

**Preferences of Social Interaction for Environmental Attributes Among  
Grandparents Who Are Taking Care of Grandchildren in Two Chinese  
Residential Communities Located in Shanghai, China**

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in  
partial fulfillment of the requirements for the degree of

Master of Landscape Architecture

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February 17, 2016

Blacksburg, Virginia

Keywords:

Chinese grandparents with grandchildren, residential communities, social interaction,

Shanghai

## **ABSTRACT**

The present thesis examines questionnaire responses regarding optimal environmental attributes of public outdoor spaces for Chinese grandparents who are taking care of their grandchildren within selected urban residential communities in Shanghai, China. This thesis also assesses the needs of these grandparents providing childcare against the environmental attributes of urban public spaces. It uses the results to formulate design recommendations that will facilitate increased social interaction between grandparents with grandchildren and other persons in open public spaces of residential communities. Public spaces are often excellent locations for social interaction between grandparents with other persons within communities. Recently, there has been an increase in the number of Chinese grandparents providing childcare for their grandchildren, and many choose to spend time with grandchildren in these public open spaces. However, the needs and preferences of this demographic do not necessarily align with those of the general population.

The current literature has identified five primary environmental attributes (access, comfort, opportunities of meeting, potential sensory elements, visibility) related to social interaction, each composed of a variety of landscape elements and characteristics. A framework was constructed based on these five environmental attributes and a variety of landscape elements and characteristics, and used to formulate a questionnaire for 46 grandparents, who take care of their grandchildren and live in high-rise buildings were surveyed. The selected participants were witnessed watching over their grandchildren in open spaces or the accompanying facilities and were asked to express a level of preference for a series of landscape elements presented in a questionnaire. The survey also included questions

regarding demographic information. Descriptive and inferential analysis were then carried out through the survey data.

The intended result of the study involved establishing a set of landscape architectural design recommendations that could be used in order to meet the preferences of this portion of society. Ideally, the findings will assist those involved in designing and managing outdoor environments in identifying the most salient environmental attributes for this growing sector of the Chinese community. The study could also help to prioritize interventions aimed at improving the use of open spaces and promoting social interaction among grandparents or grandparents with other neighbors. The approach also identified which landscape elements were most likely to attract grandparents to visit and stay in neighborhoods' open spaces longer with their grandchildren. Ideally, an outdoor public space designed following this set of design recommendations would contain the preferred environmental attributes and landscape elements of grandparents and their grandchildren and would provide more opportunities for social interaction.

## ACKNOWLEDGEMENTS

I would like to acknowledge and thank all of the people who have made my master study at Virginia Tech meaningful and memorable.

I want to express the gratitude to my advisor Professor Mintai Kim, for his great guidance, inspiration and kindness. Without him, I would not come over many hardships and this thesis would not have been possible.

I am thankful to Professor Terry Clements and Brian Katen, for their profound knowledge, support and patience. Without them, I would not expand my perspectives and reach the understanding of this thesis topic.

I also want to thank many professors that encouraged and helped me: Professor Dean R. Bork, Professor Patrick Miller, Professor C.L. Bohannon, Professor Wendy Jacobson and the entire faculty in the Department of Landscape Architecture.

Finally, I want to thank my family, especially my mother, for the endless support and love.

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# **Chapter 1. Introduction**

## **1.1. Problem Statement and Background**

This study aims to examine the environmental attributes and related environmental characteristics that promote social interaction between Chinese grandparents with their grandchildren and other neighbors within communities, based on a survey data obtained from a sample of 46 grandparents responsible for grandchildren in two residential communities of multiple high-rise buildings in Shanghai, China. The study investigates the relative importance of the landscape elements within a variety of outdoor environmental attributes associated with social interaction in open spaces of residential communities.

Additionally, the study assesses the relationship between the relative importance of these landscape elements and selected demographic groups, such as age, gender, and socioeconomic status. The research objective is to formulate design recommendations based on the preferred environmental attributes that would encourage this elderly population to spend time in open spaces within residential communities and, ultimately, have the opportunity to create more social and community ties between grandparents and neighbors. Policymakers of outdoor environments may also benefit from this study as they work to prioritize interventions that may influence grandparents' preferences for visiting and staying in open spaces while watching their grandchildren.

Responding to demographic transformations in China that over the past three decades, this study focuses on an ever more frequent phenomenon in China's modern society - the growing population of grandparents and their grandchildren who use public open spaces

within the community. There are two well-documented factors that have led to this increase. First, China is rapidly becoming an aging society (Yuanting Zhang & Goza, 2006). As the median age gradually shifted higher (Poston & Duan, 2000), the number of grandparents increased as well. As of 2011, China had a population of nearly 1.35 billion; 14% of people aged 60 or older (Kinsella & Velkoff, 2001). By 2050, the aging population will grow more than threefold and will account for one third of the national population (UN Department of Economic and Social Affairs, 2011). As the elderly population continues to increase in size, many aspects of Chinese society will need to adapt to fit their needs.

The second factor involves changing family structure and subsequent shifts in caregiving patterns based on falling fertility rates and the aging of the Chinese population (Yuanting Zhang & Goza, 2006). The number of grandparents who parent grandchildren in China has grown at a phenomenal rate over the last three decades (Juanjuan Sun, 2013; Goh, 2006) since China's one child per couple policy (OPC) was established in 1979 (Yuanting Zhang & Goza, 2006). The transformation of caregiving patterns resulted in parents and grandparents sharing the responsibility of raising the latest generation (Goh, 2006). Based on the China Health Nutrition Survey (1989 to 1993) and interview data from two counties in Heibei Province, parents are less likely to be involved in childcare when a grandmother is present. Additionally, Chinese females participate in the labor force at higher rates than much of the global population. These elevated rates of participation are, in part, due to the active involvement of grandparents who provide care while mothers leave the home to work.

Grandmothers are identified as the most important caregiver rather than the parents themselves (Short, Chen, Entwisle, & Fengying, 2002).

It is evident that the increased median age coupled with the transitional nature of family dynamics has been met with a rise in the number of grandparents who provide childcare for their grandchildren. According to Xin (Xin, 2013), with the advance of retirement age, many elderly are retired and spend most of their time in the open spaces of residential communities. This has resulted in grandparents who provide childcare for their grandchildren becoming the primary users of neighborhood open spaces (Xinhe, 2013).

As the number of grandparents and their grandchildren who use neighborhood open spaces grows, it is necessary that their needs be taken into account when designing outdoor environments. According to Kweon, Sullivan, & Wiley (Kweon, Sullivan, & Wiley, 1998), social relationships are important to individuals in all cultures and across the entire human lifespan. This is especially true of retired grandparents (Sasser, 2012). Social and community ties provide important social relationships that promote emotional and physical health for older people, and older people desire to socialize with other persons outside (Flint & Robinson, 2008; Woode, Monano, Cernak, & Iranon, 1979). Well-designed neighborhood open spaces provide ample opportunity for creating and fostering social interaction for the elderly (Flint & Robinson, 2008; Woode et al., 1979).

Research demonstrates that physical environments are capable of affecting social relationships of older people (Lawton, Nahemow, & Teaff, 1975). Public open spaces can promote social ties. Kuo et al. found that neighborhood common spaces are one of the most

important venues related to the development of social contact among neighbors (Kuo, Sullivan, Coley, & Brunson, 1998). Madanipour (2001) also found that open spaces bring people together. By providing meeting opportunities, open spaces can increase opportunities for social encounters among neighbors and foster the development of neighborhood social ties (Kweon et al., 1998; Völker, Flap, & Lindenberg, 2007). Moreover, social ties are established among neighbors due to the increased chances of meeting one another, through means of visual contact, greeting, and short-duration conversation, most of which typically occur outdoors (Greenbaum, 1982; Kuo et al., 1998). These relationships are then strengthened by the frequency of face-to-face contact and close social interaction among neighbors (Gehl, 1996).

This study aims to explore the relationship between environmental attributes and grandparents' preferences. It also aims to determine which environmental attributes contribute to their social interaction in order to improve the well-being of Chinese grandparents caring for their grandchildren.

## **1.2. Introducing the Study Location**

Survey data was collected from two residential communities in Shanghai, China. These residential communities consist of high-rise buildings located in an inner-city area. These residential communities were located in the center of Shanghai city, where there is a higher density population. The name of these communities are “the courtyards” and “the oriental garden” (see Figure 1). They are representative of typical modern communities. The majority of modern communities were established around 1990s. These two communities were

established in 2001. Shanghai, one of China's large cities, has experienced a housing development transformation from low to medium or high density since the 1980s (Gaubatz, 1999). According to Statistical Bureau of Shanghai ("Statistical Bureau of Shanghai," 1993), there has been a marked increase in the construction of high-rise housing in order to ease the high-density pressure in both commercial and residential construction fields (I. Q. Blackman & Picken, 2010). In 1980, only 1.4 percent of residential housing was located in buildings taller than ten stories. However, by 1992, 7 percent of the residential housing in Shanghai was located in structures taller than ten stories and this 'boom' continues to present day. Because Shanghai is a high-density city, residential housing located in these communities of high-rise buildings represent typical modern features of residential open space of high-rise housing communities (I. Q. Blackman & Picken, 2010) and provide an ideal sample from which to draw data.



Figure 1 The locations of two residential communities in Shanghai, China (A. The Courtyards; B. The Oriental Garden).

### 1.3. Background and Characteristics of Participants

For the study, grandparents, as caregivers for their grandchildren, were categorized in terms of their living arrangement. Previous research regarding living arrangements of

grandparents and their adult children highlights the contrasting lifestyles of those that reside in the same house and those that do not (Chen, Liu, & Mair, 2011). Research has shown that grandparents who do not live with grandchildren usually still live in close proximity to their children and often provide childcare (Greenhalgh, 1984) for their grandchildren. However, according to Chen Liu & Mair (Chen et al., 2011), there is a lack of research listing the number of grandparents living with their grandchildren.

Since 1978, as China has experienced a rapid and unprecedented urbanization and high rates of immigration to urban areas (K. H. Zhang & Shunfeng, 2003; Zhao, 1999), grandparents move from rural to urban areas to live with their adult children and grandchildren (Triadó, Villar, Celdrán, & Solé, 2014).

As more elderly individuals migrate to the cities to follow their adult children (Greenhalgh, 1984; Short et al., 2002), chances for social and emotional discord increase outside the public spaces located within communities. These include: alienation from relatives, lack of communication with peers, and difficulty adjusting to the modern and often fast-paced urban lifestyle (Yan, 2013). Therefore, it is important to have these problems about social interaction for the elderly in mind when selecting landscape elements that create social contact opportunities for grandparents in neighborhood open spaces in existing articles.

#### **1.4. Research Questions**

This paper discusses the key attributes of the outdoor environment that influence the overall experience of grandparents and promote social interaction among them in public open spaces around high-rise apartments in Shanghai, China. The central focus of this study is to

gain a better understanding of which environmental attributes of public open spaces grandparents prefer. Once identified, these attributes that are tied to design recommendations can help architects create the types of places that provide better opportunities for social interaction. By responding to the preferences of these grandparents, designers can provide an opportunity to foster important social and community ties within physical design or community space. These preferences provide important guidelines for designers, planners and those involved in the management for the neighborhood communities and policy makers of outdoor environments for grandparents and their grandchildren.

This research seeks to explore the following research questions:

1. Which environmental attributes are relevant to social interaction among grandparents caring for their grandchildren? For the purposes of this study, environmental attributes are defined as properties of the outdoor environment, such as comfort, safety, and aesthetics (See chapter two for the literature review on section 2.5).

2. What contributing landscape elements or landscape characteristics can promote social interaction among grandparents with their grandchildren? Landscape elements are physical factors of a local open space setting, such as benches or plants. Landscape characteristics may pertain to characters or particular qualities of the outdoor environment, such as benches with shade and benches alongside walkways (See chapter two for the literature review on section 2.6).

3. What is the relative importance of landscape elements or landscape characteristics within each category of environmental attribute in encouraging social interaction among

grandparents who look after their grandchildren? In short, which landscape element are most important relative to others in each category?

4. What are relationships between demographics, such as gender, age, and educational level, and the relative importance of landscape elements or landscape characteristics (see 3.1). This question is to study individual characteristics and whether or not these characteristics influence individuals' preferences for important landscape elements/characteristics. Six topics were proposed in order to examine the relationship between the importance of landscape elements and characteristics and social-demographic attributes. What are relationships between travel time among age groups? What is relationships between travel time and living situation? What are relationships between gender and visibility? What are relationships between local services among the grandparent age groups? What are relationships between accessible landscape characteristics among the grandparent age groups? What are relationships between accessible landscape characteristics among the grandchildren age groups?

