide the respondents in discussing their own experiences and needs more, most of them still focused mainly on how to care for children. More importantly, the interviewer did not probe into the individual caregiver behaviour in the playground but rather focused on childcare-related topics, limiting diversity in survey results and preventing collection of more comprehensive behavioural data.

However, this limitation also had its advantages. Interview content heavily focused on interactions between caregivers and children and their expectations of inclusive playgrounds; providing insights into their core needs when discussing inclusive design. We could then more accurately understand caregiver needs when discussing playground design as they represent one of many stakeholders involved in playground creation. Although the caregiver's behaviour was not explored in depth during the interviews, other behavioural data of caregivers in the playground was supplemented by observation, which made up for some of the missing

information. However, the depth needed to be increased compared to the discussion of childcare behaviour.

7.2.4 Respondent biases

Researchers using interview data should be wary of three potential respondent biases when making inferences from this data set: Desirability Bias, Agency Bias, and Hindsight Bias (Tavory, 2020). Agency bias refers to respondents' tendency of positioning themselves as protagonists when telling a narrative. Usually, the interview situation affects the respondent, causing them to position themselves as the 'centre of action' (Tavory, 2020, p. 452). Retrospective bias refers to the fact that people may not be able to recall the course of events accurately. The impact of these two biases on this study is relatively limited because my research objectives do not rely on interview data to draw causal inferences. I also use observation data to supplement the analysis of the behavioural needs of different stakeholders. Therefore, these biases should not be a significant limitation in the analysis.

Expectation bias is an emerging concern that must be considered carefully. Expectation bias refers to when respondents interact with interviewers and may hesitate to express content detrimental to their image, preferring instead to portray themselves in positive terms. This bias is particularly pronounced when interviewing caregivers and conducting observations because gender and culture place specific moral demands on caregiving behaviour, and sexism and racism have historically overshot in criticising people for failing to fulfil their caregiving obligations. Therefore, some respondents may disguise or modify experiences that they do not think meet the expectations of the caregiver role. Although data was collected using an observational method, some respondents may have noticed the camera or been impressed by the researcher's face and may have adjusted their behaviour accordingly.

To address this problem, I made regular appearances at playgrounds pretending to be ordinary visitors or caregivers with children to decrease subject alertness and tendencies to perform. Unfortunately, some respondents may have remembered seeing me and behaved deliberately

despite these measures; however, as so much observational data had already been accumulated across three playgrounds this potential bias did not have a substantial effect on results.

7.3 Recommendations for future research

7.3.1 Expanding sample scope and stakeholder diversity

The cases of the current study are mainly concentrated on inclusive playgrounds in the list of Hong Kong LCSD (Leisure and Cultural Services Department). Future research should further expand the scope and diversity of sample selection, including not only newly built inclusive playgrounds, but also more facilities with innovative and diverse design features. The widespread use of these new playgrounds in Hong Kong provides important feedback and reference value for the effectiveness of inclusive design. At the same time, future research should also expand the diversity of stakeholder samples to cover user groups of different races, cultural backgrounds and socioeconomic status, so as to more comprehensively reflect the actual needs of various users.

In addition, future research should also consider cross-cultural comparison as an important research direction. By comparing the design of inclusive playgrounds in different cultural environments, we can deeply explore the similarities and differences in inclusive design concepts and practices in various places. This can not only reveal the impact of local cultures on user behaviour patterns, but also provide a broader reference for the optimization and promotion of inclusive design worldwide. Cross-cultural comparison helps to identify unique needs in different cultural backgrounds and create new opportunities for international design exchanges and cooperation.

In order to ensure the extensive diversity of samples, the research can also adopt a combination of cross-sectional and longitudinal studies. Cross-sectional studies can reveal the immediate impact of inclusive playground design on different groups by collecting stakeholder data from different backgrounds at multiple time points; while longitudinal studies can track the changes

in the behavioural patterns of these groups in the process of using playgrounds, providing a more dynamic research perspective. This comprehensive research method will make future inclusive design more holistic and forward-looking and provide practical guidelines for the design of various public spaces.

7.3.2 Incorporating longitudinal and multi-seasonal observations

Due to the limitations of the observation period in this study caused by climate change and human resources, future research is recommended to adopt a long-term observation method to cover the usage in different seasons throughout the year, especially the use of playgrounds under extreme weather conditions (such as hot weather, high humidity or typhoon season). This long-term observation can more comprehensively capture the user behaviour patterns under different weather conditions, reveal the impact of extreme weather on user needs, and thus provide designers with more reference on optimising playground facilities in all kinds of weather.

Existing studies have relatively short observation periods and focus mainly on normal weather conditions. Therefore, future research should further explore the use of playgrounds in inclement weather by extending the observation period, especially how user behaviour and needs change in extreme weather conditions such as heat, humidity, cold, and strong winds. This research perspective is crucial for optimising playground design and improving its adaptability, especially in the context of increasing global climate change. Designers must ensure that playgrounds can provide users with a safe and comfortable environment, regardless of weather conditions.

Future research should also explore the coping strategies of users of different ages and abilities in extreme weather conditions, such as how children, older people and people with special needs adjust their behaviour. This behavioural research based on diverse user groups will help designers develop more inclusive and flexible design solutions to meet the challenges of climate change. By providing shade, ventilation and rain/wind protection will enable playgrounds to maintain high usage rates while offering an enjoyable experience in all weather conditions.

