

University of Groningen

## How urban green spaces relate to health and well-being

Zhang, Yang

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2017

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Zhang, Y. (2017). *How urban green spaces relate to health and well-being: The interplay between green space attachment, perceived quality and affordance*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen.

### Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

### Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

## **Chapter 6**

### The Environmental Affordances of An Urban Park: Relationships between Design and Seniors' Use of Green Spaces

### **Abstract<sup>5</sup>**

Urban parks can facilitate maintaining a healthy and active aging life by promoting seniors' physical activities and social interactions. However, such spaces may not be utilized and may not contribute to well-being, if they fail to meet the needs of seniors. In this study, the concept of environmental affordance was used to investigate relationships between park characteristics and seniors' use of parks. Drawing on a combination of interviews and the behavior mapping of three sites in an urban park in Xi'an, China, we developed a functional taxonomy of park affordances for senior visitors. Five main categories of affordances were identified: individual physical activity, group physical activity, protection against unpleasant weather conditions, social interaction, and sitting and resting. These affordances may be supported or constrained by design elements, other people and their behavior, the park's physical accessibility, facilities and maintenance, and atmosphere. Finally, we provide implications for urban planners and designers to create more livable green spaces for senior residents in urban areas.

Key words: Behavior mapping; Park design; Seniors; Urban green space

---

<sup>5</sup> This chapter is based on: Zhang, Y., Van Dijk, T., Weitkamp, G., & Van den Berg, A. E. (2017). The environmental affordances of an urban park: Relationships between design and seniors' use of green spaces. This paper has been submitted to *Urban Studies*.

## 6.1 Introduction

Urban parks are essential public green space resources that may contribute to health and well-being by stimulating restorative experiences, physical activities, and social contacts (see, for reviews, Hartig, Mitchell, De Vries, & Frumkin, 2014; Kuo, 2015; Van den Berg et al., 2015). The health and well-being benefits of green space may be especially important to seniors, who are more dependent on available neighborhood resources, and more prone to health-related problems, than younger residents. In China, the percentage of seniors is rapidly increasing, due to the increase in life expectancy, reduced fertility, and the one-child family planning policy introduced in 1979, (Liu et al., 2015). It is predicted that the percentage of citizens aged over 65 years will account for 26.9% in 2050 compared with only 8.2% in 2010 (Zeng, 2012; Zeng & George, 2010). In combination with China's unprecedented urbanization rate, this will inevitably lead to more people spending their later life in urban areas. In most Chinese cities, urban parks have become meaningful sites for everyday practices of senior residents, for example forming activity-oriented friendships (Richaud, 2016). However, urban green spaces such as urban parks are scarce resources in most Chinese cities (Zhai & Baran, 2017). These challenge designers to make the most efficient use of the limited public green space available in dense cities and optimize its values for the growing older populations.

Existing studies showed that park characteristics have a significant effect on park use such as physical activity (Kaczynski & Henderson, 2007). Some park characteristics have been associated with physical activities, such as park proximity (Giles-Corti et al., 2005; Kaczynski & Henderson, 2007), park size (Baran et al., 2014), amenity features (Kaczynski, Potwarka, & Saelens, 2008) and the presence of sport facilities (Lapham et al., 2016). Urban parks also support other pursuits, which offers opportunities for peace, relaxation, and social activities (Ward Thompson & Aspinall, 2011). However, it lacks knowledge support in how to combine and spatially arrange these park characteristics in a real setting (Nordh, Alalouch, & Hartig, 2011). Additionally, the dynamics of the relationships between user characteristics and park settings are also needed to take into account (McCormack, Rock, Toohey, & Hignell, 2010).

Few studies have taken a design perspective in understanding the relationship between park characteristics and park use of seniors in their own social-geographical context. In the Chinese context, to our knowledge, only one study

addresses this issue. The study was conducted in two urban parks in Beijing revealing the connections between the design characteristics of park pathway and seniors' walking behavior (Zhai & Baran, 2017), but did not concern other types of park use such as social activities. To fill these gaps, the current study investigates the relationship between park characteristics and seniors' park use. As limited theory is available in this field of research, we have utilized Gibson's Affordance Theory (Gibson, 1979) from environmental physiology to explore the park characteristics that are important and meaningful for seniors' park use. In the following sections, we will first discuss the concept of affordance and its relevance to urban green space design, followed by an overview of previous research on the importance of parks and green space for seniors. We will then present the methods and results of a field study in Xi'an, China, in which seniors' park uses were studied in relation to a park's affordances.

### ***6.1.1 Affordance and urban green space***

The concept of an affordance was coined by psychologist James J. Gibson (1977, 1979). In Gibson's view, environmental perception is a process in which "values" and "meanings" of things can be directly perceived. He described environmental affordances as "what it offers people, what it provides or furnishes, either good or ill" (Gibson, 1979). Affordances are the functional significance of environments in relation to the needs and abilities of an individual or a group. Affordance can be physical such as children's outdoor environment affording swinging, throwing, and being in peace and quiet (Heft, 1988). Gibson (1979) also stated that the richest and most elaborate affordances of the environment are provided by the presence of other people and their behaviors. For example, a case study conducted in UK revealed that social interaction is one of the most meaning affordances of neighborhood parks for young people (Townshend & Roberts, 2013).

Affordances in this paper refer to the significance of park use for seniors. The use of affordances provides a framework with three intertwined dimensions, involving the perceptions and interests of seniors, park characteristics, and seniors' park use. The application of the concept of this affordance approach may contribute to current green-space design studies. First, it addresses individuals' needs, for example senior park-users' interests, which in turn can provide design implication for specific target groups. Second, it requires researchers to explore the significant park characteristics, including the spatial configuration of physical park elements which focuses on the arrangement of these elements

instead of treating them independently from each other. Third, affordances propose a relational approach to studying park characteristics and the park use they bring out in seniors. Therefore, it allows researchers to collect action-based knowledge for design professionals, which could add to currently often used visual perception methods (see, e.g., Hofmann, Westermann, Kowarik, & Van der Meer., 2012; Nordh & Østby, 2013). A visual perception method typically asks respondents to rate, sort or describe static images reduces the experiences of green space users to the passive contemplation of a visual stimulus in a context that is far removed from the actual behavior in, and use of green space (Unt & Bell, 2014). Since affordance is an action-based perspective, it may promote urban green space designers to rethink green spaces as places of action instead of static visual pictures.

### ***6.1.2 The importance of parks for older adults***

Increasing evidence suggests that parks play an important role in promoting physical activity among seniors. A study in Chicago showed that seniors (55 years and over) tended to be physically active park users, who value the experience of both non-challenging activities such as walking and vigorous exercises such as running and cycling (Tinsley, Tinsley, & Croskeys, 2002). In a survey among 1515 seniors (50 years and over) in Cleveland, over 69% of seniors indicated they had moderate or high levels of physical activity with an average visiting time of two hours in local parks (Payne, Orsega-Smith, Roy, & Godbey, 2005). These physical activity outcomes may be related to the environmental characteristics of parks. A recent study revealed that the presence of certain park characteristics, such as outdoor gym facilities, significantly increased seniors' moderate to vigorous physical activities (Cranney et al., 2016).