There are two primary aspects of the study that contribute to its significance. First, this study develops a comprehensive framework structuring five key environmental attributes (access, comfort, visibility, potential sensory elements and opportunities of meeting) that were preferred by older people in existing articles and their accompanying landscape elements within each category of the five environmental attributes. Currently, there are no similar frameworks found in the Chinese literature. Second, there is no previous empirical research focused on the use of these open spaces by grandparents caring for their



grandchildren. While this population is specific, it is becoming increasingly more common and should be acknowledged. But there is none to be found concerning the Chinese population. Similar articles do exist in Western journals. These articles included studies of older people's preferences (Alves et al., 2008; D. Carstens, 1982; D. Y. Carstens, 1993; Dong, Guo, & Jiang, 2014; Kweon et al., 1998; T. Wang, 2009; Xinhe, 2013) and children's preferences (Aarts, de Vries, Van Oers, & Schuit, 2012; Burke, 2005; Moore, 1990; Rivkin, 1995) for environmental attributes. These articles reported positive relationships regarding social interaction and environmental attributes, but research is necessary to assess the unique preferences of Chinese grandparents with their grandchildren.

From the literature reviews, landscape elements were chosen from many existing articles (see chapter 2). These landscape elements either inspired social interaction among neighbors or satisfied older people's physical needs. All of these landscape elements were examined in terms of Chinese grandparents with grandchildren. The quantitative method used a questionnaire. A questionnaire was designed based on the previously mentioned environmental attributes (See chapter 2) framework (Appendix A). This questionnaire examined the perception of landscape elements by Chinese grandparent who are taking care of their grandchildren. These elements were previously examined in Western cultures, but had not been examined in terms of Chinese grandparents. Additionally, the questionnaire explored additional landscape characteristics not previously examined by other researchers in the field. Questions include landscape elements that were unspecific in the previous similar studies for promoting senior's social interaction. In this study, relative importance among a

set of landscape elements is examined. Other questions relate to the enjoyment of the child regarding play areas. However, most of the grandchildren were too young to answer the questionnaire, so their grandparents answered questions relevant to their preferences. These questionnaires were distributed to 46 Chinese grandparents who were caring for their grandchildren. After the data was collected from China, descriptive statistical analysis and inferential statistical analysis were used to analyze all of the data. Design recommendations were produced for Chinese grandparents with grandchildren in open spaces of residential communities based on the results and findings from the data.

### **1.5. Summary of Introduction**

In summary, the number of grandparents spending time with their grandchildren has increased over the past three decades, but Chinese public open spaces within these communities do not currently meet the preferences of this specific population (Xinhe, 2013). Based on this social phenomenon, four research questions are raised to assess which environmental attributes can promote social contact opportunities for grandparents with their grandchildren in selected urban residential communities in Shanghai, China. In order to improve the experiences of grandparents who parent grandchildren in these open spaces, it is critical to explore specific landscape elements or landscape characteristics in open spaces that are associated with social interaction.

### **1.6. Thesis Organization**

This thesis is organized into chapters. The first section introduces the practical problems and research problems. The second chapter is a literature review of previous studies that not

only provides a theoretical context that is related to the five environmental attributes and accompanying landscape elements, but also sets the framework that structures these five environmental attributes and the accompanying landscape elements. The third chapter explains the methodology of this research, including: the questionnaire design, the participants' selection, the data collection, and the data analysis methods. The fourth chapter summarizes the findings and results from the analysis, and these findings and possible explanations are discussed in the fifth chapter. In the sixth chapter, recommendations are made based on the findings and discussions. The limitation for this study and further implications for future design practices are also offered.

## **Chapter 2. Literature Review**

This chapter illustrates which environmental attributes and accompanying landscape elements were preferred by older people. This chapter consists of eight sections. The first section tells the importance of social interaction for older people, and the second section describes which social contacts were identified for people within communities. The third section defines open spaces in residential communities and explains the context for this research. The fourth section explains the common qualities and characteristics for older people, and these common characteristics help us choose those landscape elements requiring older people's physical needs. The fifth section and sixth sections tell the fundamental theories that the five environmental attributes and accompanying landscape elements were preferred by older people. The seventh section states the role of children's play areas for social interaction. Based on all of these literature reviews, a number of important landscape elements and landscape characteristics are identified. These landscape elements/characteristics either inspire social contact or satisfy older people's physical needs. All of these landscape elements/characteristics are examined in terms of Chinese grandparents who are taking care of their grandchildren.

A framework was used in this chapter to structure environmental attributes and landscape elements/characteristics preferred by older people in the existing articles. Grouping and structuring environmental variables in a framework were important in the application of Western theories regarding environmental attributes and landscape elements to the Chinese grandparent population. A systematic review, providing a description of what the various

studies had found and supplying some preliminary classification of earlier findings, and a framework combining key findings from the existing literature would be useful for further research (Humpel, Owen, & Leslie, 2002) for Chinese grandparents and their grandchildren in China. As Owen, & Leslie (Humpel et al., 2002) stated, “many of the empirical studies aimed at examining the association between environmental attributes and preferences were not well developed. Methods to measure environment attributes in those studies were based in part on pragmatic insights, and they operationalized some broad theoretically derived constructs. The outcome variables used in those studies were also derived from various findings in earlier existing similar research. He further illustrated that if these environmental variables were grouped, it could be used as the basis for a more theoretical synthesis.”

Justification for the study of relationships between these attributes and corresponding landscape elements/characteristics, and older people’s preferences was based on an analysis of the positive relationships between outdoor social activities and outdoor environmental attributes. Primary sources of information include Jan Gehl’s (1996) theories of social interaction and Thompson & Travlou (2007) and Marcus & Francis’ theories (1997) of preferences of older people regarding environmental attributes in open spaces. A framework consisting of a series of landscape elements/characteristics was formed based on the literature review, in order to explore which landscape elements associated with key environmental attributes help promote social interaction between older people and other persons within communities.

Many of the studies within this field use a variety of terms for old people, such as older people, old-aged adults and the elderly. For example, according to the U.S. Bureau of the Census (Velkoff & Lawson, 1998), the older population are those 60 and older, and the oldest old population are those 80 and older. According to Heidrich & Ryff (Heidrich & Ryff, 1993), old-aged adults are 65 years old or older. Marcus & Francis (1997) categorized the elderly into three types, beginning with those aged 55 years and older.

In this study, the majority of the findings were based on literature reviews aimed at old people 60 years of age and older.

## **2.1. Neighborhood Social Ties and Community Ties**

Social relationships are important to individuals in all cultures and across the entire human life span (Kweon et al., 1998). Neighborhood social ties and community ties provide important social relationships for older people that promote well-being within neighborhood open spaces. Neighborhood social ties are defined as individual and connections in neighborhood social networks (Freeman, 2001). Communities ties are defined as attachments to communities among neighbors (Riger & Lavrakas, 1981).

According to Kweon, Sullivan, & Wiley (Kweon et al., 1998), social ties are especially important for the well-being of older people because social ties provide support and opportunities for engagement to other persons or neighbors. Older people with social connections have lower levels of mortality (Engedal, 1996), reduced suicide rates (Durkheim, 1951), less fear of crime, and better physical health (Eve & Eve, 1984). Older people with

stronger social ties also have significantly higher levels of psychological well-being (Hughes, 1993).

Community ties are important for older people in a number of ways. For instance, close attachment to community has been shown to be related to life satisfaction of older people (Flint & Robinson, 2008; Woode et al., 1979). Community ties are also associated with shared emotional connections with neighbors (Coppola, Feldheim, Kennaley, & Steinberg, 1989). In contrast, losing community ties can have significant consequences, including social isolation, depression, illness, and early death (Llewellyn, 1981).

## **2.2. Definition of Social Contact**

Social contact is defined as social relationships between individuals (Shor & Roelfs, 2015). Social contacts were identified with many forms, but in this study, social contact forms for older people are related to two forms in particular: neighborhood and casual social encounters.

Jan Gehl (Gehl, 1996) identified a range of contacts ranked from low-intensity contacts to high-intensity contacts (see Figure 2). Low-intensity contacts were defined as simple contact forms, as well as prerequisites for high-intensity contacts, such as seeing and hearing people. High-intensity contacts were explained as complex and emotionally involved connections between people (p17). According to Gehl (1996), by increasing opportunities of low-intensity contacts, relationships between neighbors may be established and strengthened.

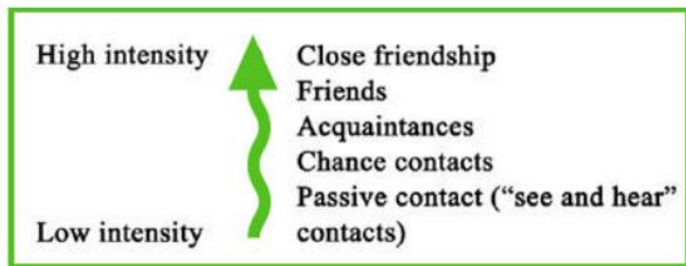


Figure 2 Simplified outline of varying contact forms (Gehl, 1996)

Based on Gehl’s simplified outline of varying contact forms, passive contact serves not only as an independent contact form, but also as a prerequisite for other, more complex interactions, such as friendship and close friendship (Gehl, 1996).

In Kim & Kaplan’s (2004) studies, the definition of social contact was developed, but contact forms were consistent to contact forms presented by Jan Gehl (Gehl, 1996).

According to Kim & Kaplan (Kim & Kaplan, 2004), social interaction in communities was defined as a formal (e.g., active, planned) or informal social opportunity (e.g., casual, unplanned) in which two or more residents build their relationships. Similar, many literatures, such as Glynn (1986), Festinger, Back, & Schachter (1950) and Burke (2005), further stated neighboring and casual social encounters, as formal and informal social opportunity, constituted social interaction.

Neighboring refers to interactions among neighbors who near each other (Burke, 2005; Festinger, Back, & Schachter, 1950; Glynn, 1986). Casual social encounters can also occur between residents who do not know each other or are not neighbors (Fleming, Baum, & Singer, 1985). Residents get to know one another through social interaction (Kim & Kaplan, 2004).



### **2.3. Definition of Public Open Spaces in High-Density Urban Residential Communities**

Public open spaces in this study are defined as the following: public spaces in a limited territory within urban areas. In high density urban areas, public open spaces of residential areas of Shanghai are generally composed of squares/plazas, neighborhood parks, pedestrian sidewalks, traffic restricted streets, transit malls, town trails, city farms, incidental spaces and natural green space, greenway and linear parkways, atriums, playgrounds, playing fields and sports grounds, school playgrounds, and memorials (Yanting Zhang, 2011). These public open spaces are important because they provide opportunities for social interaction for older people within residential communities.

### **2.4. Characteristics of Grandparents Based on Physical and Psychological Needs**

This study targeted Chinese grandparents who are mostly above 60 years old. It was important to study the characteristics of the elderly based on their physical needs because it led to an understanding of which landscape elements/characteristics helped older people perform their activities and which landscape elements/characteristics were preferred by older people.

The elderly had a range of needs and preferences, but they did share a number of common general qualities and characteristics due to the aging process. According to Alves et al. and Sasser (Alves et al., 2008; Sasser, 2012), there were a number of common general qualities and characteristics, of which, there were three aspects to emphasize: the sensory loss, potential decrease in mobility and potential loss in sense of orientation. With aging, the elderly experience mobility difficulties, such as walking slowly due to a lack of physical

strength and stamina. As people age, they begin to lose their abilities in hearing, vision and touch and can potentially have a loss of orientation, such as disorientation. Recognizing that these three aspects (the sensory loss, potential decrease in mobility and potential loss in sense of orientation) could affect older people's needs created a better understanding of which landscape elements or characteristics were specifically targeted to older people. After gaining this understanding of their needs, some landscape elements were chosen to meet them. For example, distance, non-slip pavement and seats along walkways were chosen for those grandparents who have potentially decreased mobility (see chapter two literature review, 2.6.1). Aesthetic, acoustics and tactile elements were important for those grandparents who have sensory loss (see chapter two, 2.6.2). A looped pathway was important for those grandparents who have potential loss in sense of orientation (see chapter two, 2.6.1).

## **2.5. Theories of Social Interaction**

Many articles indicate that environment characteristics play a critical role in social interaction. Jan Gehl (1996) reported that people engaged in different activities can be divided into necessary, optional and social activities (p. 11). Necessary activities occur irrespective of the conditions of the surroundings. However, in well-designed spaces, necessary activities tend to last longer. Optional activities, such as relaxing, are pursued only when the surroundings are considered attractive (Gehl, 1996). Social activities, such as seeing and hearing others, greetings and conversations, child play or group sports, result from necessary and optional activities and depend on the presence of others in public spaces. Occurrence of social activities are associated with exterior physical conditions (p. 13). Well-

design conditions can promote physical activities, such as necessary and optional activities. However social activities are indirectly supported by necessary and optional activities, improving the physical conditions for those activities can increase the number of social activities (Gehl, 1996).