In short, long-term observation and multi-seasonal data collection will help designers better understand the dynamic needs of users, promote the further optimisation of inclusive design, and ensure that public playgrounds can effectively meet the needs of all types of users in a climate with ever-changing conditions.

7.3.3 Exploring underused playgrounds and emotional inclusion

The current study is based on the design exclusion theory and derived the R-I-N-G user needs research method to optimize the design of inclusive playgrounds by matching the needs of users. However, another feasible research approach is to study those playgrounds that have very complete inclusive designs but have low usage rates or are almost abandoned, to explore how to reactivate these places and give them new vitality and vigour. For example, during the field research of the LCSD list in this study, it was found that although the Xi'anli playground on Hong Kong Island met the inclusive standards in design, few people with disabilities or even ordinary users went there. Such cases deserve further in-depth study.

Although universal design principles and inclusive design concepts have been widely used in many inclusive playgrounds, it can be seen from the data that even if these playgrounds are sufficiently perfect in terms of accessibility of facilities, the participation rate of actual users, especially children with disabilities or people with disabilities, is still very low, and in some cases even less than before the renovation. This phenomenon suggests that the design of inclusive playgrounds may not fully meet the needs of target users at some levels, especially the deep-seated impact of barrier-free design still needs to be further explored.

Therefore, future research should not only continue to focus on barrier-free design at the physical level, but also explore in depth how to enhance the user experience at the emotional and cognitive levels through detail optimization and design innovation. For example, can the design of barrier-free facilities provide more emotional connection and sense of belonging for children with disabilities and their families? Do these designs really take into account the psychological needs of users and reduce their sense of isolation in public spaces? The discussion of these issues will help to further improve inclusive design and ensure that playgrounds are

not only barrier-free in physical space, but also can enhance users' emotional satisfaction and sense of identity through design.

By studying these low-use playgrounds, valuable negative experiences can be obtained, providing new ideas for future inclusive design. Rethinking the social functions, community participation and diversified needs of playgrounds will help design inclusive public spaces that are more in line with the actual needs of society, thereby activating the potential of these places and truly achieving the goals of diversity and inclusion of playgrounds.

7.3.4 Extending inclusive evaluation frameworks beyond physical accessibility

In the process of selecting and evaluating case studies, this research developed a systematic Playground Inclusive Quality Checklist as a key tool to assess the physical inclusivity of public playgrounds. The checklist integrates multiple international standards alongside the specifications of Hong Kong's Architectural Services Department. It covers essential physical indicators such as accessible circulation, safety layout, and facility configuration, and serves as a relatively mature tool for evaluating spatial accessibility and regulatory compliance (see Section 4.2.1 and Appendix III). Within the research, this checklist was applied to evaluate 40 existing 'Design for All Children' playgrounds under the jurisdiction of the Leisure and Cultural Services Department (LCSD) in Hong Kong, providing foundational data for subsequent design improvements.

However, it is important to note that while the checklist includes a category related to 'play experience,' its evaluation remains focused on physical dimensions—mainly accessibility, safety, and functional completeness. As such, it still reflects a technical assessment of whether facilities are usable, rather than measuring the quality of user experience. It does not capture deeper dimensions such as the nature of children's play interactions, the subjective experiences of caregivers, or the overall atmosphere for social engagement. Therefore, evaluations based solely on this tool are insufficient for determining whether a space is genuinely inclusive in practice.

To address this gap, future research could build upon the existing checklist by expanding it into a more comprehensive evaluation system that incorporates both experiential and service-oriented dimensions. Potential directions for expansion include:

- ⑩ **Play Value Dimension:** Does the space support diverse types of play? Are children of different ages and abilities able to engage collaboratively?
- ⑩ **User Experience Dimension:** Do caregivers and children feel a sense of psychological safety and social comfort? Are there areas perceived as unwelcoming or underused?
- ⑩ **Service Mechanism Dimension:** Are soft service supports—such as informational signage, community participation mechanisms, or facilitation tools—integrated into the space?
- ⑩ **Behavioural Data Dimension:** Are behavioural observations or digital feedback mechanisms in place to continuously monitor user interaction patterns, dwell times, or social dynamics?

Incorporating these dimensions would allow inclusivity assessments to move beyond basic compliance toward a more nuanced understanding of behavioural responsiveness, emotional quality, and social engagement. This multidimensional evaluation approach would enable the development of more adaptive and targeted assessment models, offering practical guidance for government bodies and community stakeholders in site improvement, policy formulation, and service design.

Moreover, this layered evaluation logic aligns with the macro–meso–micro systemic design framework proposed in Section 6.6. Together, they close the loop between strategy development and ongoing operational feedback, offering a robust mechanism for the continual refinement of inclusive play spaces.

Appendices I Inclusive playgrounds list

This list is provided by Leisure and Cultural Service Department (LCSD). Information about the inclusive playgrounds is given blow.