Seniors' park experience may also result in psychological and social benefits. Godbey and Blazey (1983) explored the usage of seniors (55 years and over) in five urban parks in the USA, which showed around half of the seniors reported a better mood after their visits. Compared with non-park users, park users tend to report better mental-health scores among seniors (Payne et al., 2005), and highly stressed seniors park users would likely stay longer than less stressed park users (Orsega-Smith, Mowen, Payne, & Godbey, 2004). Furthermore, a park may provide opportunities for people to meet other people. For example, a case study in the Netherlands indicates that high-quality green spaces in the living environment support social contacts for seniors who have a smaller social network (Kemperman & Timmermans, 2014).

### ***6.1.3 The present research***

In the present study, we aim to expand the knowledge on how an urban park could be designed and managed to meet seniors' needs in their park use. This study explored the affordances of an urban park for seniors in Xi'an, China. As affordances emerge from users' interactions with a physical and social environment, we adopted a case study strategy, with multiple methods of data collection that allowed us to study park affordances in a real-life context (Yin, 2003). We first conducted on-site interviews with senior park visitors who described their daily experience, behaviors, and perceived park qualities. We then made systematic observations of senior park visitors using a behavior mapping technique to verify and enrich the interview data.

## **6.2 Methods**

### ***6.2.1 Study Location***

Data were collected in Xingqinggong Park, located in Xi'an, a city with more than 5 million inhabitants in Shaanxi province in China. In this study, we referred seniors to be people who are 55 years and over. The promotion of healthy aging is a focus of the local municipality, and interventions to promote a higher level of physical activity are needed especially for seniors (Sun et al., 2015).

Xingqinggong Park was originally built in 1958 on the site of the ruins of an imperial palace of the Tang Dynasty (Figure 6.1). The park covers an area of 52ha with 10ha of water surface. It includes both natural elements such as trees, bushes, and flowerbeds, and artificial elements such as squares, pavilions, and benches. The park has a rectangular shape of approximately 800m by 700m, with four main entrances, one on each side of the park. In 2006, it became a publicly accessible park. Its popularity among senior visitors makes Xingqinggong Park a suitable location for the present research.



**Figure 6.1**

Aerial image of Xingqinggong Park, in Xi'an City, China, with the locations of three observational mapping places.

### **6.2.2 Interviews**

Interviews were conducted in July 2014. A total number of 22 older visitors were interviewed (11 females and 11 males) from 55 to 82 years old. Older participants were recruited while they were resting in the park, or engaged in individual or group activities. Ten of them indicated that they visited the park every day; ten visited the park several times per week or per month; two had only visited the park a few times. The interviews were conducted at working days and weekends, at different times of the day. Initially, many potential participants were unwilling to cooperate in the research, when they were directly approached by the researcher. Later, the researcher used a more effective indirect approach by first joining in the activities of the older adults, for instance, dancing, playing badminton, and practicing Tai Chi. After initial, more casual conversation, an in-



depth interview request was proposed and the use of the data was explained. Notes and recordings were made during the interviews. A semi-structured interview strategy was used, with questions revolving around three key topics, including: 1) daily park-use patterns (e.g., visiting frequency, visiting durations, travel time); 2) physical and social park use (e.g., physical activities, social interactions, and other valuable use); 3) park characteristics that support or limit park use. Most of the interviews lasted between 15 to 45 minutes.

### **6.2.3 Behavior mapping**

After the interviews were held and analyzed, we found seniors may be lack capabilities in associating park characteristics to park affordances, particularly in spatial arrangements of park characteristics. Therefore, behavior mapping was carried out to study the spatial relationship between park characteristics and park-use behavior. Three places in the park, around 2000 to 3000 m<sup>2</sup>, were chosen for observing (Figure 6.2): the east part of the south gate square (P1), the exercise forest (P2), and the Changqing Pavilion (P3). These three places represent three types of park spaces: open space, half-open space, and enclosed space. P1 is an open space with three connected paved squares and a corridor with green cover (Figure 6.2); P2 is a half-open space covered with large trees with some exercise facilities (badminton court) and paved exercise places (Figure 6.2); and P3 is a small enclosed hill with bamboo cover and a pavilion on its top (Figure 6.2).

The approach of behavior mapping was modified from Goličnik and Ward Thompson (2010) and Unt and Bell (2014). The data were collected in October 2015 on three sunny days and one rainy day, including two working days and two weekend days, and only targeted seniors. On each day, there were six rounds of observation: 6-8 am; 8-10 am; 10 am-12 noon; 12-2 pm; 2-4 pm, 4-6 pm. Eventually, 24 rounds of observation were conducted for each site. The temperature on the observation days was around 11-13°C in the early morning, rising quickly to 21-22°C in the middle of the day on the sunny days, and 14°C on the rainy day, which is suitable for outdoor activities.

Each round of observations included a systematic walk through the observation site within ten minutes, taking a visual scan of the site, which were recorded as point data on the maps of the site. When the entire site was unable to be observed at once, different observation points were used to reduce the bias caused by the order of observation. The data were collected passively, avoiding any interaction

with users. Seniors were identified by a combination of their appearance and motor ability such as obvious facial wrinkles, humpback, white hair, and limitations in movements.



**Figure 6.2.**

Impressions of the three behavior mapping places: The eastern part of Nanmen Square (P1, upper left); The exercise forest (P2, upper right); The Changqing pavilion (P3, bottom). (Photos by the first author).

#### **6.2.4 Data analysis**

A content analysis approach was applied to the interview data to derive categories of both the environmental features that are perceived as significant by seniors and affordances of the environmental characteristics responding to their needs. Then, combined with behavior mapping data, we developed a functional taxonomy of the seniors' park environment. For the behavior mapping data, digital maps were created that summarize the fieldwork data using AutoCAD. Following Goličnik and Ward Thompson (2010) the blocks of park observation data were analyzed both separately in order to discuss daily visits and as daily composites for overall spatial pattern analysis.

## 6.3 Results

### 6.3.1 Interview outcomes

In the interviews, seniors were asked about environmental characteristics that appeared to positively or negatively contribute to the park's qualities based on their experience using them. Five main categories of characteristics were identified (design elements, people, physical accessibility, facilities and maintenance, and atmosphere). Within each category, up to five distinct positive and negative characteristic groups were identified. As shown in Table 6.1, "design elements", in which "trees" is the most frequently mentioned characteristics, followed by "other natural elements" "lake", "soft soil", and "paved ground". The appearance of "other people and their activities" and of "group participants" was the second most frequently mentioned category of positive characteristics, especially by active users who participated in group activities. The interviewees also expressed appreciation of the "physical accessibility" of Xingqinggong Park in terms of size, proximity, and location. Park "facilities and maintenance" were also frequently mentioned by interviewees as important park qualities, including "benches", "toilets", "exercise facilities", "park maintenance", and "shops". Finally, seniors also acknowledged quiet and coolness as important features that contributed to the "atmosphere" of the park.