There is an abundance of studies focused on environmental characteristics that affect social contacts and support the statement of Jan Gehl in that social interactions in surroundings are influenced by outdoor environmental attributes, such as Marcus & Francis (1997), Thompson & Travlou (2007), Yao Zhong (2008). Marcus & Francis (1997) emphasized that comfort, safety, ease of access to the outdoors, opportunities for meeting and socializing with other people are increasingly important aspects of outdoor spaces preferred by older people. Thompson & Travlou (Thompson & Travlou, 2007) used two instruments to examine the relationship between the physical environment and older peoples' level of activity. Older people's level of activity was a certain level of functional capability to perform intended activities. The results showed that access, comfort, and safety are strongly considered by older people, and these environmental attributes were relevant to participation in outdoor activity.

In China, Yao Zhong (2008) also supported Francis' assertion (2003) that comfort, safety, ease of access to the outdoors, opportunities for meeting and socializing with other people are increasingly important aspects of outdoor spaces preferred by older people. Zhong (2008) presented that there are four environmental attributes related to social interaction in Chinese residential communities: access, safety and comfort along with opportunities for meeting

other people.

These four environmental attributes (access, comfort, visibility, opportunities of meeting) played a key role in encouraging people's outdoor activity in urban areas. However, older people's outdoor activities were related to the occurrence of social activities. Because the more outdoor activities occur, the more social activities arise. According to Jan Gehl (1996), the more time spent outside, along with an increased number of outdoor activities, frequency of social activities increased (see Figure 3).

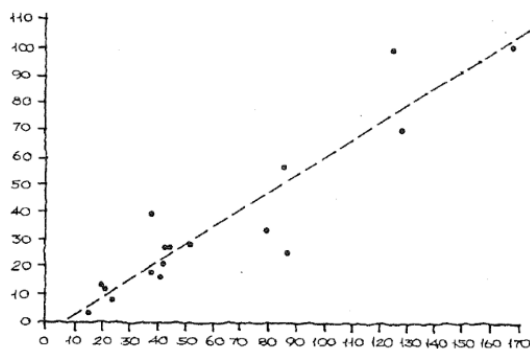


Figure 3 Chart plotting the relationship between the number of outdoor activities and frequency of interactions (Gehl, 2011)

Thus, there are four environmental attributes: comfort, safety, ease of access to the outdoors, opportunities for meeting indirectly associated with older people's outdoor social activities. Additionally, based on the description on the common sensory characteristics for older people in section 2.4, potential sensory elements were especially important to satisfy older people's needs in outdoor spaces (Marcus & Francis, 1997). According to Marcus & Francis (1997), potential sensory elements are those elements that make sensory information to facilitate environmental comprehension and enjoyment to compensating for age-related sensory losses. So it is categorized into framework with the above four environmental

attributes. Some studies focused on social contacts in residential communities showed deep insight regarding these environmental attributes, and these literatures will be discussed in following sections related to access, safety, comfort, opportunities of meeting and potential sensory elements.

Based on theories of social interaction discussed by Jan Gehl (1996), Catharine Ward Thompson et. al (2007), and Marcus & Francis (1997), access, comfort, safety, opportunities for meeting and potential sensory elements were important environmental attributes, these attributes played an important role in promoting participation of older people in outdoor activities and social interaction. They were adopted as key factors in the development of a framework illustrating which environmental attributes affected social contact between older people in urban open spaces. Potential sensory, as a compliment, played an important role in promoting the usage of open spaces based on older people's needs. Thus, it was also structured as one key attribute in the framework.

## **2.6. Landscape Elements/Characteristics Categorized in Five Environmental Attributes: Access, Potential Sensory Elements, Visibility, Comfort, and Opportunities of Meeting**

### **2.6.1. Access**

Access refers to the ease with which a site or service may be reached or obtained (Nicholls, 2001). According to Fleming et al. and Giles-Corti, Broomhall, et al. (Fleming et al., 1985; Giles-Corti et al., 2005), the provision of common access in open spaces enabled people to have more opportunities for physical activity and social contact and stimulated social activities (Howell, 1978). In agreement with Aarts et al. (2012) and Kazmierczak (2013), the

accessible green spaces could provide opportunities for social interaction between people. Thus, access was a key environmental attribute involved in the encouragement of social interaction. Turel, Yigit & Altug (Turel, Yigit, & Altug, 2007) offered five reasons why older people did not walk outside: distance between destination, difficulty in walking, poor sidewalks, lack of places to rest, and fear of crimes. Distances, high quality pavement, clear directionality of pathway, and places to rest were important to encourage the use of open spaces. Other studies (these studies were discussed in distance, non-slip pavement, a looped pathway, seats along the walkway, seats with weatherproof covers and access to local service sections) relevant to accessibility supported, refuted, and even complemented Turel, Yigit & Altug's statements. In my study, five important landscape characteristics were identified based on these earlier studies (see chapter two literature review, 2.5). These landscape characteristics included distance from home to destinations, seats along the walkways from home to destinations, seats along the walkway, seats with weatherproof covers, non-slip pavement, access to local service and a looped pathway. These landscape characteristics would be discussed in the following sections.

### *Distance*

Distance played an important role in outdoor physical activity of older people. The important association between distance and physical activity were shown by many studies from different countries. According to Giles-Corti & Donovan (2002), a study of a sample of 1803 participants (aged 18 to 59 years) in Western Australia showed that the distance between home and public open spaces was linked to the incentive to walk to local amenities.

Sugiyama & Thompson (Sugiyama & Thompson, 2008) stated that distance was related to participation of older people in outdoor activity in the UK. Rodiek & Fried (Rodiek & Fried, 2005) emphasized that comfortable walking distances to destinations were related to health and well-being. Older people were more likely to be satisfied with life than those who had no such spaces within a walking distance. This result was from a survey aimed at identifying specific environmental features preferred by older people in Texas (Rodiek & Fried, 2005).

There are also some studies presenting that short distance would be preferred by older people in neighborhood open spaces. Giles-Corti et al.; King et al.; and Tinsley Tinsley, & Croskeys (Giles-Corti et al., 2005; King et al., 2005; Tinsley, Tinsley, & Croskeys, 2002) asserted that, as the distance between home and facilities decreased, the utilization of recreational facilities in open spaces increased.

According to Turel, Yigit & Altug (Turel et al., 2007), walking distance within 5-10 minutes to a neighborhood park is important in encouraging older people to use open spaces. An article by Susana Alves (Alves et al., 2008) asserted that distance to the park was associated with the living situations of the elderly. Those living alone preferred to existed distance to open spaces, but those living with someone else tended to prefer availability of facilities and a car park.

### *Seats along walkway*

Studies (Brawley, 1997; Stoneham & Thoday, 1996) have argued that it is important to offer seats along a walkway to enhance usage of open spaces for older people. Sidewalk and road-side seating were proven to be directly associated with outdoor activities of the elderly

because it provided unexpected seating if there was a need to stop and rest while walking (Brawley, 1997; Heath & Gifford, 2001; McBride, 1999; Pynoos et al., 1991; Z. Wang & Lee, 2010; Zhong, 2008). This path feature was preferred by older people who had a lack of physical strength and stamina (Sasser, 2012).

Seats as destinations by many people in open spaces, were thought to be good facilities (Sugiyama, Thompson, & Alves, 2009) and provided physical comfort for walkers (Rodiek & Fried, 2005). However, according to Stoneham & Thoday (Stoneham & Thoday, 1996), seats along a walkway can be seen as resting areas, one feature of an accessible path to open spaces. Ultimately, it was categorized as an access attribute by Stoneham & Thoday (1996, p.56). In my study, seats alongside walkways were more focused on creating an accessible condition to walk to open spaces for grandparents with grandchildren. They were categorized as an accessible attribute.

### ***Seats with weatherproof***

According to Marcus & Francis (1997), a canopy or cover should be offered as protection from the weather, such as rain or snow, for older people. Many studies also stated that frequent benches under shady areas along outdoor walkways were more popular among older people (Brawley, 1997; Heath & Gifford, 2001; McBride, 1999; Pynoos et al., 1991). As these benches might provide resting areas as well as protecting older people against the weather (Dong et al., 2014).

### ***Non-slip pavement***



According to Rodiek & Fried (Rodiek & Fried, 2005), fatal slips and falls were a major concern for older people. This concern inhibited the decision to go outdoors (Marcus & Francis, 1997). Non-slippery pavement has proven to be very important for the elderly in outdoor environments (T. Blackman et al., 2003; Stoneham & Thoday, 1996; Turel et al., 2007). Marcus & Francis (Marcus & Francis, 1997) stated that smooth, yet non-slip surfacing materials for walkways in outdoor environments are better for older people.

There were other landscape elements relative to safety in relation to physical mobility, such as minimal changes in grade and handrails on the ramps, and wide walkways (Lovering, 1990; Stoneham & Thoday, 1996; Turel et al., 2007). However, in this study, non-slippery pavement was selected as a critical accessible characteristic due to two causes. Slipping related fall increase around age 60 and further increase after age 75 (Zamora, Alcántara, Artacho, & Cloquell, 2008). The major concern for older people is safety (Marcus & Francis, 1997) when using outdoor spaces. The participants in this study did not have mobility problems in open spaces, so wide walkways and handrails on the ramps were not taken into consideration.

### *Access to local services*

The accessibility to a destination played an important role in preferences of participants. These accessible utilitarian destinations as a determinant of physical activity have been indicated by Michael, Green, & Farquhar (2006) and Humpel et al. (Humpel et al., 2002). They included local shops, recreational amenities, and other services that provided older people with places to walk and meet others (Michael, Green, & Farquhar, 2006). In contrast,

an area that lacked accessible services for daily activities was linked to a decrease in the incentive to walk to local amenities and an increase in isolation (Michael et al., 2006).

### ***A looped pathway***

The observational study of an elderly housing project in Ohio, made by Regnier, Hamilton, & Yatabe (Regnier, Hamilton, & Yatabe, 1995) found that sense of orientation, opportunities for sensory stimulation, and control and mastery over the environment were the three most significant design factors that influence outdoor use by older people. As a critical design factor, sense of orientation shed light on the importance of a looped pathway for older people (Marcus & Francis, 1997). Walkway loops could help those older people orient themselves when interacting with others and finding their way around the outdoor areas (DeLong, 1970; Marcus & Francis, 1997; Pastalan, 1971). These findings had great impact on many later practical projects. Terry Harting (2007) stated the design elements used for American residential gardens commonly incorporated a simple looped pathway for older adults who had impaired navigational abilities.

### **2.6.2. Potential sensory elements**

Potential sensory elements are important for older people in outdoor environment. Potential sensory elements are those elements make ample sensory information to facilitate environmental comprehension and enjoyment to compensating for age-related sensory losses (Marcus & Francis, 1997). These landscape elements were categorized by Marcus & Francis (Marcus & Francis, 1997) into visual, auditory, and tactile stimulation. Of these, tactile clues were particularly important. Tactile clues included tactile pavements, tactile landscape walls,

and so on. In addition, According to Matthews and Ryan (Matthews, 1992; Ryan, 1992) and Carstens, (D. Y. Carstens, 1993), plants and sculpture attribute to a visual stimulation as well as development of basic and social skills. However, pools and fountains induced a positive acoustic perception (Han, Yu, & Zhang, 2006; Niu, 2006; Wang., 2007; W.-y. Zhang, Wu, & Xiao, 2009).

Based on these earlier studies, plants, sculptures, fountains, peaceful water pools, and textured landscape elements, such as landscape walls would be measured as visual, auditory and tactile stimulation.

### **2.6.3. Visibility (Safe and security)**

The literature showed that enjoyment of open spaces was dependent on the perception of safety and security. Franck & Paxson (Franck & Paxson, 1989) emphasized fear of crime and violence, especially against women, could cause seemingly good spaces to go unused.

Francis (Francis, 2003) also agreed that fear of crime and violence often led to avoidance of spaces—even well-designed and attractive ones. According to Marcus & Francis (1997) and Yao Zhong (2008), the fear of crime inhibited older people from going outside. In contrast, feeling safe and secure encouraged outdoor use among older people and was a strong determinant of their life satisfaction. Increasing visibility of communal spaces was highlighted in other studies as being the key environmental attribute, promoting perceived safety (Schroeder & Anderson, 1984) and influencing social interaction (Williams, 2005).

According to Schroeder & Anderson (Schroeder & Anderson, 1984), plant density played an impact on visibility of communal space. They noted that removing vegetation to

increase visibility would produce an environment that feels safer, but it would decrease the scenic quality of the site. A compromise between perceived safety and scenic quality can be achieved by reducing shrubs and raising tree canopies in order to improve visibility at ground level (Schroeder & Anderson, 1984).

#### **2.6.4. Comfort**

According to Carr et al. (Carr, 1992), for an open space to be well used, it must be comfortable. This could involve offering welcoming and attractive places, such as a place to rest when someone is tired, attractive activity areas and views of visual interests. The various forms of accessibility, including physical and symbolic access, were also basic prerequisites for comfort (Francis, 2003) and social cohesion (Peters, Elands, & Buijs, 2010). In this study, comfort was related to the quality of open spaces (destinations) where the elderly could stay longer. Francis (Francis, 2003) believed that adding a view onto the place from windows was associated with comfort. Thus, as one of environmental attributes preferred by older people, comfort was a key factor that could influence the decision to use or stay in outdoor environments among grandparents who look after their grandchildren.