District	Name of playground	Play Equipment	Visit
Central & Western	Hong Kong Park	The 1000-square-metre Children’s Playground is located on six playforms at different levels, including baby joice, tunnel slide, airplane, playground modular panel, superscoop, spring rider, adventures cape, swing, paybooster system/space centre, the space saucer, the space station, spring pod, toddler town	Visited
	Mount Austin Playground	For toddlers, including multi-seat swing with one cradle seat, spring riders, modular play system; for children including multi-play system	None
	Sai On Lane Children’s Playground	For toddlers, including panel series and spring rider; for children, including slide, climbing frame and play panel	Visited
Eastern	Quarry Bay Park	The play equipment is designed for use by children with and without disabilities, including climbing frame, slide, play panels, rocking horse, swing, and sway boat.	Visited
Islands	Man Tung Road Park	For toddlers, including slide, rocking and play panel; for children, including rocking, climbing-rock board, climbing rope and climbing frame and play game box with stand; changing rooms and accessible toilets.	Visited
	Tung Chung North Park	For toddlers, including riders and play panels; for children, including climbing frame and slide	Visited
Kowloon City	Ho Man Tin Park	For toddlers, including rocking horses and slide; for children, including climbing frame, slide and play panels.	Visited
	Kai Tak Avenue Park	Airport theme playgrounds, including slide, swing, link bridge and climbing facilities.	Visited
	To Kwa Wan Recreation Ground	For toddlers, including swing, slide; for children, including climbing frame, swing, slide, riders, and play panels.	Visited
Kwai Tsing	Kwai Chung San Kui Park	For toddlers, including climbing frame and slide; for children, including climbing frame and slide.	Visited
	Shek Yam Lei Muk Road Park	For toddlers, including climbing frame and slide; for children, including climbing frame, slide, swing, and spring rider.	Visited
	Tsing Yi Northeast Park	For toddlers, including telescope, slides, play panels, spring riders, and seesaw; for children, including rock blocks, pikes peak, bridge, balance beam, spring rocket and swing.	Visited
Kwun Tong	Yuet Wah Street Playground	For toddlers, including decks, play panels, slide, ramps and bridge; for children, including decks, slides, climbers and play panels.	Visited

North	North District Sports Ground	For toddlers, including climbing frame, slide; for children, including climbing frame, swing, slide and saddle spinner.	Visited
	Po Wing Road Playground	For toddlers, including climbing frame, slide; for children, including climbing frame, slide, and seesaw.	Visited
	Yat Ming Road Park	For toddlers, including slide, play panels; for children, including climbing net, climbing frame, slide spinning tower.	Visited
Sai Kung	Po Hong Park	For toddlers, including climbing frame, slide, play panel and swing; for children, including climbing frame, slide, play panel, and swing.	Visited
	Sai Kung Waterfront Park	3 set for toddlers and children, including climbing frame, swing, slide and play panels.	Visited
	Sheung Ning Playground	For toddlers, including climbing frame, swing, slide, and play panel; for children, including climbing frame, slide, and play panel.	Visited
	Tiu Keng Leng Sports Centre (District Open Space)	For toddlers, including climbing frame, slide, sailing and 3-seater rocking; for children, including climbing frame and net, slide, wheel equipment.	Visited
Sham Shui Po	Lai Chi Kok Park	For toddlers, including climbing frame, swing, and slide; for children, including climbing frame, swing, and slide.	Visited
	Nam Cheong Park	For toddlers, including play house, swing, and slide; for children, including push-up parallel bar, horizontal ladder, sit-up, jumping bar, and play panels; for children, including push-up parallel bar, horizontal ladder, sit-up, jumping bar and play panels; for older people, including twister, stepper, rider, pull down machine Tai Chi wheel, and upper back stretcher.	Visited
Sha Tin	Ma On Shan Park	Playground with fitness corners. For play equipment, including multi play equipment, composite playhouse, rocking, rotating whirl; for fitness equipment, including up back stretch, riders, Tai Chi wheel, pull-down machine, calf shoulder, back stretch, push up, people walking paths, calf stretch, warm up, vertical ladder, jump touch, sit up, chin up, balance beam, vault beam, horizontal ladder, beam run, spring up, step up, parallel bars, and cool down.	Visited
	Sha Tin Park	For toddlers, including play panels, rockings, tool shop, toy car, sports car; for children, including buck-a-bout, buoy bouncer, sea horse, horse, seal and fun trainer, and play panels; for older people, including stepper, rider, Tai Chi wheel, twister and steeping platform; 1 set for disabled.	Visited
Southern	Ap Lei Chau Park	For toddlers, including play panels; for children, including climbing frame and slide; and saddlemate.	Visited
	Repulse Bay Beach Children's Playground	For children with disabilities, including merry-go-round and seesaw; for children, including merry-go-round, and climbing frames.	Visited
Tai Po	Kwong Fuk Park	For toddlers, including climbing frame, play panels, slides,	Visited