**Table 6.1**

Environmental characteristics favored by senior park users and their frequencies.

| Environmental characteristics | Example citation from the interviews   | Frequency  |
|-------------------------------|--|------------|
| <b>1. Design elements</b>     |  | 14 (63.6%) |
| Trees                         | "There are so many trees here. It provides relief from the hot weather, and I prefer to walk under the shade of the trees." (Interviewee 11)   | 5 (22.7%)  |
| Other natural elements        | "There are a lot of flowers in blossom in April. I remember the blossoming of peonies and tulips. I have some pictures in my cellphone... This year the peony blossom was not as good as last year due to the rain. You see (pointing to the picture in her cellphone) this is the | 3 (13.6%)  |

---

|                                   |  |            |
|-----------------------------------|--|------------|
|                                   | chrysanthemum blossoming in September. There are some pomegranate trees.” (Interviewee 18)   |            |
| Lake                              | “Here (under the flower trellis) is a reliable place for me to practice calligraphy... and I can walk a little farther to get some water for calligraphy writing from the lake. I can also have a rest over there, and drink some water or smoke.” (Interviewee 4) | 3 (13.6%)  |
| Soft soil                         | “Here my feet can feel the ground, which is considered very important for Tai Chi, because when you stand on the ground, your Qi is connected to the Qi of the earth.” (Interviewee 16)  | 2 (9.1%)   |
| Paved ground                      | “There are a lot of places in the park where I can practice calligraphy on the paved ground, using water from the lake.” (Interviewee 4)   | 1 (4.5%)   |
| <b>2. People</b>                  |  | 12 (54.5%) |
| Other people and their activities | “The environment of Xingqinggong Park is pretty good. And it is very suitable for praying. So many people are here. Now I choose here for praying instead of communities. The park is a good place to socialize with other people.” (Interviewee 19)               | 6 (27.3%)  |
| Group Participants                | “We have a small circle here. People who join this group are interested in reading, calligraphy, and painting.” (Interviewee 4)  | 6 (27.3%)  |
| <b>3. Physical accessibility</b>  |  | 10 (45.5%) |
| Size                              | “How about Changle Park? That one is much closer to your home (interviewer) “... True, it is very close, but there’s nothing there; why should I visit it... It is too small compared with Xingqing Park.” (Interviewee 6)   | 5 (22.7%)  |
| Proximity                         | “(Compared with other parks) I like here the most, because it is close to where I live and it has more visitors.” (Interviewee 8)  | 4 (18.2%)  |
| Location                          | “It is one of the biggest parks in Xi’an. It is located almost at the center of the city. In the city center, no park is bigger than this one.” (Interviewee 15)   | 1 (4.5%)   |

---

|                                      |  |            |
|--------------------------------------|--|------------|
| <b>4. Facilities and maintenance</b> |  | 10 (45.5%) |
| Benches                              | “I usually do my activities in the places between East Gate and North Gate. There are some benches. When I finish doing my aerobic exercise, I can have a rest on the benches.” (Interviewee 12) | 3 (13.6%)  |
| Toilets                              | “It is very convenient. There are a lot of toilets inside the park.” (Interviewee 11)  | 2 (9.1%)   |
| Exercise facilities                  | “I suggest there should be more activity venues for older users such as more exercise facilities over there (in the north part of the park).” (Interviewee 2)                                    | 2 (9.1%)   |
| Park maintenance                     | “Compared with the park I have been to in Wuhan, this park is very well maintained.” (Interviewee 15)  | 2 (9.1%)   |
| Shops                                | “Um, if you want to have a drink, you can go to that small shop to buy something” (Interviewee 13)   | 1 (4.5%)   |
| <b>5. Atmosphere</b>                 |  | 4 (18.2%)  |
| Quiet environment                    | “My favorite place is in the west part of the park. It’s very quiet. The more quiet a place is, the more I like it.” (Interviewee 3)   | 2 (9.1%)   |
| Cool environment                     | “How do you like the park?” (Question from interviewer). “Of course I like it very much; I like the coolness here and the presence of all kinds of people.” (Interviewee 7).                     | 2 (9.1%)   |

Most of the dimensions that positively contributed to perceived park quality also contained characteristics that seniors disliked in their visiting experience. As shown in Table 6.2, both “facilities and maintenance” and “atmosphere” were the most mentioned categories of negative characteristics. Lack of “benches” “exercise facilities” and “pavilions” in terms of quantity and quality were frequently mentioned in the category of “facilities and maintenance”. Disturbing weather conditions such as “hot weather”, “raining”, and “darkness” were most frequently reported as features that contributed negatively to the atmosphere in the park. Other “people” might also lead to negative experiences, including “conflicts in (group) use”, “too crowded”, and “smoking”. Within the category of design features, only “view restriction” was mentioned in a negative sense.

Natural features were not mentioned in a negative sense. Physical accessibility was also not spontaneously mentioned by the interviewees in a negative sense, indicating that the size, location and proximity of the park were perceived as adequate.

**Table 6.2**

Environmental characteristics disliked by senior park users and their frequencies.

| Environmental feature                               | Example citations from the interviews  | Frequency |
|---|--|-----------|
| <b>1. Facilities and maintenance</b>                |  | 7 (31.8%) |
| Lack of quantity and diversity in styles of benches | “Um, there are not enough, especially weekends when more people visit the park. The style of benches is not good, and they are all the same (style). It does not fit with the surrounding environment.” (Interviewee 3)  | 3 (13.6%) |
| Not enough exercise facilities                      | “Yes, more people choose to play here. I can find courts for badminton over there. But they are usually occupied by people who come earlier. We are still lacking in public facilities for activities.” (Interviewee 10)   | 2 (9.1%)  |
| Lack of pavilions and other places of shelter       | “There aren’t many (pavilions). So, on rainy days, I can’t visit the park. There is almost no place to get out of the rain. I can choose to stand under the trees, but this is not safe. When the rain is too heavy, the trees also don’t work.” (Interviewee 3) | 2 (9.1%)  |
| <b>2. Atmosphere</b>                                |  | 7 (31.8%) |
| Hot weather   | “Well, I only can practice this (ground calligraphy-writing) for two hours and no more. Otherwise, I get very tired, especially when the weather gets hotter.” (Interviewee 4).  | 4 (18.2%) |
| Raining   | “No reason to come here on rainy days.” (Interviewee 6)  | 2 (9.1%)  |
| Darkness at night                                   | “I don’t come here in the evening. It is too dark here.” (Interviewee 10)  | 1 (4.5%)  |
| <b>3. People</b>                                    |  | 4 (18.2%) |

|                           |  |           |
|---------------------------|--|-----------|
| Conflicts in (group) use  | “I bring a music player with me. When a group of elderly people are dancing here, I go some places else. When I focus on my own music, I don’t want to hear other music; if I do, I get upset.” (Interviewee 2)                          | 2 (9.1%)  |
| Too crowded               | “...Um, it is true that Huancheng Park is more convenient to get to for me, but there are too many people visiting that park. It’s not easy for elderly people to find a place for practice and entertainment.” (Interviewee 5)          | 1 (4.5%)  |
| Smoking                   | “I dislike people smoking here. Imagine, when you are doing sports here, someone comes and starts to smoke. Your objective is to do aerobic exercise, and not breathe in second-hand smoke.” (Interviewee 2)                             | 1 (4.5%)  |
| <b>4. Design elements</b> |  | 2 (18.2%) |
| View restriction          | “In a rural landscape, you have a broader horizon. But inside the park, your horizon is very limited; walls are all around you. It feels like I’m an animal in a cage. How free am I, if I go outside to enjoy nature?” (Interviewee 17) | 2 (18.2%) |