#### ***Visual interest***

Humpel et al. (Humpel et al., 2002) found that aesthetic items, particularly those pertaining to the attractiveness and pleasantness of the local environment having enjoyable scenery, were significantly associated with physical activity in older people. Susana Alves (Alves et al., 2008) insisted that older people were more likely to visit open spaces if they provided entertaining views or things to watch.

According to earlier studies about visual interests, plant (Alves et al., 2008; Kuo et al., 1998) and water features (Kuo et al., 1998; Sugiyama & Thompson, 2008), such as a fountain in an outdoor space, added visual interest to harsh urban environments. These features could attract older people to stay in these places longer and stimulate conversation (Alves et al., 2008; Kweon et al., 1998; Sugiyama & Thompson, 2008). Marcus & Francis (Marcus & Francis, 1997) stated that a sculpture or fountain, as aesthetic landscape elements, with high visibility and near well-traveled paths might encourage people to stop, perhaps to sit nearby or strike up a conversation.

According to Marcus & Francis (Marcus & Francis, 1997), providing views of **activity areas** could promote participation of older people in open spaces. Jan Gehl (1998) stated that people and human activity are the greatest objects of attention and interest. Moreover, Marcus & Francis (Marcus & Francis, 1997) thought meeting, talking with others, and feeling like part of the activity were very important to many older people. Even sitting and watching the activities of others might be an active form of participation.

Therefore, plants, sculptures, water features, and activity areas, as visual interests, would make open spaces more attractive to older people. In this study, plants, sculptures, and water features were measured as potential sensory elements for Chinese grandparents with grandchildren due to overlap with potential sensory elements. However, what specific activity areas, as a visual interest, would be preferred by grandparents who take care of grandchildren? Specific activity areas that were preferred by Chinese grandparents will be measured in the survey.

### **2.6.5. Opportunities of meeting**

Both Marcus & Francis (1997) and Jan Gehl (1998) confirmed that meeting and talking with others were very important to many older people. However, more modest forms of contact, including mere seeing, hearing, or being near to others, were apparently much more in demand. This may be because seeing and hearing might encourage occurrences of higher level social activities, such as short greetings, chatting, or discussion (Gehl, 1996). If opportunities of encountering others disappeared, social activities disappeared as well (Zhong, 2008).

Francis (Francis, 2003) listed what creates opportunities of meeting, such as developing focal points (public gathering places that allow a variety of activities) and arranging amenities to encourage social interactions, as well as providing a variety of activity spaces in adjacent buildings to attract a diverse group of people. Other existing studies not only supported these statements, but also presented specific details of gathering places, amenities, and spaces adjacent to buildings for older people.

#### ***Space types with playgrounds (active or passive activities sties with playgrounds)***

Different age groups of the elderly have different needs for activity types in the light of their different characteristics. Marcus & Francis and Xin (Marcus & Francis, 1997; Xin, 2013) believe there are two types of activity areas preferred by older people: passive activity and active activity areas.

In this study, space types were more focused on common spaces for grandparents and their grandchildren. According to Wang (2009), neighborhood open spaces for older people

with children included **passive spaces** and **active spaces** (T. Wang, 2009). These spaces should be designed separately but should still allow visual access to play areas for children (T. Wang, 2009). Marcus & Francis (Marcus & Francis, 1997) claimed that area for more passive exercise could encourage use by the less able.

Turel et al. insisted that (Turel et al., 2007) passive recreational activities, such as strolling and sitting played an important role in the preferences of older people. Since these findings from Marcus & Francis and Turel et al. were for older people, these conclusions could not confirm that older people prefer passive spaces when they were watching over their grandchildren. In order to further explore preferences of grandparents for space types when monitoring their grandchildren, a set of combined or adjacent spaces consisting of different space types and playgrounds would be measured in the survey.

### *Size of spaces*

Carstens (1982) thought that a peaceful and quiet environment was more preferred by older people. But Marcus & Francis (Marcus & Francis, 1997) refuted this statement by stating that meeting and socializing with other people were more important to many older people. He thought that a small and intimate space should be provided to older people in order to support a close relationship with a few friends. However, there was no literature discussing specific size of spaces preferred by older people. In order to understand preferences of Chinese grandparents for space size, a question about space size would be designed for participants in the survey.

### *Recreational facilities for the elderly*

According to Kuo et al. and Volker et al. (Kuo et al., 1998; Völker et al., 2007), most contact between neighbors occurs in places like local recreational facilities, schools, churches, and parks. It was understandable that an open space with good facilities increased the occurrence of social interactions because these facilities were found to be associated with outdoor activity (Kaźmierczak, 2013; Sugiyama & Thompson, 2008) and health of the elderly (D. Carstens, 1982).

According to Carstens (1982) health and exercise were concerns of many older people and were one reason for outdoor activities. Keysor and Jette (2003) indicated that, for the aging elderly who lack strength or stamina, participation in regular physical activities could improve their functional capability through enhancing muscle strength, aerobic capacity, balance, and flexibility. Such enhancements helped to reduce the possibility of falling, a major cause of disabilities in later life. Thus, specific recreational opportunities should be provided for the elderly (Marcus & Francis, 1997). In this study, because the target population was grandparents with grandchildren, facilities consisted of recreational amenities for older people, and playgrounds would be measured based on preferences of grandparents.

### ***Socializing areas near indoor activity sites***

According to Marcus & Francis and Zhong (Marcus & Francis, 1997; Zhong, 2008), outdoor **socializing areas near indoor activity sites**, such as building entries and elevators were important for older people, due to the high resident traffic of these areas (Yao Zhong, 2008). As the possibility of meeting other neighbors increased, the number of social activities increased as well (Yao Zhong, 2008).



## **2.7. The Role of Children's Plays Areas for Social Interaction and Play Areas in Outdoor Open Spaces**

Play areas for children not only supported contact between children but also their guardians (Każmierczak, 2013; Marcus, Sarkissian, Wilson, & Perlgut, 1986). Kazmierczak (Każmierczak, 2013) highlighted the importance of children as ice-breakers in the initial contact. Huang and Marcus (Huang, 2006; Marcus et al., 1986) also asserted that, as the opportunity for children to play at play areas in open public spaces increased, more social interactions were observed among children and their supervisors. However, opinions about the types of play areas and play materials children preferred were divided. These different types of play areas and play materials in play areas would be chosen as landscape characteristics to be examined in terms of Chinese grandparents when they are playing with their grandchildren. According to Burke and Medrich and Benson (Burke, 2005; Medrich, 1976), young children had an intimate knowledge of their neighborhoods and the formal and informal play opportunities there. Marie-Jeanne Aarts (Aarts et al., 2012) elaborated that, in the Netherlands, informal play areas, such as sidewalks, were important to outdoor play.

However, Alexander, Ishikawa, & Silverstein (Alexander, Ishikawa, & Silverstein, 1977; Huang, 2006) emphasized the role of playgrounds as a formal place to bring children together, thus having an important effect on outdoor activities. Guido Stut (Stut, 2013) also agreed that playgrounds, as a formal play area, played an important role in promoting more active outdoor activities compared to playing in informal public areas. Furthermore, many previous studies (Hart, 1982; Heft, 1988; Matthews, 1992; Moore, 1990; Moore & Wong,

1997; Naylor, 1985; Rivkin, 1995; Titman, 1994) asserted the importance of the natural materials and environment as a part of juvenile growth and development, these natural materials and environment was preferred by pre-school children. In summary, playgrounds as a formal play area were preferred by young children due to more opportunities for social interaction. In this study, playgrounds, as a formal play area, provide recreational facilities for children. Play areas with natural activity materials combined with recreational facilities for the elderly would be measured in the survey.

## **2.8. Summary of Literature Reviews**

This chapter reviewed literature related to five important environmental attributes (access, potential sensory elements, visibility, comfort and opportunities of meeting) preferred by older people for their participants in outdoor activities. It also discussed literature relative to various landscape elements/characteristics. Based on the literature reviews, the important environmental attributes and landscape elements/characteristics, as independent variables, were summarized.

### **2.8.1. Identification of Important Environmental Attributes and Illustration of Literature Review Findings**

All of the independent variables identified in this study were derived from the literature review. From the literature, four key books and many studies further provided the theoretical basis for this selection. These four key books were *People Places: Design Guidelines for Urban Open Space* (Marcus & Francis, 1997), *Open Space: People Space* (Thompson &

Travlou, 2007), *Urban Open Space: Designing for User Needs* (Francis, 2003), and *Landscape Design for Elderly and Disabled People* (Stoneham & Thoday, 1996).

### **Five environmental attributes**

According to *People Places: Design Guidelines for Urban Open Space* (Marcus & Francis, 1997) and *Open Space: People Space* (Thompson & Travlou, 2007), there are four environmental attributes that are preferred by grandparents: access, opportunities of meeting, comfort, and visibility. Potential sensual elements as a supplement was emphasized by many studies (see literature reviews) and they were especially important for older people. Thus, potential sensual elements were added to be one environmental attribute in the framework.

**Access: distance, non-slip pavement, a looped pathway, seats along walkways, seats with overhead covers along walkways, and access to local services.**

Turel, Yigit & Altug (Turel et al., 2007) presented five problems which identified six landscape characteristics. These five problems were presented in *Evaluation of Elderly People's Requirements in Public Open Spaces: A Case Study in Bornova District (Izmir, Turkey)*. The five problems were as follows: distance between destinations, difficulty in walking, poor sidewalks, lack of places to rest, and fear of crime. Because perceived safety was considered to be related to visible common space in open spaces (Schroeder & Anderson, 1984), it was categorized under visibility.

Based on the other four questions, distance, non-slip pavement, a looped pathway, seats along walkways, seats with overhead covers along walkways, and access to local services

were grouped into the access attribute. These six landscape characteristics were identified because some sources identified them into access attribute, these sources include *Landscape Design for Elderly and Disabled people* (Stoneham & Thoday, 1996), the design recommendations for the elderly in *People places: Design Guidelines for Urban Open Space* (Marcus & Francis, 1997), and the study in *Neighborhood Design and Active Aging* (Michael et al., 2006). These six landscape characteristics were selected as important independent variables for the accessible environment attribute because of the physical needs of older people and their frequent occurrence in many studies (see literature review).

### **Visibility**

Schroeder & Anderson (Schroeder & Anderson, 1984) in *Perception of personal Safety in Urban Recreation Sites* and Williams (Williams, 2005) in *Designing Neighborhoods for Social Interaction: The Case of Cohousing* identified the importance of visibility for common spaces for older people in open spaces. Thus, it was categorized as a key environmental attribute.

### **Comfort: visual interest**

Francis (Francis, 2003) in *Urban Open Space: Designing for User Needs* argued that a window view was a comfort attribute. Francis (2003) argued that adding public art, flowers, and fountains could increase the sense of comfort in a community. Major visual interests that were presented in earlier studies support these statements (Alves et al., 2008; Gehl, 1996; Kweon et al., 1998; Marcus & Francis, 1997; Sugiyama & Thompson, 2008). Water features,

plants, sculptures, and social activity sites were selected as independent variables in this study based on the literature review.

### **Potential sensual elements**

Marcus and Francis (Marcus & Francis, 1997) in *People Places: Design Guidelines for Urban Open Space* identified three major elements for potential sensual stimulation. These elements were aesthetic, audible, and tactile landscape elements. Water features (fountain/pool), plants, and sculptures were selected as audible and aesthetic landscape elements. Marcus and Francis (Marcus & Francis, 1997) emphasized the importance of tactile landscape elements for the elderly, such as tactile landscape walls.

### **Opportunities for meetings: space types, facilities, socializing areas near indoor activities sites, size of spaces**

Francis (Francis, 2003) in *People Places: Design Guidelines for Urban Open Space* listed three elements that created opportunities of meeting: developing focal points (public gathering places that a variety of activities), arranging amenities to encourage social interaction, and providing a variety of uses in adjacent buildings to attract a variety of people. According to many other studies, such as Marcus & Francis (Marcus & Francis, 1997), Volker et al. (Völker et al., 2007), Turel et al. (Turel et al., 2007), and others, **space types, facilities, socializing areas near indoor activities sites, and size of spaces** were related to opportunities for meeting. Thus, these four landscape elements were selected as independent variables in this study.

In summary, through four key book reviews and several studies about environmental attributes, a series of important landscape elements or characteristics were identified. The important landscape elements or characteristics were grouped into four key environmental attributes and were used as independent variables in this research to explore the preferences of Chinese grandparents for social interaction while watching over their grandchildren.