		rocking, and human bob; for children, including physical challenging climbers, play panels and slides.	
	Tai Po Waterfront Park	For toddlers, including play panels, slide, swing, and rocking; for children, including climbing frame, play panels, slide, rocking, and puzzle box.	Visited
Tsuen Wan	Shing Mun Valley Park (South Garden)	Theme Park, toddlers' part named 'adventure land'; children's part named 'Shing Mun Castle'. For toddlers, including dinosaur land, wonderland, maze, and seesaw; for children, including main castle, fort, guard tower, cable, suspension bridge, entrance and river.	Visited
	Tsuen Wan Park	For toddlers, including spring riders, and slides; for children, including climbing wall, swings, and slides.	Visited
Tuen Mun	Tsing Tin Playground	For children, including decks, play panels, slides, a ramp, bridges, ladders, and climbers.	Visited
	Tuen Mun Park	7 zones, including trampoline, balance plate, talk tubes, melody chime, drums, water play equipment, climbing tower, climbing net, climbing rope, roller slide, embankment slides, rotating climbing tower, carousel, egg hunting sand pit, climbing rock, sand play table, sensory wall, cocoon seating, and swings.	Visited
Wan Chai	Victoria Park	For toddlers, including climbing frame, swings, and play panels; for children, including climbing frame, swings, slides and play panels.	Visited
	Wan Chai Park	Including seesaw, saddle mate, climbing frame, and slide.	Visited
	Wong Nai Chung Road Crescent Garden	For toddlers, including climbing frame, swings, and play panels; for children, including climbing frame, slides, play panels, sway boat, and climbing wall.	Visited
Wong Tai Sin	Fung Tak Park	For toddlers, including climbing frame, slide, and play panels; for children, including climbing frame, slide, and play panels.	Visited
	Lion Rock Park	Including climbing frame, slide, and play panels.	Visited
Yau Tsim Mong	Cherry Street Park	For toddlers, including slides, spring riders, play panels, and swings; for children, including climbing frame, slides, bridge, and swings.	Visited
	Kowloon Park	For toddlers, including slide, and play panel; for children, including ramp, play panel, and swing boat.	Visited
	Middle Road Children's Playground	For toddlers, including slide, ride, and play panel; for children, including climbing frame, slide, bridge, and swing.	Visited
Yuen Long	Tin Shui Wai Park	/	Under transformation
	Yuen Long Park	For toddlers, including swing, seesaw, spring rocking, climbing frame, slide, and play panel; for children, including swing, ramp, and play panels.	Visited

Adapted from Leisure and Cultural Services Department. (n.d.). Play equipment in children's playgrounds.

<https://www.lcsd.gov.hk/en/facilities/facilitieslist/children/playequipment.html>

Appendices II A survey on the current usage of public play spaces in Hong Kong (2023/02/20)

Part I: Demographic information

Q1. Your relationship with the children?

- A. Parents
- B. Grandparents
- C. Other relatives
- D. Appointed Caregivers (Domestic Assistants)
- E. Other: _____

Q2. Your age?

- A. Less than or equal to 20
- B. 21-35
- C. 36-50
- D. 51-65
- E. More than 65

Q3. Your gender?

- A. Male

B. Female

C. Other

Part II: Your opinions on the inclusiveness of playground.

Q4. What is/are the purpose(s) for you to come to the playground? [More than one answers]

A. Enjoy nature

B. To relax

C. To exercise

D. To use digital devices

E. To meet friends

F. To take child(ren) to play

G. For education

H. For family union

I. For photography

J. Listen to music or radio

K. Reading

Q5. Who do you think the playground is designed for? [More than one answers]

A. Children

B. Parents/Grandparents

C. Domestic Assistants

D. Other visitors

Part III: Your thinking about children's opinions on the playground.

Q6. Do you think the current design of the playground facilities can fulfill your child(ren)'s needs? [Only one answer]

A. Yes

B. No

Q7. What are the needs that you think the current design of the playground facilities have not met your child(ren)'s needs? [More than one answers]

A. None

B. To play alone

C. To play with other child(ren)

D. To play with parents/grandparents/domestic assistants

E. To get some fresh air

F. To exercise

G. To meet friends

H. To improve cognition

I. Others: _____

Q8. When do you think is the happiest moment your child(ren) experience in the playground?

[Only one answer]

- A. When they play alone using the facilities.
- B. When they play with other children in the playground.
- C. When they play with parents/grandparents/domestic assistants.
- D. Others: _____

Q9. What is the facility that you think your child(ren) play most? [Choose one answer with ✓]

Which one is the facility that your child(ren) play least? [Choose one answer with ✕]

- A. Swings
- B. Slides
- C. Seesaws
- D. Spring rockers
- E. Playhouses
- F. Climbing frames and walls
- G. Balance beams
- H. Sandpits
- I. Water play features
- J. Fitness equipment
- K. Ball games

L. Other: _____

Q10. What do you think why your child(ren) likes the facility? [Only one answer]

- A. Fun and exciting
- B. Social interaction
- C. Physical development
- D. Imagination and creativity
- E. Aesthetics and design

Q11. What do you think why your child(ren) don't like the facility? [Only one answer]

- A. Age-appropriateness
- B. Safety concerns
- C. Lack of variety
- D. Poor maintenance
- E. Personal preferences
- F. Other: _____

Part IV: Your present thoughts and future expectations on the playground.

Q12. Do you want to play with children in the playground?

- A. Yes
- B. No

Q13. What do you usually do in the playground?

- A. Enjoy nature
- B. To relax
- C. To exercise
- D. To use digital devices
- E. To meet friends
- F. To take child(ren) to play
- G. For education
- H. For family union
- I. For photography
- J. Listen to music or radio
- K. Reading

Q14. What factors may influence the interactions of you and your child(ren)?

- A. Rules of the playgrounds
- B. Willingness of child(ren)
- C. Requirements of child(ren)'s parents
- D. Limited physical capabilities
- E. Your attitude towards playground and children

F. Facilities' playfulness

G. Social interactions

H. Age and developmental stage of children

I. Time constraints

J. Family norms and expectations

K. Language and communication barriers

L. Number of children in the playground

M. Other: _____

Appendices III Playground inclusive quality checklist (2023/6/13)

Public Playground No. ____

General information

Playground Name:

Playground District:

Playground Address:

Access

1. The playground can be clearly seen from the adjacent street and/or neighbouring properties.

0=Hard to be seen.

1=Partly can be seen.