### 6.3.2 Behavior mapping

Composite maps of the behaviors in the three observation sites are presented in Figures 6.3-6.5. Based on these maps, three types of spaces were identified: moving spaces, ornamental spaces, and gathering spaces. Moving spaces mainly consist of roads and pathways. They afford the most common activity: walking. Ornamental spaces are characterized by a combination of green elements such as trees, bushes, flowers, and grass. Although large sections of the ornamental spaces are not accessible due to fences and bushes, the presence of these natural elements makes ornamental spaces an optimal place for activities such as Tai Chi and Kong Fu practice. For example, as shown in Figure 6.5, the northeast corner of P3, surrounded by trees and bamboo, provides a quiet natural environment for Tai Chi and Kong Fu practice. Gathering places are mostly comprised of open spaces, which provide opportunities for physical activities and social interactions. Most physical activities are practiced here. In Figure 6.3, paved opens spaces afford Xingjiang dancing, Latin dancing, and aerobics practices. Exercise facilities in Figure 6.4 afford physical activities such as light-intensity exercise,

badminton, and gymnastics. In addition to active use, passive use such as sitting, standing, and talking are also mostly found in gathering spaces.

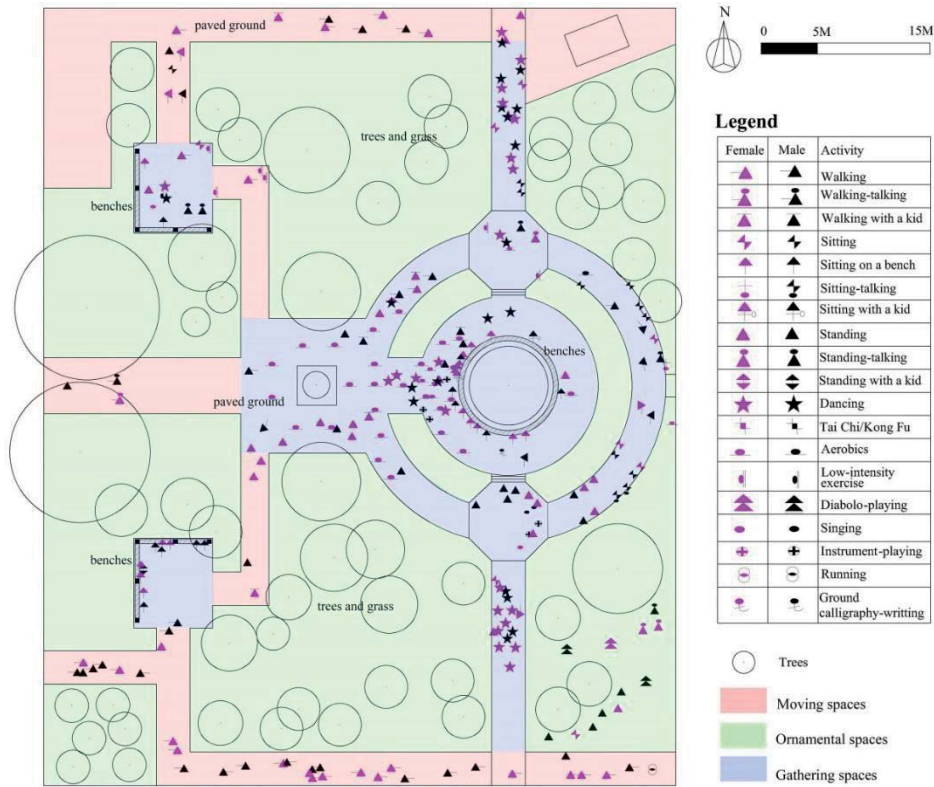
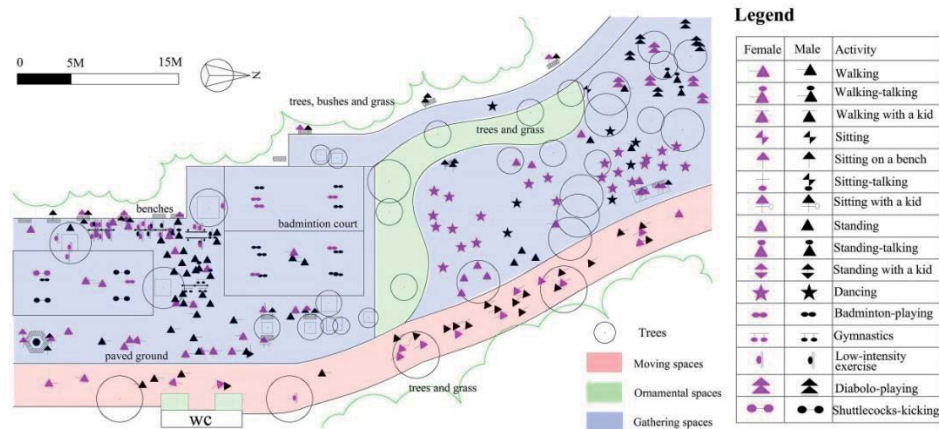


Figure 6.3

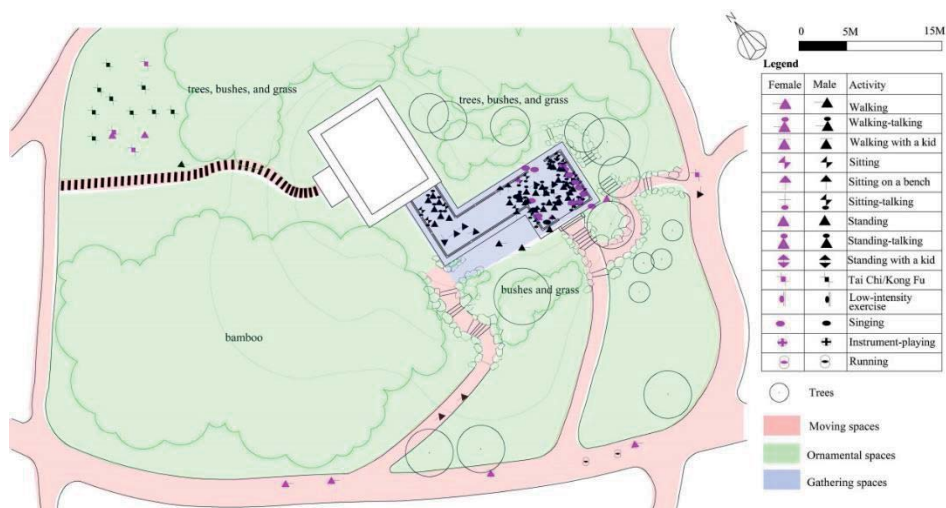
A composite map of observation Place 1.