### **2.8.2. Structuring Five Environmental Attributes and Accompanying Landscape Elements**

Five environmental attributes and accompanying landscape elements/characteristics were important to promote older people's social interaction in outdoor environment and some of them satisfied older people's physical needs for outdoor environments based on their physical characteristics. A conceptual framework (see Figure 4) was created in order to show the relationships of these environmental attributes and supportive landscape elements. As a critical procedure of the investigation, this framework will help the design of the questionnaires in the survey and lead to design guidelines for open space. All of landscape elements or landscape characteristics, as independent variables, will be measured for Chinese grandparents who were looking after their grandchildren.

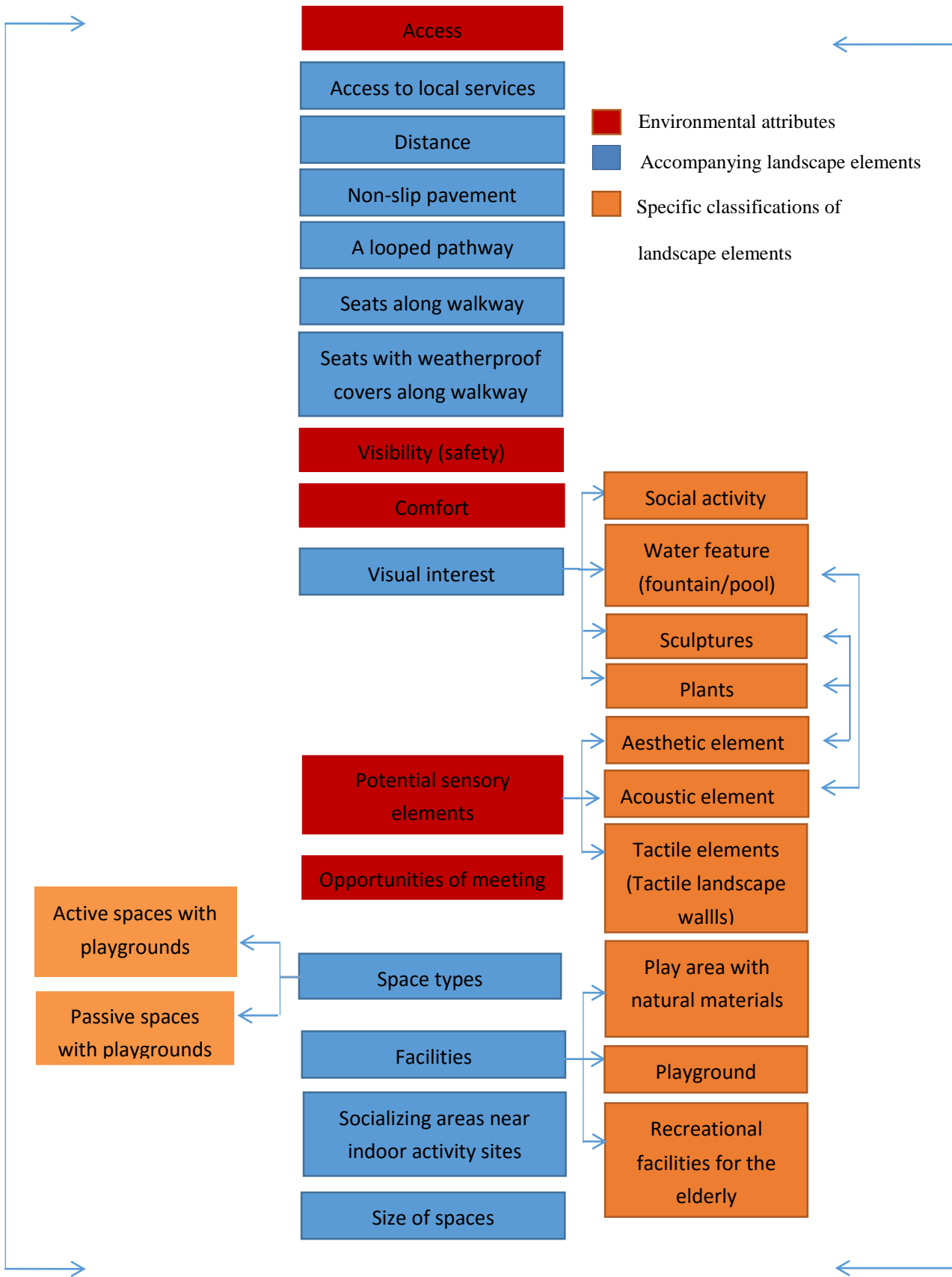


Figure 4 Schematic illustrations of landscape elements/landscape characteristics

These landscape elements/characteristics were separated into three categories (see Table 1): landscape architecture elements/characteristics that promoted social interaction between older people, landscape architecture elements/characteristics that satisfied needs of older people, and landscape architecture elements/characteristics that satisfied needs of grandchildren. In order to explore perceptive outcomes from former literatures, this study searched those landscape elements or characteristics in terms of both the general population and older people. A conclusion of how the landscape elements/characteristics were derived from literature reviews is shown in Table 2.

Most previous researchers have explored landscape elements/characteristics for those 60 to 65 years old. Because the focus of this study was on grandparents who were watching over their grandchildren, younger grandparents (<60) also participated in the survey.

Table 1 Landscape elements' classifications in terms of landscape elements/characteristics that promote people's social interaction, landscape elements/characteristics that satisfy grandparents' needs and that satisfy grandchildren's needs.

	<b>Landscape architecture elements/ characteristics which can promote people's social interaction</b>	<b>Landscape architecture elements/ characteristics which increase grandparents' physical activity as well as satisfy grandparents' needs.</b>	<b>Landscape architecture elements which satisfy grandchildren's needs</b>
<b>Access</b>		<b>Access to local services</b>  (Local shops, recreational amenities, and other services.)	
		<b>Distance</b>	
		<b>Seats along walkway</b>	
		<b>Seats with weatherproof covers along walkway</b>	



		<b>A looped pathway</b>	
		<b>Non- slip pavement</b>	
<b>Comfort</b>	<b>Water feature</b> (Acoustic element) <b>Sculptures, plants</b> (Aesthetic element)	<b>Activity area</b> More activity spaces Less activity spaces	
<b>Potential sensual elements</b>		<b>Tactile elements</b> (such as <b>tactile landscape wall</b> ) <b>Acoustic elements</b> (such as <b>water feature</b> ) <b>Aesthetic element</b> (such as <b>plants and sculptures</b> )	
<b>Opportunities for meeting</b>	<b>Socializing areas near indoor activity sites</b>		
		<b>Facilities</b> Recreational facilities for the elderly	<b>Facilities</b> Playground Play area with natural materials
		<b>Space types</b> Passive space with playground Active space with playground	
	<b>Size of spaces</b>		
<b>Visibility</b>			

Table 2 The conclusion of the landscape elements/characteristics that are derived from the literature review.

Environment al attributes	Category	Landscape elements/characteristics	Literature reviews	Authors and Dates
Opportunities of meeting	Facility	Playground	As the opportunity for children to play in play areas in open public spaces increased, more social interactions were observed among children and their supervisors.	Hang, 2006
			Playgrounds, as formal play areas, played an important role in promoting more active outdoor behaviors compared to play behaviors in informal public areas.	Stut, 2013
		Play area with natural materials	Natural materials and environment played an important role in children's growth and development.	Hart, 1982; Naylor, 1985; Heft, 1988; Moore, 1990; Matthews, 1992; Titman, 1994; Rivkin, 1995; Moore & Wong, 1997
		Recreational facilities for the elderly	Good facilities were found to be associated with the elderly's walking or outdoor activity time.  Most contact between neighbors occurred in places like local, recreational facilities, school, churches and parks.	Sugiyama, 2006; Kazmierczak, 2013  Kuo et al., 1998; Volker et al., 2007
	Space types with playgrounds	Passive or active spaces with playgrounds	Neighborhood open spaces included passive spaces and active spaces for older people. These spaces should be designed alone but keep visual access of children's play areas.  Areas for more passive exercise or just sitting in the sun close to the building could encourage the less able to use open spaces.	T. Wang, 2009  Marcus & Francis, 1997
	Size of the spaces		In order to support a close, intimate relationship with a few friends, a small intimate space should be provided to them.	Marcus & Francis, 1997
	Socializing areas near		Socializing areas near indoor activity sites were the most popular areas for older people.	Marcus & Francis, 1997; Zhong, 2008

	indoor activity sites			
Potential sensory elements		Aesthetic, audible, and tactile landscape elements.	Of visual, auditory, and tactile stimulation, tactile stimulation was particularly important.	Marcus & Francis, 1997
Comfort	Visual interests	Plants, water features, and sculptures.	Plants and water features in outdoor spaces added visual interest to harsh urban environments. They could attract people to stay in places and stimulate conversation.	Kuo et al., 1998 Sugiyama & Thompson Alves et al., 2008
			An aesthetic landscape element like a sculpture or fountain, if highly visible and near well-traveled paths, might encourage people to stop, perhaps to sit nearby or strike up a conversation.	Marcus & Francis, 1997
		Open spaces with various activity spaces (more active or less active).	<p>Opportunities for meeting and talking with others and feeling part of the activity were very important to many older people.</p> <p>Older people whose ages were approximately 50-70 years old liked active activities; older people whose ages were approximately 70-80 years old preferred passive activities; older people whose ages were approximately 80 years old and over preferred passive activities.</p> <p>Providing views of activity areas could promote older people's participation.</p>	Marcus & Francis, 1997
Access	Access to local services		<p>The accessibility of a destination played an important role in older people's preference to visit a place. Accessible utilitarian destinations include local shops, recreational amenities, and other services that provide older adults with places to walk, meet others, and stay active without a car.</p> <p>In contrast, an area that lacked accessible services was linked to decreased incentive to walk to local amenities and increased isolation.</p>	Michael, Green, & Farquhar, 2006

	Distance		<p>(a) As the distance between home and facilities decreased, the utilization of recreational facilities in open spaces increased.</p> <p>(b) A walking distance of 5-10 minutes to a neighborhood park was important in encouraging older people to use open spaces.</p>	<p>(a) Giles-Corti et al., 2005; King et al., 2005; Tinsley, Tinsley, &amp; Croskeys, 2002</p> <p>(b) Alves et al., 2008</p>
	A looped pathway		Design elements used for American residential gardens commonly incorporated a simple looped pathway for older adults who have impaired way-finding abilities.	Harting, 2007
	Non-slip pavement		<p>(a) Non-slip material such as wood for paving was the best.</p> <p>(b) Surfacing materials that were smooth, yet not slippery was better for the elderly.</p> <p>(c) The fear of falling inhibited older people's decision to go outside. Thus, pavement was very important for the elderly.</p>	<p>(a) Dong, Guo, &amp; Jiang, 2014</p> <p>(b) Marcus &amp; Francis, 1997</p> <p>(c) Marcus &amp; Francis, 1997 and Stoneham &amp; Thoday, 1996</p>
	Seats along walkway		<p>(a) Sidewalk and road-side benches or seating were important for walking among the elderly.</p> <p>(b) Frequent benches under shade along outdoor walkways were popular among the elderly as they might unexpectedly need to stop and rest while walking.</p>	<p>(a) Z. Wang &amp; Lee, 2010</p> <p>(b) Brawle, 1997; Pynoos et al., 1991; McBride, 1999; Heath &amp; Gifford, 2001</p>
	Seats with weatherproof covers along walkway		<p>(a) Frequent benches under shade along outdoor walkways were more popular among older people as they might unexpectedly need to stop and rest while walking.</p> <p>(b) Seats with weatherproof covers protected older people against the bad weather.</p> <p>(c) A canopy or cover offered protection from the weather for older people, such as rain and snow.</p>	<p>(a) Brawle, 1997; Pynoos et al., 1991; McBride, 1999; Heath &amp; Gifford, 2001</p> <p>(b) Dong et al., 2014</p> <p>(c) Marcus &amp; Francis, 1997</p>

Visibility			Fear of crime and violence, especially against women, could cause seemingly good spaces to go unused and often leads to people avoiding spaces—even well-designed and attractive ones.	Franck & Paxson, 1989, Francis, 2003
			Increasing visibility of communal spaces was highlighted as being the key environmental attribute promoting perceived safety as well as influencing social interaction.	Schroeder & Anderson, 1984, Williams, 2005

## Chapter 3. Methodology

In this study, an on-site survey investigating preferences of grandparents for a number of landscape elements and the relative importance of landscapes elements was administered to grandparents living in high-rise buildings in Shanghai, China. In order to achieve a more holistic understanding of the influence of landscape elements for social interaction among grandparents who take care of their grandchildren, a questionnaire was designed according to a framework, which was designed based on a review of the literature (See Figure 4).

The methodology of this thesis is presented in four parts: identification of social-demographic attributes, design of the questionnaire, selection of participants, the collection of data, and the analysis of the data. This framework also defines the underlying structure of this study.

This chapter is organized into four sections that systematically define the process of this research. The first section discusses what social-demographic attributes and individual characteristics were identified. The second section explains the design of the questionnaire as an experimental tool. The third section explains how the sample group of this study was selected and how the data was collected. The final section discusses the data analysis techniques and methods used.