2=Easy and clearly can be seen.

2. Equitable access - pathways, accessible by wheelchairs and strollers; bicycle, strollers, and scooter storage.

0=There is no quitable route for people to easily enter and exit.

1=Parts of the surfaces to access the playground are smooth and accessible, people with mobility equipment, such as wheelchairs, walkers, and forearm crutches may sometimes need others' help to access.

2=All surfaces throughout the playground are smooth and accessible, so people with mobility equipment, such as wheelchairs, walkers, and forearm crutches can navigate fluidly.

3. Easy navigation of playground - circuitry-style configuration of equipment. Enables children to fluidly navigate the playground and maintain continuous activity - connecting bridges, walkways, and stepping stones.

0=There is no circuit-style configuration of equipment.

1=Parts of the equipment applied circuit-style structure.

2=All equipment applied circuit-style structure to meet the special needs.

4. Generous surfaces are provided around play equipment to park strollers and mobility devices (areas outside impact zones preferable).

0=No space for parking.

1=Limited space for parking.

2=Enough space for parking.

5. There is a flush transition between the navigation path and the accessible surface leading up to the equipment.

0=No transition.

1=The transition is not flush enough.

2=The transition is accessible for all mobility equipment and has luminance contrasted.

Play Experience

6. The playground provides play opportunities for a variety of age groups.

0=Only for young children (2-5 years old).

1=For children and teens (2-12 years old).

2=For children, teens, and adults (including the elders).

7. The play experience is welcoming and inclusive for people from different backgrounds (e.g., through language, ethnicity, nationality, appearance, etc.).

0=Present only one culture.

1=Present two types of cultures.

2=Present more than two types of cultures.

8. Varied play types and experiences (i.e., imaginative and creative play, social play, active play, cognitive play challenges, sensory play provision, exploratory and natural play, intergenerational play, etc.) are provided.

0=None available.

1=Provided with homogeneous options of play facilities (i.e., having facilities for promoting only one capability).

2=Provided with heterogeneous, diverse play facility options (i.e., facilities for promoting motions and cognition capabilities).

9. There are dedicated distinct, separate play experiences for different abilities/levels/ages/needs (i.e., baby/toddler area).

0=None available.

1=There are dedicated distinctions available, but not based on abilities/levels/ages/needs.

2=There are dedicated distinctions available, and the different abilities/levels/ages/needs are considered.

10. Graduated challenge is provided within one type of play experience (usually physical) i.e., a balancing challenge that progressively gets harder, in a sequence of items (i.e., slides or swings...with different sizes).

0=There are play facilities of one size.

1=There are play facilities of different sizes, but the challenges that progressively get harder are not considered.

2=There are play facilities of different sizes and the challenges progressively get harder in a sequence of items.

11. There are a variety of multi-user equipment items (i.e., musical instruments, large raft rockers, and swinging).

0=Facilities that are designed for one user.

1=Provided interactive features but limited people playing with them.

2=Facilities that fit multiple people (i.e., children and caregivers) to play together.

Equipment

12. Equipment has a coordinated colour scheme.

0=the play equipment used analogous colours (e.g., Adjacent colours on the colour wheel)

1=the play equipment used distinguishable colours (e.g., complementary colours, triadic colours)

2=the play equipment used distinguishable colours that correspond to the surroundings.

13. Equipment is scaled for people of differing sizes (i.e., swing seats of varying configurations).

0=The play equipment that is designed into only one size.

1=The play equipment that has different sizes but is only for children to use.

2=The play equipment that fits people of differing sizes (i.e., children, adults).

14. Equipment is selected to allow a carer to assist a playing person (i.e., spacious decks on the top of slides).

0=None of the equipment is selected to allow a carer to assist a playing person.

1=Key equipment is selected to allow a carer to assist a playing person.

2=All equipment is selected to allow a carer to assist a playing person.

15. Ramped access is considered for elevated play experiences, with appropriate manoeuvring space.

0=None of the equipment considered the space.

1=Key equipment considered the space.

2=All equipment considered the space to meet all people's play needs.

16. Transfer systems are used when ramps cannot be used - comprising transfer platforms, transfer steps, and transfer supports.

0=None of the equipment considered the transfer systems.

1=Part of the equipment considered the transfer systems as a supplement.

2=All equipment used in the transfer systems when ramps cannot be used.

17. Play equipment has an appropriate height that considers people's special needs (i.e., people in wheelchairs can fit their knees under counters).

0=None of the equipment is installed at the heights that consider people's special needs.

1=Key equipment installed at a certain level of height that considers people's special needs.

2=All equipment installed at different heights to facilitate use at standing and sitting heights to meet all people's needs.

Maintenance and Safety

18. The playground can be used at night with adequate lighting.

0=None present.

1=Available for partial space or bad lighting.

2=Readily available to all with adequately lit.

19. Supportive facilities (i.e., restroom) are clearly visible from the playground and are adequately lit.

0=None present.

1=Available for partial space or bad lighting.

2=Readily available to all with adequately lit.

20. There are clear sightlines from seating areas to allow supervision by carers.

0=Hard to be seen.

1=Partly can be seen.

2=Easy and clearly can be seen.

21. The playground has a security fence (e.g., attached to the facilities or for the areas).

0 = The facility has no security fence.

1 = The facility has a security fence, but some children are not considered.

2 = The facility has a security fence, considering all children's conditions.

22. Play panels or elements maintenance.

0=Having serious rust and damage.