**Figure 6.4**

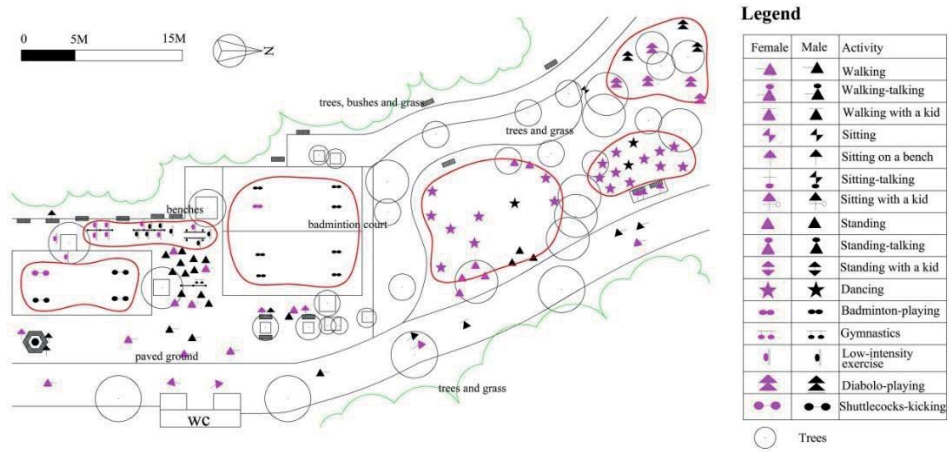
A composite map of observation Place 2.



**Figure 6.5**

A composite map of observation Place 3.

Within gathering spaces, the mapping results show a spatial pattern that can be described as “connected spaces with buffer areas”. Older group users try to keep a distance from both the spatial boundaries and other group users. As shown in Figure 6.6, group activity participants stay at least two meters away from physical boundaries. In addition, different types of buffer areas can be identified among groups. In Figure 6.6, the shuttlecock-kicking group stays around 6 meters from the badminton group, with an ornamental space functioning as a buffer between the badminton group and the east-dancing group. Trees become a potential natural buffer among two dancing groups and a diabolo-playing group. Later, when more people were participating in the group activities, participants used a rope tied between trees to mark the buffer between the two dancing groups and the diabolo-playing group (Figure 6.7).



**Figure 6.6**

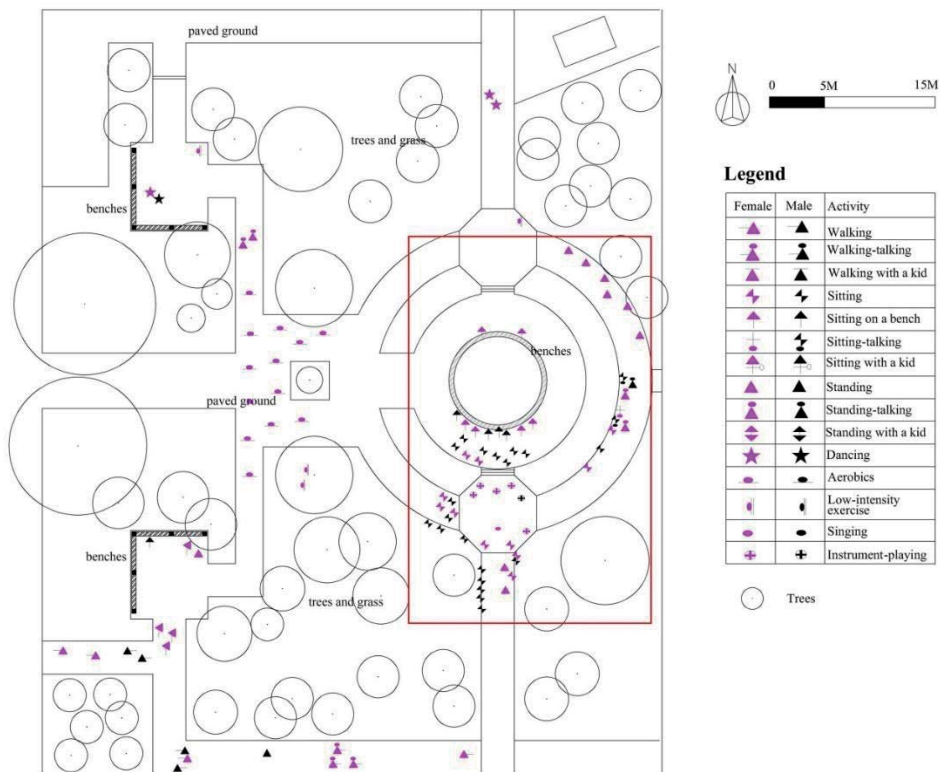
Users of P2 on Monday, October 12, 2015, 9:30 am. It is a sunny morning with a slight breeze.



**Figure 6.7**

Ropes tied between trees to strengthen the buffer area among group activities (photo by the first author).

Seniors' passive park use, such as standing, sitting, and watching, also indicated the pattern of an "edge effect" indicating that edges of woods, clearings and other public spaces are preferred as gathering places, since they provide a combination of privacy and visibility (De Jonge, 1967; Gehl, 2011). Two types of edge effects were identified. As shown in Figure 6.8, the physical boundaries of the green corridor to the east of the red rectangle are dominated by sitting and standing behaviors. The physical edges may provide seniors with psychological comfort, since their backs are shielded. Another type of "edge effect" happens with active park use. In the red rectangle in Fig. 8, a singing group attracts seniors to stand and sit around it.

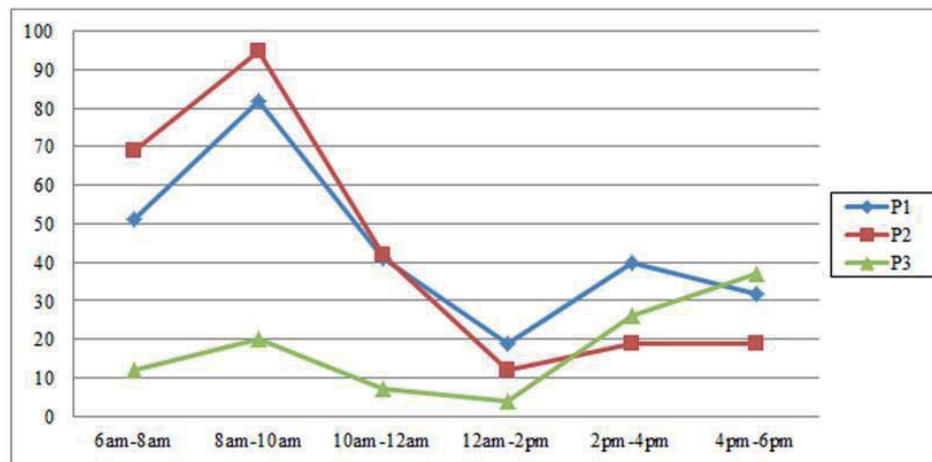


**Figure 6.8**

Users of P1 on Sunday, October 11, 2015, 9:00 am. It is a sunny morning with a slight breeze.

### 6.3.3 Daily-use patterns

Figure 6.9 provides a summary of the daily-use patterns of seniors at the three observation places. It is based on the average number of senior participants in each observation block on the three sunny observation days. In observation places P1 and P2, the number of visitors was highest in the morning, with a peak value in the period from 8-10am. The number of visitors in P1 and P2 was lowest around lunchtime, when, as they indicated in the interviews, many senior visitors went home to lunch and rest, and slightly increased again after 2 pm. The number of visitors in P3 tended to be lower than in P2 and P3, especially in the morning. This may be explained by the lack of gathering spaces for activities. The highest numbers of visitors were observed in the late afternoon after 4 pm, because the pavilion in P3 afforded the social interaction of a group of older men. Compared with sunny days, the numbers of senior participants in P1 and P2 were greatly reduced on rainy days. However, at P3, there were little changes on rainy days because of the pavilion, which provides protection from unpleasant weather conditions.