### 3.1. Identification of Social-Demographic Attributes and Individual Characteristics

Based on the literature review findings, the following social-demographic attributes characteristics were selected as variables: **gender, age, educational level, living situation, grandchildren's ages, number of children under guardianship, and time of day when going outdoors**. These individual social-demographic attributes were examined in the survey

in order to understand the personal and social backgrounds of participants and to explore the relationships between individual attributes and the relative importance of landscape elements/characteristics.

### **3.2. Literature Review Findings and Design of Questions for the Questionnaire**

In this study, research questions were based on findings from the literature review that identified landscape elements or characteristics. Four research questions were used to structure the questionnaire: (1) Are the identified landscape elements preferred by Western older people also preferred by Chinese grandparents who take care of their grandchildren? (2) Could some of the landscape characteristics preferred by older people that were presented in earlier relative studies be more specific for Chinese grandparents who take care of their grandchildren? (3) What is the relative importance of landscape elements or characteristics in each group? (4) Were there relationships between grandparents' social-demographic attributes and individual characteristics and the relative importance of landscape elements or characteristics?

In the current literature, there are some landscape elements or characteristics that were unclear or unspecific regarding older people. There is a shortage of research comparing a set of landscape elements in order to explore the importance of the landscape elements in each environmental attribute. Through testing these independent variables, the relationships between specific landscape elements and the relative importance of landscape elements in a given set of landscape elements and the perceptual outcomes of those elements were

analyzed. In the questionnaire, I assumed the participants would like to socialize with other people.

**For access, the following items were considered: walkway distance, non-slip pavement, looped pathways, seats along walkway, seats with overhead covers along walkway, and access to local services**

### *Specific distance*

Although Turel, Yigit, & Altug (Turel et al., 2007) stated that 5-10 minutes of walking to open spaces was preferred by older people in Turkey, there is no research examining what the maximum travel time for grandparents with grandchildren might be in China. Therefore, the survey would investigate the maximum travel time older people would be willing to walk to an open space with their grandchildren. Living situation made a difference in maximum travel time (Alves et al., 2008). Thus, whether or not travel time is related to living situation is also examined in the survey.

***Comparison of the relative importance among accessible landscape characteristics: non-slip pavement, a looped pathway, seats along walkway, seats with overhead covers along walkway, and access to local services***

Two questions were used in the survey in order to explore relative importance among a set of accessibility landscape characteristics. The first question examined local services that grandparents would prefer to visit in their residential community. The following amenities were surveyed: Supermarkets, restaurants, post offices, pharmacies, and recreational



amenities. The second question examined what types of places grandparents would prefer when they considered the accessibility of residential community spaces. These areas included access to local services, accessible paths, seats that were alongside the paths which were connected to the residential open space, overhead protection along walkways, and places that had non-slip pavements. Analyzing the answers to these questions would show what accessible landscape characteristics were important to the grandparents.

### **Specific levels of visibility for common spaces**

Visibility in open spaces is considered a key environmental attribute that increases the sense of safety for older people. However, there is no literature stating how much visibility in activity areas older people in China preferred. This was another attribute that was examined in the questionnaire.

### **Comfort: what type of social activity sites are preferred by grandparents and their grandchildren?**

#### *Social activity sites*

What type of activity sites were preferred by participants? This question was used in the survey because no previous literature explored the relationships between preferences of grandparents for activity and the activity site in China.

### **Potential sensory elements: what is the importance of water features, plants, sculptures, and tactile landscape walls?**

*Water features (fountains and pools), plants, sculptures, and tactile landscape walls.*

Fountains, pools, plants, and sculptures were highlighted as visual interests as well as audible and aesthetic landscape elements. They were all grouped as potential sensory elements in the literature. The range of potential sensory elements was versatile, including not only these four visual interests, but also tactile landscape walls. Water features (fountains and pools), plants, sculptures, and tactile landscape walls were examined in the survey in order to explore the relative importance of potential sensory elements.

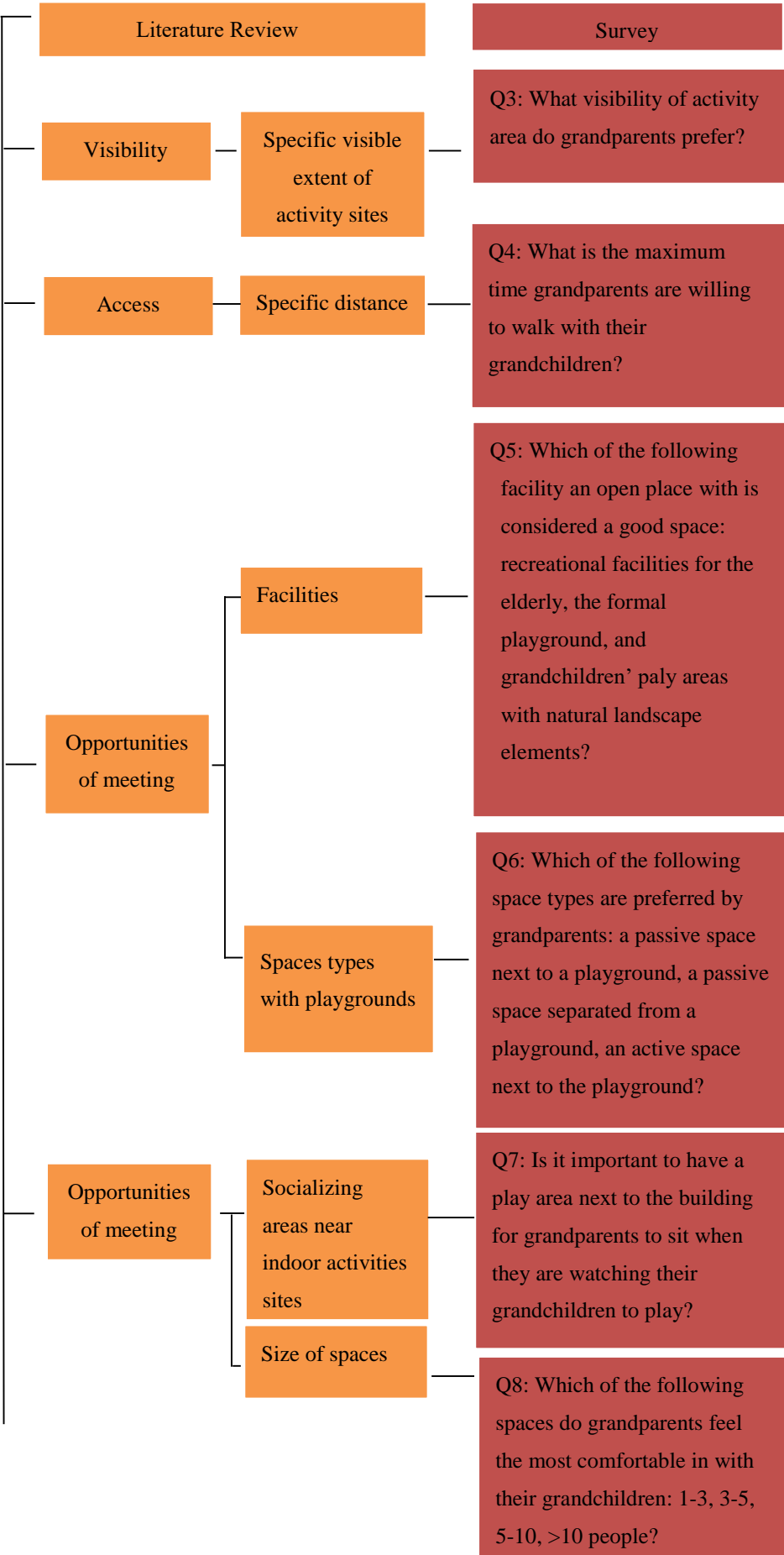
**Opportunities for meeting other people: size and space types, socializing areas near indoor activities sites, and other facilities.**

A series of questions was designed in order to understand the specific features of each landscape characteristic that promoted opportunities for meeting to further examine specific preferences for **size and space types, socializing areas near indoor activities sites, and other facilities** for grandparents who watch over their grandchildren. For example, what sorts of space type within open spaces would grandparents who take care of grandchildren prefer? Also, what size of open spaces would be preferred by grandparents with their grandchildren? Which type of facilities would grandparents who take care of their grandchildren prefer? Is socializing areas near indoor activities sites important for grandparents when watching their grandchildren play?

These questions were designed to explore specific features of landscape elements and were based on the framework that structured the independent variables derived from the literature review (See Figure 6). A schematic illustration of the relationships between those identified independent variables and opposite questions is shown in Figure 5. Due to the

targeted population in this study were Chinese grandparents, children's questions regarding play areas were answered by grandparents.

Research methods



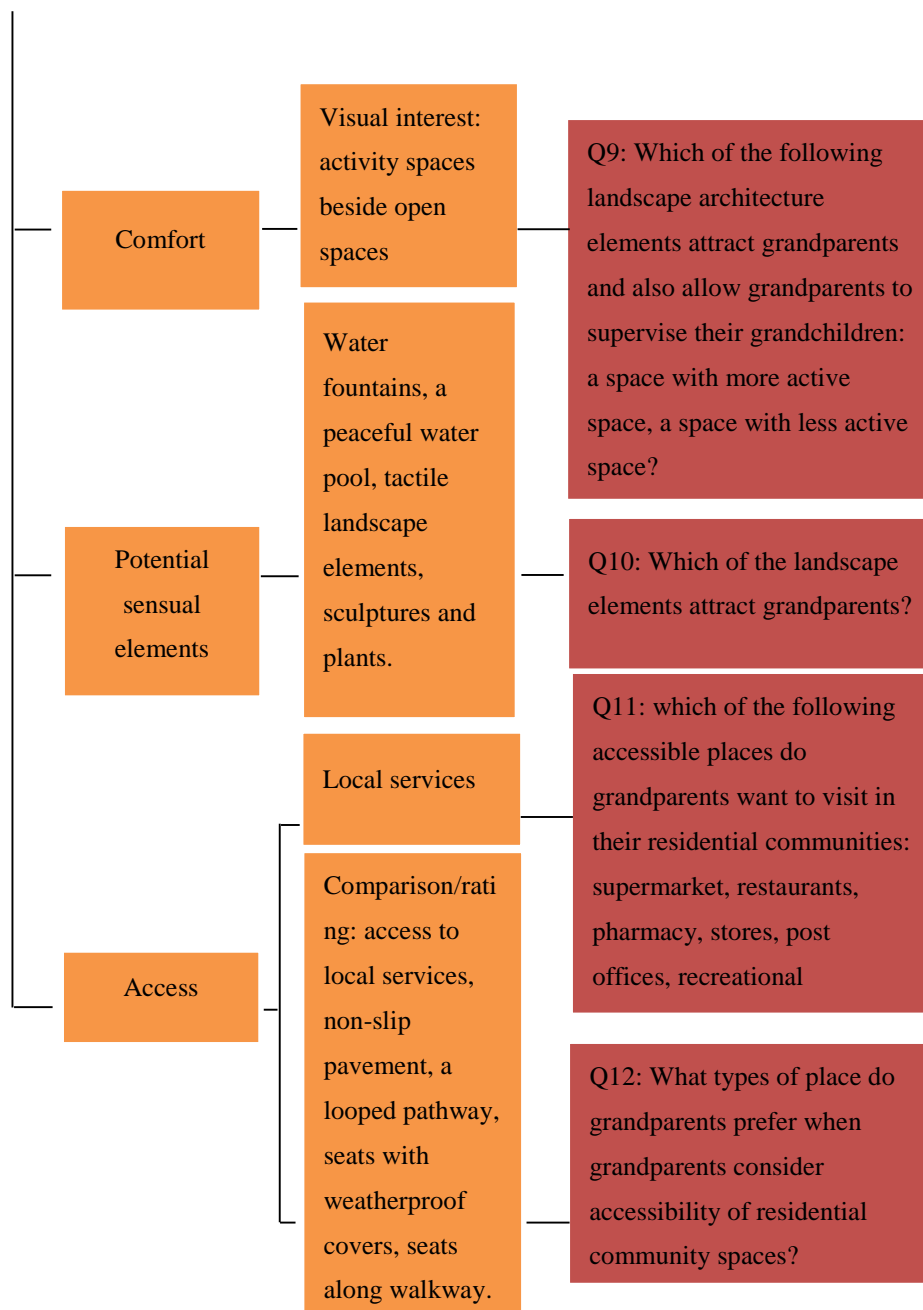


Figure 5 Schematic illustrations of landscape elements (independent variables) and questions in the questionnaire

### 3.3. Design of Questionnaire

A questionnaire was created in order to test the relationships between specific features of landscape elements/characteristics and the relative importance of identified landscape

elements in each group (See Appendix A). These closed-ended questions were developed from the literature review findings.