1=Partially rusted and damaged.

2=Clean, well maintained.

Supportive facility

23. Seating choices and arrangements are available.

0=None available.

1=Having a limited number of seats.

2=Enough seats have varied arrangements (i.e., individual seating options, group seating options).

24. There is accessible space adjacent to seats for mobility devices, prams, and personal belongings.

0=No designated spaces.

1=Having a limited amount of designated spaces.

2=Having enough designated spaces, so people can sit side-by-side with peers.

25. Trash bins are provided within the playground or at the entry.

0=None available.

1=Trash bins can be found somewhere in the park but not next to the playground.

2=Trash bins are right attached to (next to/in) the playground or at the entry.

26. Drinking fountains are available and the special needs (i.e., enough space for mobility devices) are considered.

0=None available.

1=Drinking water can be found somewhere near the playground.

2=Drinking water is right attached to (next to/in) the playground, and there is sufficient space around the drinking fountain for wheelchair accessibility.

27. Accessible toilets are available within the playground or nearby.

0=None available.

1=Available but not accessible for children or the disabled.

2=Available and accessible to all people, even including changing facilities for children/adults.

28. Electronic device charging stations are available.

0=None available.

1=Available but not sufficient.

2=Provide enough electronic device charging stations.

Surroundings/Environment

29. The playground has adequate shade or grassy areas over key play areas and seating.

0=None available.

1=Having shelters for play areas or seating.

2=Having shelters for play areas and seating.

30. The playground has been reviewed to understand the wind.

0=Did not consider the wind.

1=Wind is considered, but they use screening to protect areas from the wind.

2=Take the wind into account, and combine the wind with the play facility.

31. Utilize existing nature features (vegetation, trees, views, creeks).

0=Did not use the existing nature.

1=Utilize part of the existing natural features.

2=Utilize existing nature features to design the playground.

32. Materials and textures of the facilities are considered where possible.

0=Materials and textures are similar.

1=Materials and textures are different but didn't take the weather and environment into account (i.e., steel slides in hot summer).

2=Materials and textures are different and suitable for the local weather and environment.

33. Edging choices are flush with adjacent materials and do not create trip hazards, or hazards if fallen onto (i.e., steel edges).

0=Edges or seams are not flushed.

1=Partial edges are flush with adjacent materials.

2=All edges are flush with adjacent materials.

34. Mosquitoes are controlled in the playground.

0=no control by any measures.

1=Use artificial control (cleaning the environment, wind and plants) to control the number of mosquitoes

2=Combination of devices (such as mosquito-repellent lamps) and artificial control to control the number of mosquitoes.

Appendices IV Interview Prompts

Interview Prompt I: Interview Prompts for Caregivers in Inclusive Playgrounds

Section 1: Demographic and Family Context

- What is your relationship with the child? (e.g., parent, grandparent, relative, etc.)
- Are you the primary caregiver? If not, who usually takes care of the child, and why?
- (If the interviewee is a foreigner) Would you mind telling me where you are from?
- Could you briefly tell us your and your child's? (i.e., sex, age, ethnicity, etc.)

Section 2: Daily Routine and Playground Usage

- When do you usually go to playgrounds, and why those times?
- How many times a week do you visit this playground? Around what times?
- How long do you typically stay at the playground during each visit?
- Do you think this duration is sufficient for you and your child?

Section 3: Play Experience and Social Interaction

- Could you share a recent memorable play experience with your child? (What did you play? How? Why was it memorable?)
- Do you ever arrange playdates with friends and their children at the playground?
- Compared to other leisure activities, why do you choose to bring your child to the playground?

- What kind of equipment or areas does your child enjoy the most? How does he/she interact with them? With whom does he/she usually play?
- How do you view your child's play preferences (e.g., safety concerns, enjoyment, unfamiliarity)?
- When accompanying your child at the playground, what are your main concerns or priorities?

Section 4: Challenges and Limitations

- What do you usually do while your child is playing? (Why?)
- From the perspective of your child's developmental needs, what aspects of the playground's design or facilities could be improved?
 - Why do you think this is needed?
 - Are these needs influenced by social, economic, or ecological factors?
- From your own perspective as a caregiver, what part of the playground do you like the most? Why?
- Are there any things you wish you could do here while taking care of your child, but find it hard or impossible? (Why?)
- What do you think is missing in this playground—or in playgrounds in general?
- In your view, what is the importance or impact of having a well-designed and clean playground for children's growth or for the family?

Interview Prompt II: Interview Prompts for Cleaning Staff in Inclusive Playgrounds

Section 1: Basic Information and Routine Tasks

- Could you briefly describe your main responsibilities in the playground?
- What areas or facilities are you responsible for cleaning (e.g., ground surfaces, play equipment, water features, sand pits, restrooms)?
- What does your daily cleaning routine look like (timing, frequency, procedures)?

Section 2: Challenges in Hygiene and Safety

- What are the most common issues you face in your cleaning work?
 - Are there specific zones (e.g., sand pits, water play areas, climbing structures) that are particularly difficult to clean?
 - Have you encountered problems such as litter, food waste, or sharp objects in play areas?
- How do peak hours (e.g., weekends, holidays) affect your ability to maintain cleanliness?

Section 3: Facility Design and Work Efficiency

- Do you think the current design of the playground supports or hinders your cleaning tasks?
- Which design features make cleaning more difficult? (e.g., poor drainage, insufficient lighting, hard-to-reach corners)

- What kind of tools, devices, or spatial improvements would make your work easier or more efficient?