**Figure 6.9**

Average number of senior participants at observation places P1, P2, and P3 on three sunny days, based on six observation blocks.

### 6.3.4 Affordances

Five main categories of affordances were identified: individual physical activity, group physical activity, protection against unpleasant weather conditions, social interaction, and sitting and resting (Table 6.3).

**Table 6.3**

Overview of park affordances for seniors with supporting and non-supporting environmental features.

| Main Category                   | Affordances                        | Supported environmental characteristics                                   | Unpleasant environmental characteristics    |
|---------------------------------|------------------------------------|---|---|
| 1. Individual physical activity | Walking/Running                    | “Paved ground,” “trees,” “size of park”                                   | “Raining,” “hot weather”                    |
|                                 | Aerobics                           | “Trees”   | “Smoking”                                   |
|                                 | Sketching                          | “Other people and their activities,” “trees,” “other natural elements”    |   |
|                                 | Low-intensity exercise /gymnastics | “Exercise facilities,” “trees”  | “Not enough exercise facilities,” “Raining” |
|                                 | Ground calligraphy-writing         | “Lake,” “paved ground,” “proximity”                                       | “Hot weather”                               |
| 2. Group physical activity      | Tai Chi/Kong Fu                    | “Soft soil,” “trees,” “quiet environment,”                                | “Too crowded”                               |
|                                 | Singing                            | “Group participants,” “connected spaces with buffer area”                 | “Conflicts in (group) use”                  |
|                                 | Dancing/Aerobics                   | “Group participants,” “paved-ground,” “connected spaces with buffer area” |   |

|  |   |   |  |
|--|---|---|--|
|  | Badminton-playing/<br>shuttlecocks-kicking/Diablo-playing | “Group participants,”<br>“exercise facilities,”<br>“connected spaces with<br>buffer area” | “Not enough exercise<br>facilities,” “raining,”<br>“hot weather”             |
| <b>3. Protection against unpleasant weather conditions</b> | Protection against unpleasant weather conditions          | “Trees,” “cool environment”   | “Lack of pavilions and other places of shelter,”<br>“raining,” “hot weather” |
| <b>4. Social interaction</b>                               | Direct social interaction                                 | “Group participants,”<br>“benches,”   | “Conflicts in (group) use,” “lack of pavilions and other places of shelter”  |
|  | Passive watching  | “Other people and their activities,” “benches,”<br>“edge effects”                         | “Darkness at night”  |
| <b>5. Sitting and Resting</b>                              | Sitting and Resting                                       | “Benches,” “trees,” “edge effects”  | “Lack of quantity and diversity in styles of benches”                        |
|  | Restoration   | “Quiet environment,”<br>“benches,” “trees,” “other natural elements”                      | “Too crowded,” “view restriction”  |

### *Individual physical activity*

Various types of individual physical activities occur in Xingqingong Park, such as walking, aerobics, sketching, low-intensity exercise, and ground calligraphy-writing (see Figure 10). Individual activities are favored by senior interviewees, since these are flexible and easy to practice. For example, a 78-year-old female participant mentioned her aerobic practice: “...*When there are dancing groups or other people here, I will go to other places. For me, it is all fine. I just practice aerobics myself and have fun. I can do it whenever I want. I don’t like to join them (group activities), (because) they have time limitations... I bring a music player with me to practice the aerobics anywhere I want.*”

Individual physical activities are sensitive to the presence of required environmental features. For example, places with trees and tree shade are the best option for aerobics and walking activities, because these protect participants against the hot weather in summer time. Disturbances of individual physical activity derive mainly from features such as hot weather, not enough exercise facilities, and smoking behavior.



**Figure 6.10**

Examples of individual activities: Aerobic practice (left) and ground calligraphy-writing (right). (Photos by the first author).

#### *Group physical activity*

Diverse group activities of seniors can be observed in Xingqinggong Park, such as dancing, singing, Tai Chi, and badminton-playing (see Figure 6.11). With respect to the environmental features required for these activities, a distinction can be made between small and big group activities.

Small group activities that involve only a couple of participants require relatively little environmental support in terms of space and facilities. Participants may easily compromise with the lack of space and facilities. When a 55-year-old badminton player found the only badminton court had been already occupied by other players, he and his partner chose to play badminton at a nearby paved-ground area, saying “*There are public badminton courts over there, but they are already being used by people who came earlier. This (badminton court) is a public facility, and there are not enough of them.*” When the environment does not support their activities, people tend to search for alternative options, such as playing badminton on the square without net and court.

Big group activities involving more participants usually need a consistently available place in the park to perform their group activities. It is important for

the group to find a place that can fit their activities. For example, soft soil, trees, and a quiet environment are appreciated for Tai Chi activities as indicated by an over 55-year-old participant. Besides the physical features, most group participants state that the other “group participants” are important to them. As a 65-year-old singer indicated *“I have invitations from several singing groups, since the instrument players prefer playing with me. I can give my song collection book to them, and they can choose and practice any song from the book.”* For aerobic and dancing groups, some group members may provide music for other group members. As mentioned by two older dancers, *“When I first came here, I joined in with them. Now I have become used to this group; I don’t want to change to another group.”*

When the environmental features cannot meet the needs of bigger groups, this may lead to tension among the various groups. An interviewee indicated that *“...there used to be another singing group over there (and singing group opposite the present group); the two of them interfered with each other. Then tension between the two emerged, which resulted in conflict and confrontation. Finally, one of the groups left for another park.”*



**Figure 6.11**

Examples of group activities: Dancing practice (left) and Tai Chi practice (right). (Photos by the first author).

#### *Protection against unpleasant weather conditions*

During the heat of summer, there is an obvious moving trend from sunny squares in the morning to tree shade and other sun-shielding buildings later in the day. Particular environmental features are highly favored by elderly users for resisting unpleasant weather: trees and a cool environment. The shade of big trees may provide users with immediate protection from sunburn, creating a quiet and cool



natural environment. Trees may also support activity areas on rainy days. An over 70-year-old woman indicated that, *“When it is raining a bit, I’ll do low-intensity activity under the trees. But when the rain is heavy, I won’t come.”*

Besides trees, the pavilions and other buildings may function as a shelter for users on both sunny and rainy days. For hot days in summer, these types of facilities can provide good opportunities for rest. For rainy days, they enable some group activities to still be performed. As shown in Figure 6.12, a medium-size singing group was still in the park on a rainy day. The instrument player indicated that, *“When it starts to rain, we move into the pavilion to protect our instruments from the rain. However, it’s a shame that there’s only one pavilion nearby.”*

#### *Social interaction*

Direct social interactions among seniors usually occur during their participation behaviors. For example, greetings and short chats are quite often seen with the group-activity participants. More intimate relationships such as friendship may develop due to the same interests and steady contacts. A *“small circle”* is developed by seniors to refer to the intimate relationship among group participants, for example, *“we have a small circle, a group of friends who also like calligraphy, reading, and drawing,”* indicated a 60-year-old man. Places with sitting and resting opportunities, such as benches, may stimulate social interactions during activity breaks.