The questionnaire of this study had three parts: preference for different landscape elements, rating different landscape elements, and social-demographic questions relative to individual characteristics.

**Part I:** This part of the questionnaire examined preferences for different landscape elements/characteristics. A series of descriptive landscape elements/characteristics were presented to participants, and they were asked to choose which landscape elements they preferred. These questions covered the elements of visibility, walking distance, space types and size of spaces, socializing areas near indoor activity sites, social activity sites with open spaces, and facilities. This part consisted of multiple-choice questions. These descriptive questions asked participants their opinions about specific features of landscape elements and revealed what properties of landscape elements/ characteristics were important to the grandparents. There are a variety of questions presented in the questionnaire in this part. Chinese grandparents were forced to choose one item to express their preference in each question. A multiple choice format was used in this part because I wanted to know the favorite landscape elements or characteristics according to Chinese grandparents' preferences.

**Part II:** A Likert-type scale was used in this part of the questionnaire. This scale of responses ranges from strongly agree to strongly disagree with a neutral response in the middle (Maurer & Pierce, 1998). It is often used to measure attitudes by asking the extent to

which they agree or disagree with statements about the items in the question (Maurer & Pierce, 1998). In addition, according to Dawes (Dawes, 2008), the Likert-type scale produces somewhat different comparative mean scores that are worth investigating. Finer scales, such as a seven-point scale, can result in a greater spread of the data and a greater standard deviation (Dawes, 2008).

In this study, participants were asked to rate each landscape characteristic. A seven-point Likert-type scale was used to measure preferences with 1 being “dislike very much,” 2 being “quite dislike,” 3 being “dislike,” 4 being “neutral,” 5 being “somewhat like,” 6 being “quite like,” 7 being “like very much.” Measurement of preferences is an important part of the examination of perceptual progress (Kaplan & Kaplan, 1989).

In this part of the survey, participants could rate a variety of landscape elements/ characteristics according to their first impression for comparison questions. The two comparison questions were as follows: Which places did grandparents prefer to visit in their residential community? Answer choices were supermarkets, restaurants, shopping centers, post offices, pharmacies, and recreational amenities. What types of places did grandparents prefer when they considered accessibility of residential community spaces? The choices were places that had access to local services, places that had a looped pathway, seats alongside the paths which connected to the residential open spaces, seats with covered areas alongside the walkway, and places that had non-slip pavement.

The second type of question provided descriptive comparisons of a variety of landscape elements and asked the respondents to choose their favorite item. There was one comparison

question: which of the following types of space attract grandparents to visit while allowing them to supervise their grandchildren? The answer choices were a plaza with a water fountain where grandparents could watch their grandchildren play, a space with a peaceful water pool, a space with plants, a space with textual landscape elements (such landscape walls), or spaces with remarkable sculptures. A Liker-type scale was used in this part because I wanted to know the descending order for grandparents' preferences for compared landscape element/characteristics.

**Part III:** The third part of the questionnaire contained questions regarding socio-demographic background and individual characteristics. Green, Murphy, & Snyder (Green, Murphy, & Snyder, 2000) recommend that questionnaires should begin with general questions and end with specific demographic questions. Demographic questions are considered easier to answer, so they were put at the end of the questionnaire in order to allow participants self-perception of individual experience with outdoor activities.

This provided researchers with a deeper insight of how personal characteristic differences affected perception of environmental attributes. Based on the current research, age, gender, living situation, locations for daily care of grandchildren, the number of grandchildren, the range of ages of first grandchildren, and the outdoor activity time were selected as social variables examined in the questionnaire



### **3.4. Hypothesis for the Relationships between Identified Independent Variables and Social-demographic Attributes**

Six hypotheses were proposed in order to examine the relationship between the importance of landscape elements and characteristics and social-demographic attributes. Is there any relationship between travel time among age groups? Is there any relationship between travel time and living situation? Is there any relationship between gender and visibility? Is there any relationship between local services among the grandparent age groups? Is there any relationship between accessible landscape characteristics among the grandparent age groups? Is there any relationship between accessible landscape characteristics among the grandchildren age groups?

### **3.5. Selection of Participants**

The survey was conducted in two high-rise residential communities in Shanghai, China over a period of six days, during which the weather was sunny and warm. The questionnaire was distributed in the morning around 8-10 a.m., during mid-day around 12 p.m., and in the afternoon from 4-6 p.m. Fifty grandparents who were watching over their grandchildren and using open spaces in residential communities were selected to participate in this research. They were witnessed using the open spaces or the accompanying facilities as they were watching their grandchildren play in playgrounds or strolling with them in open spaces of residential communities. Paper-based questionnaires were sent directly to the fifty grandparents who volunteered to participate in the survey. A total of 46 people responded to the questionnaire, most of whom were 60 years old. Most respondents had no disabilities or mobility issues.

People from these communities had a variety of perspectives in terms of their personal and social backgrounds.

The procedures of this research included the Virginia Tech Institutional Review Board (IRB) application, recruitment, consent process, and survey.

**IRB Application:** All research materials were submitted to the IRB and permission was granted before the on-site survey was launched. The rights and safety of human subjects participating in this on-site research were protected.

**Recruitment and Consent Process:** The research covered subjects who were grandparents and who were watching over their grandchildren in residential communities of high-rise buildings. These grandparents differed by gender, age, education level, living situation, and number of grandchildren, etc. Two inclusion criteria were used in the survey:

- 1) Participants had to be Chinese and comprehend Mandarin since the survey was in Mandarin.
- 2) Participants had to be grandparents who were watching over their grandchildren.

The eligibility of volunteers who met the requirements of the survey was confirmed on site, and the recruitment material and consent forms were distributed to the volunteering grandparents. The responses were anonymous, and their identities remained confidential.

### **3.6. The Analysis of the Data**

All information collected from the questionnaire was used as data in this research. The participants had to choose their preferred item from a series of items or rate items in a given

set. There were three types of data collection used on the questionnaire: Likert scaling scores, Yes or No answers, or the most preferred answer.

In this study, statistical analysis was used for analyzing questions that explored environmental and social-demographic attributes for grandparents who watch over their grandchildren. Descriptive and inferential statistical analysis were used in order to answer the research questions. SPSS Version 22 was used to perform inferential statistical analysis. Excel Version 2013 was used to present descriptive statistical analysis. The descriptive statistical analysis used a mean rating, bar chart, and pie chart.

The inferential analysis used One-way ANOVA analysis and Fisher's Exact Test. One-Way ANOVA is used to determine whether any significant differences between the means of two or more groups. Fisher's Exact Test is a statistical significance test used in the analysis of contingency categories. In inferential statistical analysis, if the p-value is less than 0.05, it can be concluded that the difference was significant. In this study, inferential analysis was used to analyze the relationships of environmental attributes and social-demographic attributes.

### **3.7. Summary of Methodology**

In summary, the research in this study included a mix of qualitative and quantitative methods. All of the independent variables identified in this research were derived from the literature review. An on-site survey tool was used to conduct the survey and collect the data. Statistical analysis was performed to analyze the data collected from the survey. Suggestions for design guidelines of outdoor environment attributes will be provided based on the final findings of this research.

## **Chapter 4. Findings and Results**

This chapter presents the findings and results of the statistical analysis of the data collected during the on-site survey. Results are organized into three sections: social-economic characteristics, environmental attributes, and correlations between social-economic characteristics and relatively important landscape elements.

In the first section, descriptive analysis was conducted on social-economic characteristics to describe the data collected from the survey. The second section includes results from the survey regarding the relative importance of various landscape elements and characteristics. Visual aids including pie charts, bar charts, and mean ratings were utilized to present the results of the data. In the third section, inferential statistics were conducted to examine the significant differences of several individual variables regarding their impacts on preferred landscape elements by participants, such as age, gender, and living situation. Statistical tests used in this section include Fisher's exact test and the one-way ANOVA. Finally, the last section summarizes the findings and results.

### **4.1. Personal and Social Characteristics**

#### **4.1.1. Demographic Characteristics: Age, Gender, and Education Level**

Of an original sample size of 46 participants, one participant withdrew from the study, and three were excluded due to incomplete data. Thus, the final sample included 46 participants. All participation was voluntary, and responses were kept anonymous. Participant distribution is summarized in Table 2 according to demographic attributes (gender, age, and educational levels).

Table 3 Participant demographic attributes

	Numbers (N)	Percentage
<b>Overall</b>	46	100%
<b>Gender</b>		
Male	24	52%
Female	22	48%
<b>Age</b>		
<60 years old	6	13%
60-65 years old	15	33%
65-70 year old	10	22%
70-75 years old	9	19%
75-80 years old	5	11%
> 80 years old	1	2%
<b>Educational level</b>		
Elementary school	16	35%
High school	21	46%
Undergraduate	8	17%
Master's degree	0	0%
Ph.D.	1	2%
No formal education	0	0%

The data showed that gender was distributed nearly equally among the participants. 52% (n=24) of the participants were male, and 48% (n=22) of participants were female. Age ranges were distributed among six groups: <60 years old (n=6), 60-65 (n=15), 65-70 (n=10), 70-75 (n=9), 75-80 (n=5). However, one participant was over 80 years old (Figure 6).

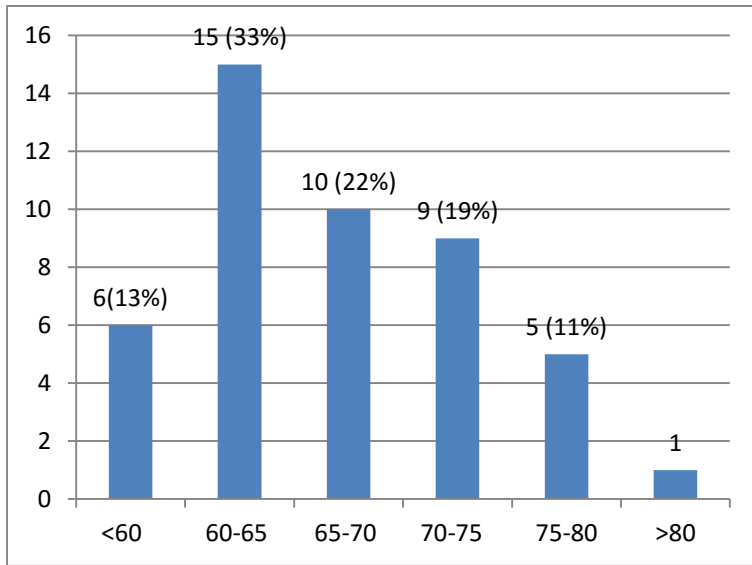


Figure 6 Distribution of participants' age

Within the sample, 35% (n=16) of participants had an elementary school education, 46% (n=21) of participants had a high school education, 17% (n=8) of the participants had Bachelor's degree, and one participant had a Ph. D (Figure 7).

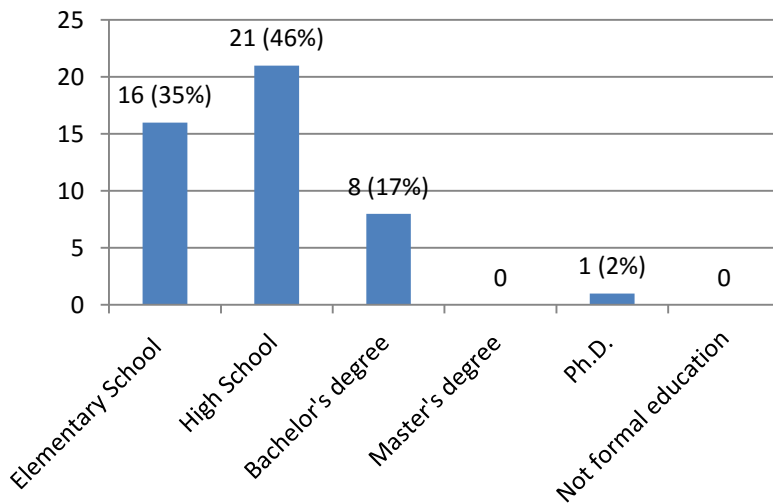


Figure 7 Distribution of participants' educational levels

In summary, males and females were represented fairly equally within the sample, most participants were between 60 and 75 years of age, and the majority reported having a high school education.

#### **4.1.2. Individual Characteristics: Living situation, Locations for daily care of grandchildren, Grandchildren’s situation and Travel time every day**

The distribution of participant characteristics is summarized in Table 4 and includes information regarding the living situation of participants, location and time of daily care of grandchildren, the number of children cared for at a time, and information concerning ages of the grandchildren.