Section 4: User Behaviour and Its Impact

- What behaviours from children or caregivers create challenges for your cleaning work?
- How do you think users can be guided to better maintain the cleanliness of the playground?

Section 5: Facility Safety and Maintenance Feedback

- Have you ever encountered broken or unsafe facilities during your work? If so, how do you usually report or handle them?
- Do you find the current feedback and repair mechanisms to be responsive and timely?

Section 6: Inclusive Design and Specific Needs

- Inclusive playgrounds often serve a diverse user group, including people with disabilities. Are there any special hygiene or maintenance considerations in this context?
- Do you think the placement of cleaning tools or the condition of accessible restrooms affects the experience of these users?

Section 7: Improvement Suggestions and Support Needs

- If you could propose some changes to improve your work environment or efficiency, what would they be?
- Would you like to be included in discussions or feedback mechanisms related to playground maintenance? What kind of communication would be helpful?

Section 8: Sense of Value and Recognition

- Have you experienced moments at work that made you feel recognised or appreciated?
- How do you perceive your role in contributing to the overall inclusivity and user experience of the playground?

Interview Prompt III: Interview Prompts for Security Staff in Inclusive Playgrounds

Section 1: Job Responsibilities and Daily Practices

- Could you describe your daily responsibilities as a security staff member in the playground?
- What areas do you regularly monitor, and how do you conduct your patrols?

Section 2: Risk Awareness and Safety Concerns

- What types of safety risks do you most often pay attention to in the playground?
 - Are there specific zones or facilities that pose higher risks (e.g., slides, climbing frames, sand or water areas)?
 - Are there concerns related to crowding or user behaviour that might lead to safety issues?

Section 3: Facility and Environmental Management

- How do you ensure playground equipment is safe for children's use?
- How do you handle natural elements such as wet sand, slippery surfaces, or hot metal equipment under the sun?
- Are there aspects of the playground design that make your safety work more difficult or more efficient?

Section 4: Monitoring User Behaviour and Interventions

- How do you monitor and respond to unsafe behaviour among children (e.g., pushing, improper use of equipment)?

- How do you balance safety enforcement with allowing children to engage in reasonable risk-taking during play?
- Have you experienced challenges dealing with caregivers' expectations or interventions?

Section 5: Responding to Incidents and Emergencies

- Could you describe how you typically respond to accidents, injuries, or conflicts in the playground?
- What are the most common challenges you face when managing emergencies (e.g., communication barriers, lack of manpower)?
- Are you trained in first aid or emergency response protocols?

Section 6: Crowd and Flow Management

- How do you manage high-traffic times (e.g., weekends, after school)?
- Are there strategies you use to prevent overcrowding or conflicts during peak hours?

Section 7: Support for Children with Special Needs

- How do you assist children with physical, sensory, or behavioural challenges in the playground?
- Are there specific facilities or design features that support or hinder safe use by these children?

Section 8: Communication and Coordination

- How do you collaborate with other staff (e.g., cleaners, maintenance, supervisors) to ensure overall safety?

- What communication systems or protocols do you use to report issues or coordinate actions?

Section 9: Improvements and Suggestions

- What improvements would help you perform your safety duties more effectively (e.g., more staff during peak times, clearer signage, additional training)?
- Are there technological tools (e.g., surveillance, people flow analytics, emergency alarms) that you think would enhance safety management?

Section 10: Role in Inclusive Design

- What does inclusive design mean to you in terms of safety management?
- In what ways do you think the playground could improve its inclusivity and accessibility while maintaining a safe environment for all users?

Section 11: Reflections and Personal Experience

- Can you share any memorable experiences that reflect the importance of your role?
- What gives you the most satisfaction in your work as a security staff member in an inclusive playground?

Appendices V Interviewee information sheet

No.	Role	Age of their children	Notes
P1	Father	5.5-year-old	Frequently brings his child to the playground; Typically visits the playground 1-2 times a week, spending about an hour each time; Safety is the primary concern.
P2	Father	2-year-old	His child enjoys activities like climbing hills and playing with water; The facilities lack fences, posing a safety risk.
P3	Father	3-year-old	Parent-child interactions; Playground activities; Safety considerations.
P4	Father	7-year-old	The playground's environment and facilities positively impact the child's growth, especially in social and physical activities.
P5	Father	6-year-old and 10-year-old	The child enjoys cooperative play with other children; the proximity of the playground is a reason for their frequent visits; Emphasizes that safety and the novelty of the facilities attract the child.
P6	Father	7-year-old	Safety and the variety of facilities; Issues with overcrowding at the playground; Visits the playground once a week, playing for about half an hour each time.
P7	Mother	8-year-old	The playground's design and facilities are seen as needing further optimization, particularly regarding safety and providing more seating.
P8	Mother	4-year-old	Adding more age-appropriate facilities like swings and shaded areas.
P9	Mother	3-year-old	The primary purpose of visiting the playground is for the child's socialization and relaxation; Notes issues with untimely maintenance of certain facilities.
P10	Mother	5-year-old and 3-year-old	The safety of the facilities and the cleanliness of the playground; Emphasizes the positive impact of a well-maintained playground environment on the child.
P11	Mother	3.5-year-old	The child enjoys playing with water in the playground, particularly suitable in hot weather; Emphasizes safety but expresses concerns about the maintenance of playground facilities.
P12	Mother	3-year-old	Takes the child to the playground after school or on weekends based on the child's needs; The child enjoys climbing facilities;