Apart from the direct social interactions, indirect social interactions, like passive watching, are also valuable for seniors (see Fig. 12). A more than 70-year-old lady described her experience as follows: *“I don’t talk with other people; I just walk around the park alone. Well, actually, when I watch other people and their activities in the park, I also get a feeling of interaction.”* In turn, the participants in the activity were also glad to be watched. When an elderly man drew a picture of a dancer, the dancer was very pleased, and even asked for a copy of the picture.



**Figure 6.12**

Examples of protection against unpleasant weather conditions and social interactions: A singing group on a rainy day (left) and indirect interaction (right). (Photos by the first author).

#### *Sitting and resting*

Most interviewees indicated they will sit or rest in the park as a break from activities, for example: “Usually I have a walk around the lake and then have a rest” (an over 70-year-old woman), and “I will take a rest during exercise; too much strenuous exercise is also not good for elderly people” (an over 70-year-old woman). The sitting opportunities provided by benches, the pavilion, and other environmental characteristics invite seniors to sit and rest. However, when these opportunities are not available, seniors may either choose not to stay or to figure out alternatives, such as carrying a small “folding chair” with them to the park by a 82-year-old man. The design and quality of benches are also of concern to seniors. In general, participants indicate that benches should be comfortable so they can sit for an extended period of time and should also facilitate getting up. It is also important that the seating location is attractive and inviting. Figure 6.13 shows that the combination of large tree-shade and back-shielding locations constitute popular sitting places for older people, and the performance of group activities in the center is attractive for people to sit and watch.



**Figure 6.13**

Examples of sitting and resting: A sitting place with trees and edges (left) and a sitting place with a broad view (right). (Photos by the first author).

#### **6.4 Discussion**

This study explored the interconnections between park affordances for seniors and park environmental characteristics. On-site interviews in an urban park in Xi'an, China revealed five categories of park characteristics that may contribute positively or negatively to seniors' park affordances, including design elements, people, physical accessibility, facilities and maintenance, and atmosphere. In particular, we found that seniors focus on how the park's environmental characteristics may enable their activities and behaviors, which, in turn, impacts on their perception of the environmental characteristics. This is in line previous findings showing that what people can *do* in outdoor environment settings is more important to them than the environment itself, with its attributes and elements (Hadavi, Kaplan, & Hunter, 2015).

Three behavior usage spaces were identified through behavioral mapping: moving spaces, ornamental spaces, and gathering spaces. Within these spaces, buffer areas such as a certain distance, a line of trees, and a piece of ornamental space were found to play an important role to separate groups, which is consistent with findings from the UK, (Goličnik & Ward Thompson, 2010). The buffer areas not only segregate the group spaces but also allow different groups to easily see each other. This provides opportunities for seeing, hearing, and socially interacting, corresponding with Gehl's (2011) self-reinforcing process of "something happens because something happens". Another spatial-use pattern is "edge effects" that have been demonstrated by previous studies in urban green spaces (e.g., Goličnik & Ward Thompson, 2010; Unt & Bell, 2014). In our observations, sitting or standing at the edges of squares and roads was frequently

seen. The behavior of attachment to “edges” is generally seen as a way for older people to feel psychological comfort, because their backs are shielded and a better vantage point for watching can come about.

Five main categories of park affordances were identified: individual physical activity, group physical activity, protection against unpleasant weather conditions, social interaction, and sitting and resting. In particular, our study shows that group activity seems more popular among seniors in the Chinese context than in the western context, which is probably related to a more collectivist culture. Group activities promote the direct social interactions that may help senior participants develop intimate friendships among participants, known as a “*small circle*.” Passive observers are easily attracted by active park-use behaviors, and active participants may gain a sense of gratification by being watched. This reciprocal attraction between active and passive senior participants is in line with the idea of affordance theory, which states that “behavior affords behavior” (Gibson, 1979). The results resonate the argument made by Richaud (2016) that “fun-based friendships in Chinese urban parks remain significant sources of support and well-being for these aging city dwellers.

Clark and Uzzell (2002) suggested that people should be considered as mediators instead of as “objects” in the perceptual process, which means the affordances vary with the presence or absence of other people in an environment. In our findings, the social affordances of an urban park may change when other people are present in the park. For example, when there are active users in the gathering spaces, a bench at the edge of the space may afford indirect social interaction for passive observers. Therefore, our research confirms that park affordances for social interactions alter vis-à-vis the presence or absence of other seniors.

#### ***6.4.1 Strengths and limitations***

The main value of this study lies in the fact that seniors were allowed to provide narratives, in their own words, of factors that hinder or enable their experience of an urban park, and the combination of these narratives with behavioral mapping data. Nevertheless, there are limitations to this study. The first limitation is that our data did not include the interactions between seniors and other park users. It is possible that the seniors’ park-use behaviors are partly impacted by the presence or behaviors of other age groups. Therefore, it will be interesting to investigate park affordances, when including all age groups.

Second, although interviews and behavior mapping were carefully conducted in the urban green spaces of Xingqinggong Park, the context-sensitivity in terms of climate, private living conditions, and other sociodemographic contexts influence the generalization of the results. Finally, the current study only focused on seniors who actually visited the urban park; this excludes any information about seniors who do *not* visit urban green spaces. Since the benefits of green space visits for well-being have been well documented, future studies might involve how to promote the visiting of urban parks on the part of seniors and thereby maintain healthy aging.

#### **6.4.2 Practical implications**

Based on the current findings, we propose some action-based knowledge for design professionals to create attractive park environments for seniors. First, an attractive park environment for seniors should be a place with sub-spaces catering to distinct functions that satisfy their needs and support their behavior. Primarily, according to the local context, a senior's park should contain the environmental features that support the possible activities and behaviors, such as big trees for enjoying shade in the heat of summer, benches for sitting, and courts for badminton playing. It may be practical to start out by arranging for environmental elements that potentially support several affordances (e.g., paved ground supporting walking, dancing, and aerobics). This will increase the use opportunities of a certain sub-space.

Furthermore, the combination of the three types of spaces – moving space, ornamental space, and gathering space – should be carefully considered. Gathering spaces are connected by moving spaces and embedded in ornamental spaces. Ornamental spaces with trees, bushes, flowers, or grass help to create a mold for quiet and restorative environments. However, a high percentage of inaccessible ornamental spaces will lead to shrinking spaces for gathering spaces.

Third, in the spatial configuration of gathering spaces, “connected spaces with buffers” may be involved as a strategy to facilitate and stimulate a maximum amount of group-use behavior. Green elements such a line of trees, bushes, or a patch of grass, may act as “soft” buffers that may not only divide large gathering spaces into small connected spaces but also offer the opportunity to “see and to be seen” for group users. In addition, sitting opportunities in a gathering space should be amply provided for so that active seniors may rest in the space, and passive observers may easily combine resting and observing together. Ideal

places for sitting are at the edges of gathering spaces that allow their backs to be shielded and also provide a wide perspective for watching. Finally, the service facilities such as toilets and teahouse should not be too far from the gathering space.

## 6.5 Conclusions

We recommend that policy-makers, concerned with the quality of life in cities, promote the amount of green space available while at the same time stressing the application of good design principles. The latter will allow green spaces to accommodate a maximum number of people and preferences by including different sub-spaces, and favor the designation of use spaces over moving spaces and ornamental spaces, making the best use of limited urban space and financial resources. In the Chinese context, with the increase in “empty-nest” seniors who do not live in families, the traditional role of the family in taking care of seniors has been weakened (Liu et al., 2015). Due to the shrinking network of seniors, it may become harder for seniors to find social support from their previous social network. This study shows that the lack of available social support from local communities (Liu et al., 2015) may be partially compensated for by park affordances of social interactions.

## References

- Baran, P. K., Smith, W. R., Moore, R. C., Floyd, M. F., Bocarro, J. N., Cosco, N. G., & Danninger, T. M. (2014). Park use among youth and adults: examination of individual, social, and urban form factors. *Environment and Behavior*, 46(6), 768-800.
- Clark, C., & Uzzell, D. L. (2002). The affordances of the home, neighbourhood, school and town centre for adolescents. *Journal of Environmental Psychology*, 22(1), 95-108.
- Cranney, L., Phongsavan, P., Kariuki, M., Stride, V., Scott, A., Hua, M., & Bauman, A. (2016). Impact of an outdoor gym on park users' physical activity: A natural experiment. *Health & Place*, 37, 26-34.
- De Jonge, D. (1967). Applied hodology. *Landscape*, 17(2), 10-11.
- Gehl, J. (2011). *Life between buildings: Using public space* Island Press.

- Gibson, J. J. (1977). The theory of affordances. In R. E. Shaw, & J. Bransford (Eds.), *Perceiving, acting, and knowing: Toward an ecological psychology* (pp. 67-82). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston, MA: Houghton Mifflin.
- Giles-Corti, B., Broomhall, M. H., Knuiiman, M., Collins, C., Douglas, K., Ng, K., ... & Donovan, R. J. (2005). Increasing walking: how important is distance to, attractiveness, and size of public open space?. *American journal of preventive medicine*, 28(2), 169-176.
- Godbey, G., & Blazey, M. (1983). Old people in urban parks: An exploratory investigation. *Journal of Leisure Research*, 15(3), 229.
- Goličnik, B., & Thompson, C. W. (2010). Emerging relationships between design and use of urban park spaces. *Landscape and Urban Planning*, 94(1), 38-53.
- Hadavi, S., Kaplan, R., & Hunter, M. C. R. (2015). Environmental affordances: A practical approach for design of nearby outdoor settings in urban residential areas. *Landscape and Urban Planning*, 134, 19-32.
- Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and health. *Annual Review of Public Health*, 35, 207-228.
- Heft, H. (1988). Affordances of children's environments: A functional approach to environmental description. *Children's Environments Quarterly*, 5(3) 29-37.
- Hofmann, M., Westermann, J. R., Kowarik, I., & van der Meer, E. (2012). Perceptions of parks and urban derelict land by landscape planners and residents. *Urban Forestry & Urban Greening*, 11(3), 303-312.
- Kaczynski, A. T., & Henderson, K. A. (2007). Environmental correlates of physical activity: a review of evidence about parks and recreation. *Leisure Sciences*, 29(4), 315-354.
- Kaczynski, A. T., Potwarka, L. R., & Saelens, B. E. (2008). Association of park size, distance, and features with physical activity in neighborhood parks. *American journal of public health*, 98(8), 1451-1456.
- Kemperman, A., & Timmermans, H. (2014). Green spaces in the direct living environment and social contacts of the aging population. *Landscape and Urban Planning*, 129, 44-54.
- Kuo, M. (2015). How might contact with nature promote human health? promising mechanisms and a possible central pathway. *Frontiers in Psychology*, 6.

- Lapham, S. C., Cohen, D. A., Han, B., Williamson, S., Evenson, K. R., McKenzie, T. L., ... & Ward, P. (2016). How important is perception of safety to park use? A four-city survey. *Urban Studies*, 53(12), 2624-2636.
- Liu, J., Tian, J., Yue, P., Wang, Y., Du, X., & Chen, S. (2015). Living experience and care needs of chinese empty-nest elderly people in urban communities in beijing, china: A qualitative study. *International Journal of Nursing Sciences*, 2(1), 15-22.
- McCormack, G. R., Rock, M., Toohey, A. M., & Hignell, D. (2010). Characteristics of urban parks associated with park use and physical activity: a review of qualitative research. *Health & place*, 16(4), 712-726.
- Nordh, H., Alalouch, C., & Hartig, T. (2011). Assessing restorative components of small urban parks using conjoint methodology. *Urban Forestry & Urban Greening*, 10(2), 95-103.
- Nordh, H., & Østby, K. (2013). Pocket parks for people—A study of park design and use. *Urban Forestry & Urban Greening*, 12(1), 12-17.
- Orsega-Smith, E., Mowen, A. J., Payne, L. L., & Godbey, G. (2004). The interaction of stress and park use on psycho-physiological health in older adults. *Journal of Leisure Research*, 36(2), 232.
- Payne, L., Orsega-Smith, E., Roy, M., & Godbey, G. (2005). Local park use and personal health among older adults: An exploratory study. *Journal of Park and Recreation Administration*, 23(2), 1-20.
- Richaud, L. (2016). Between 'face' and 'faceless' relationships in China's public places: Ludic encounters and activity-oriented friendships among middle-and old-aged urbanites in Beijing public parks. *Urban Studies*.
- Sun, L., Jiang, X., Zhao, X., Zhang, Y., Xu, Y., & Shang, L. (2015). Physical activity level and associated factors among civil servants in Xi'an, china. *Journal of Science and Medicine in Sport*.
- Tinsley, H. E., Tinsley, D. J., & Croskeys, C. E. (2002). Park usage, social milieu, and psychosocial benefits of park use reported by older urban park users from four ethnic groups. *Leisure Sciences*, 24(2), 199-218.
- Townshend, T. G., & Roberts, M. (2013). Affordances, young people, parks and alcohol consumption. *Journal of Urban Design*, 18(4), 494-516.
- Unt, A., & Bell, S. (2014). The impact of small-scale design interventions on the behaviour patterns of the users of an urban wasteland. *Urban Forestry & Urban Greening*, 13(1), 121-135.
- Van den Berg, M., Wendel-Vos, W., van Poppel, M., Kemper, H., van Mechelen, W., & Maas, J. (2015). Health benefits of green spaces in the



- living environment: A systematic review of epidemiological studies. *Urban Forestry & Urban Greening*, 14(4), 806-816.
- Ward Thompson, C., & Aspinall, P. A. (2011). Natural environments and their impact on activity, health, and quality of life. *Applied Psychology: Health and Well - Being*, 3(3), 230-260.
- Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Zeng, Y. (2012). Toward deeper research and better policy for healthy aging—using the unique data of chinese longitudinal healthy longevity survey. *China Economic Journal*, 5(2-3), 131-149.
- Zeng, Y, George, L. K. (2010). Population aging and old-age care in China. In D. Dannefer, & C. Phillipson (Eds.), *The SAGE handbook of Social Gerontology* (pp. 420-429). London: Sage.
- Zhai, Y., & Baran, P. K. (2017). Urban park pathway design characteristics and senior walking behavior. *Urban Forestry & Urban Greening*, 21, 60-73.