			Suggestions for improvement include adding swings and drink vending machines.
P13	Mother	7-year-old	Takes her child to the playground three to four times a week; The child particularly likes swings, which are scarce in some playgrounds; Considers the playground safe but mentions potential conflicts with other children.
P14	Mother	2-year-old	Usually visit a nearby playground; The child enjoys running, jumping, and playing on swings; Hopes for additional facilities like restrooms.
P15	Mother	7-year-old	Frequently brings the child to the playground, usually after school; The child enjoys running and climbing activities; Hopes the playground can optimize some older facilities and add new play options.
P16	Grandfather	3.5-year-old	Occasionally brings the child to the playground, primarily after school; The child enjoys slides and climbing activities; The playground's design and facilities could be optimized.
P17	Mother	3-year-old	Takes the child to the playground two to three times a week, usually in the afternoons; The child enjoys watching insects and flowers and does not play on slides much; Mentions the playground is good for the child's physical activity but suggests addressing issues with insects.
P18	Mother	3-year-old	Typically visits the playground on weekends; The playground is considered too small, with facilities not well-suited for younger children; Suggests adding more facilities suitable for younger children.
P19	Helper	2-year-old	Takes the child to the playground twice a week; The child usually plays alone, enjoying activities like running and sliding; Overall satisfaction with the playground is high, with the facilities considered safe.
P20	Helper	2-year-old	Brings the child to the playground daily if it's not raining; The child enjoys running and swinging activities; Hopes to add more diverse and colourful facilities to the playground.
P21	Helper	7-year-old	Takes the child to the playground three to four times a week, each visit lasting about three hours; The child enjoys running and playing, especially with other children; Believes the playground's social environment benefits the child's independence and bravery but hopes to prevent bullying.
P22	Helper	8-year-old	Usually takes the child to the playground after school, particularly

			on Thursday afternoons; The primary focus is on the child's safety, with a view that the playground lacks some adventurous and challenging features.
P23	Helper	8-year-old	Takes the child to the playground for 2 to 4 hours weekly; the child is only allowed to play after completing homework; Focuses mainly on the child's safety and health, believing that sometimes the activities are too tiring; Playground facilities should be more challenging while still safe.
P24	Helper	8-year-old and 10-year-old	Takes the child to the playground three to four times a week, each visit lasting about two hours; The kids enjoy activities like sliding and cycling; Satisfied with the playground's facilities and environment but emphasizes the need for better accommodations for caregivers, such as more rest areas.
P25	Helper	8-year-old	Brings the child to the playground three times a week, each visit lasting about three hours; The child enjoys playing with friends, but the playground's facilities are limited and lack appeal; Hopes for more engaging and interactive facilities.
P26	Grandmother	8-year-old	Takes the child to the playground after school, emphasizing the need for more shade and ventilation; The playground's facilities are monotonous and lack diversity; suggestions include adding shaded and air-conditioned areas. Mentions the challenges of supervising children in the playground, especially in hot weather.
P27	Grandmother	2-year-old	Takes the child to different playgrounds daily, usually choosing those with swings and slides; Emphasizes child safety, especially preventing collisions and falls; Suggests adding facilities suitable for different age groups to ensure the environment is appropriate for all children.
P28	Grandmother	5-year-old	Brings the child to the playground once or twice a week, each visit lasting about an hour; The child enjoys climbing activities; the parent believes outdoor exercise benefits the child; Satisfied with the overall playground facilities and environment.
P29	Grandfather	2-year-old	Takes the child to the playground every day, each visit lasting about half an hour; The child enjoys puzzles and sliding activities; the parent emphasizes the importance of social activities for the child; Believes the playground space is inadequate and suggests adding more interactive and social opportunities.
P30	Cleaning Staff	/	Main responsibilities include daily cleaning of trash, maintaining cleanliness of water pits and sand pits; Needs more cleaning tools and training;

			Concerns about water/sand pit safety; High concern for children's safety due to potential hazards like sharp objects in sand pits and slippery surfaces.
P31	Cleaning Staff	/	Responsibilities include cleaning playground areas, equipment, seats, and restrooms; Struggles with hidden trash and high areas; Suggests more staff during peak times; Emphasizes the importance of public awareness and cooperation in keeping the environment clean, such as not littering.
P32	Cleaning Staff	/	Focuses on maintaining cleanliness and safety, especially in less visible or hard-to-reach areas like the tops of slides and climbing frames; Difficult to clean during bad weather; Recommends better lighting and maintenance; Hopes for a more streamlined reporting and maintenance system for playground equipment issues.
P33	Security Staff	/	Manages safety patrols, equipment inspections, and emergency response in the playground; Concerned about potential safety hazards like overcrowding and equipment malfunctions; Recommends more cameras and training for special needs communication; Suggests more specific training for communicating with special needs children and their families.
P34	Security Staff	/	Responsible for checking play equipment for damage and safety hazards, and monitoring children's behaviour; Concerned about overcrowding; suggests better signage for safety; Suggests clearer signage and safety instructions, especially for children with special needs.
P35	Security Staff	/	Ensures all children can safely enjoy the playground, focusing on high-risk areas like climbing structures and swings; Needs more personnel during busy times; emphasizes inclusive play environment; Suggests more staff training in emergency response and handling situations involving special needs individuals.

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