Table 4 Participants’ individual characteristics

	Numbers	Percentage
Overall	46	100%
<b>Living situation</b>		
Living alone	12	26%
Living with spouse	21	46%
Living with extended family	13	28%
<b>Locations for daily care of grandchildren</b>		
Living with grandchildren	27	59%
Not living with grandchildren	19	41%
Taking care of grandkids at grandparents’ house	16	84%
Taking care of grandkids at grandchildren's houses	3	16%
<b>The number of grandchildren to hang out with at once</b>		
one	32	70%
Two	11	24%
More than two	3	6%
<b>The range of the fist grandchildren’s age</b>		
0-3 years old	11	24%
3-5 years old	14	30%
5-10 years old	15	33%
10-12 years old	4	9%
>12 years old	2	4%
<b>The range of age about the rest of the grandchildren</b>		

1 years old	5	
2 years old	2	
3 years old	4	
4 years old	2	
5 years old	2	
7 years old	1	
8 years old	1	
<b>The usual time for hanging out</b>		
Morning	32	70%
At noon	1	2%
Afternoon	10	22%
At night	3	6%

Responses concerning the living situation among grandparents who watch over their grandchildren are shown in Figure 8. Of 46 participants, 26% (n=12) of participants live alone, 46% (n=21) of participants live with a spouse, and 28% (n=13) of participants live with extended family (See Figure 8).

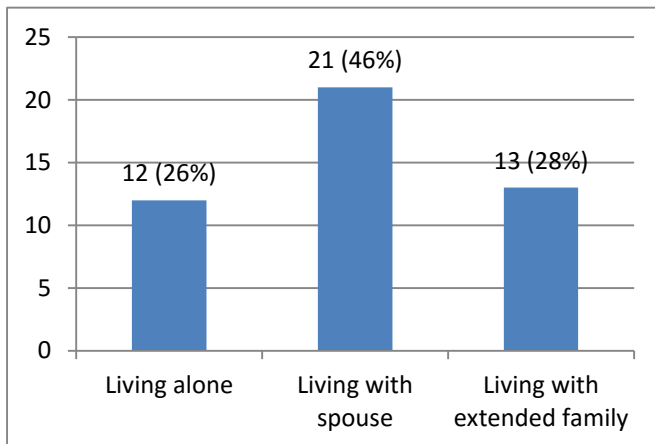


Figure 8 Participants' living situation

59% (n=27) of participants live in the home with their grandchildren, 41% (n=19) of participants do not. Of the 19 participants who do not live with grandchildren, 84% (n=16) of participants take care of their grandchildren at their homes and 16% (n=3) of participants take care of their grandchildren at grandchildren's homes (See Figure 9).



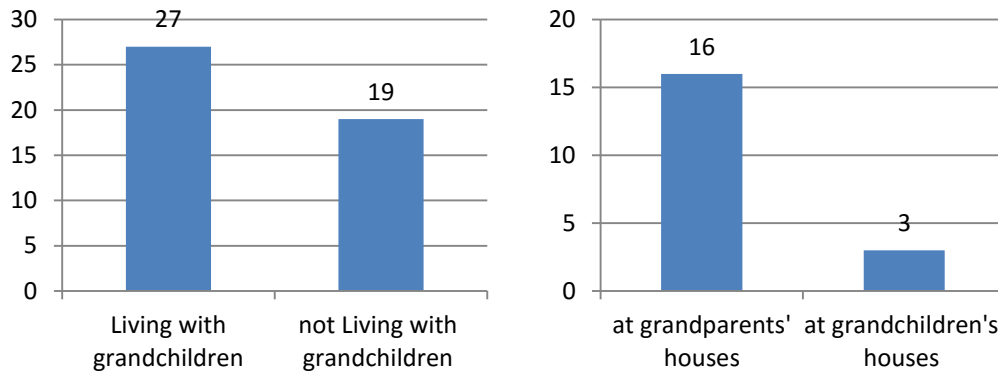


Figure 9 Whether or not participants live with grandchildren? if not, where do they take care of the grandchildren?

Figure 10 shows the number of grandchildren that the participant is typically responsible for at one time. 70% (n=30) of participants usually take one grandchild outside, 24% (n=11) take two kids outside at once, and 6% (n= 3) of respondents usually take more than two. Based on participant responses regarding the age of their oldest grandchildren, 24% (n=11) of the grandchildren were 0-3 years old, and 30% (n=14) of the grandchildren were 3-5 years old. 33% (n=15) of the grandchildren were 5-10 years old, 9% (n=4) of the grandchildren were 10-12 years old, and 4% (n=2) of the grandchildren were older than 12 years old (See Figure 11). For those grandchildren taken outside with their brothers or sisters, ages ranged from 1 to 8 years old.

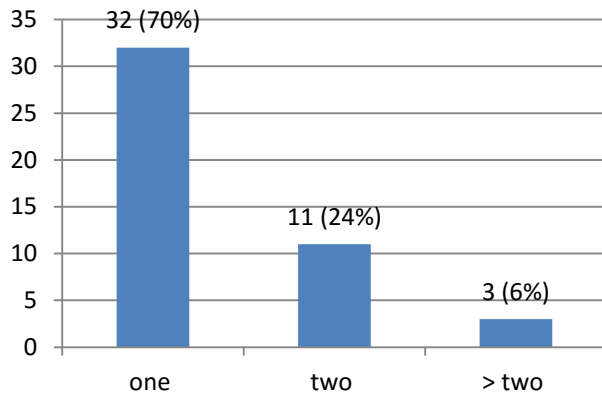


Figure 10 The numbers of grandchildren who are taken by grandparents outside at once

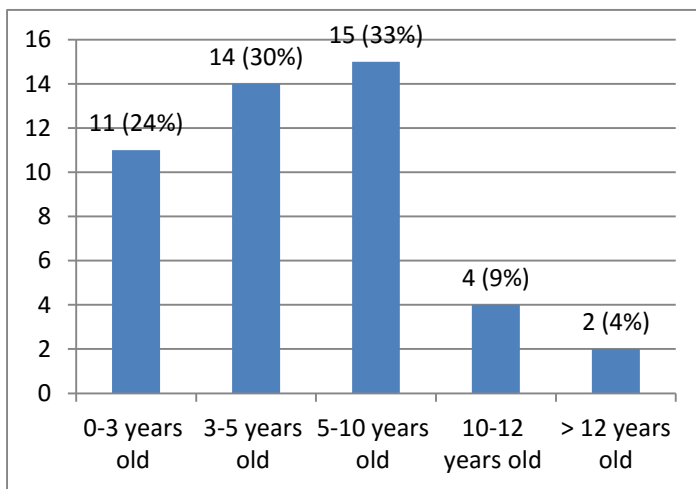


Figure 11 The range of age among grandchildren who are taken by grandparents

According to Figure 12, 70% (n=32) of participants usually take their grandchildren outside in the morning, 2% (n=1) of participants usually go at noon, 22% (n=10) of participants usually go in the afternoon, and 6% (n=3) of participants usually go at night.

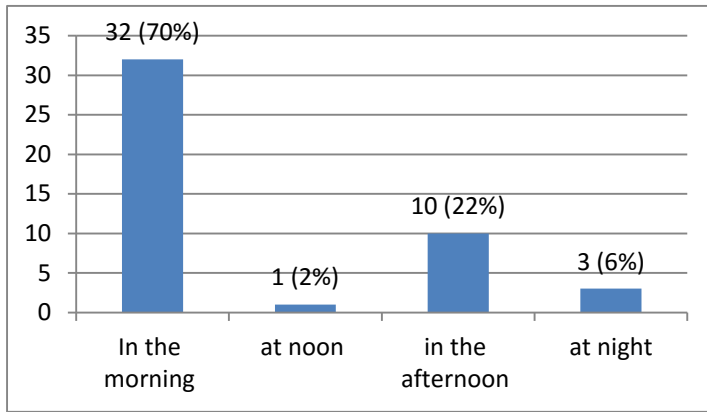


Figure 12 Distribution of time of day of walking with their grandchildren

In summary, most grandparents reported that they either live with grandchildren or provide childcare in their house for their grandchildren. The majority of participants usually take one grandchild to use residential open spaces, most often in the morning. Most grandchildren were between 3 and 5 years old.

#### **4.2. Specific features of landscape elements and relative importance of landscape elements/characteristics preferred by grandparents who watch over grandchildren**

The purpose of these questions is to explore the specific features of independent variables included in the framework (See Figure 4).

##### **4.2.1. What are specific features of landscape elements/characteristics preferred by grandparents who watch over their grandchildren?**

The following results show the preferences of grandparents regarding social interaction in open public spaces of residential communities. 98% (n=45) of participants reported that they would like to socialize with other adults and children. (See Figure 13).

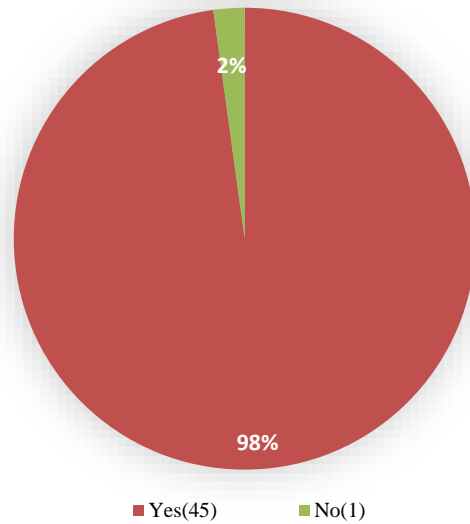


Figure 13 Participants who would like to socialize with other adults/other children

The finding discloses the majority of participants have the desire to socialize with other people.

**Visibility attribute**

The following pie chart shows the level of visibility within activity areas that is preferred by participants. In open spaces of residential communities, 41% of respondents preferred “activity areas that have good visibility,” 35% preferred “activity areas are hardly visible by people,” 17% preferred “activity areas are easily visible by people,” and 7% preferred “activity areas that are not visible by other people” (See Figure 14).

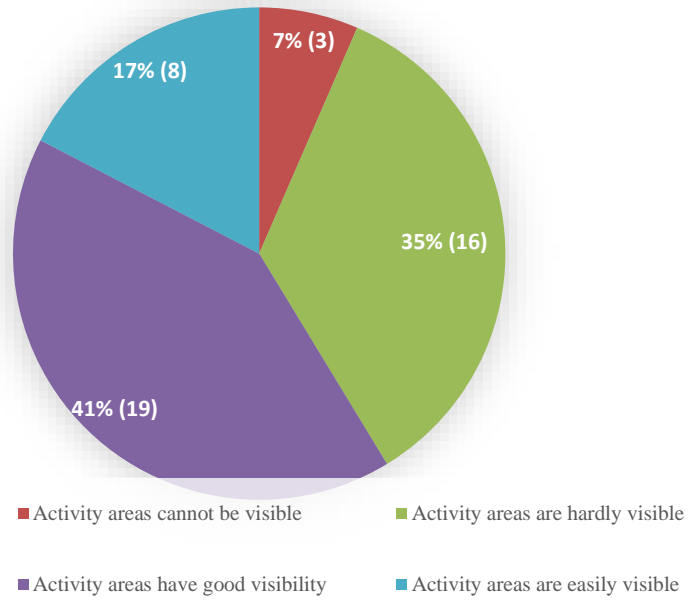


Figure 14 Preferences for visibility

## Opportunities for Meeting

### *Socializing areas near indoor activity sites*

Figure 15 shows that 78% (n=36) of participants prefer socializing areas near indoor activity sites.

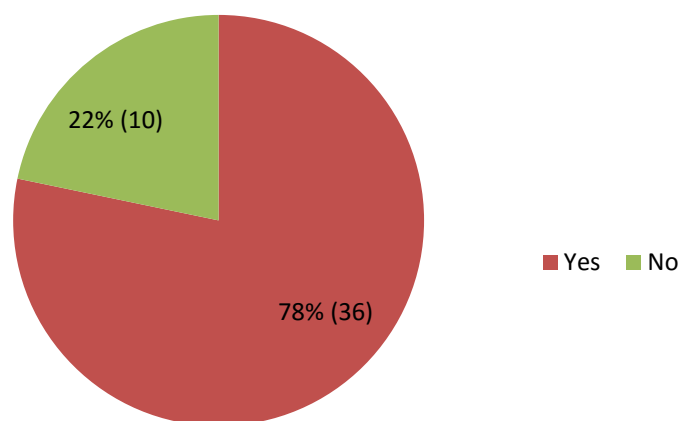


Figure 15 Preferences for socializing areas near indoor activity sites

### *Facilities*

Figures 16 and 17 represent preferences regarding different types of facilities both from their perspectives and the perspectives of their grandchildren. The results show the same levels of preference (37%, n=17) for both “places that have the recreational facilities for grandparents” and “places with children’s facilities visible to grandparents.” 26% (n=12) of participants prefer “places that have natural landscape elements for grandchildren” (See Figure 16).

In addition, when they consider the same characteristics for places to visit concerning their grandchildren’s needs, 35% (n=16) of participants are willing to visit “places that have the recreational facilities for grandparents” that they can use while their grandchildren play. 32% (n=15) of participants tend to visit “places with children’s facilities visible.” A similar number of participants prefer “places that have natural landscape elements for grandchildren” (See Figure 17 **Error! Reference source not found.**). These findings indicate that the participants report highest levels of preference for either recreational facilities for the elderly or formal playgrounds.

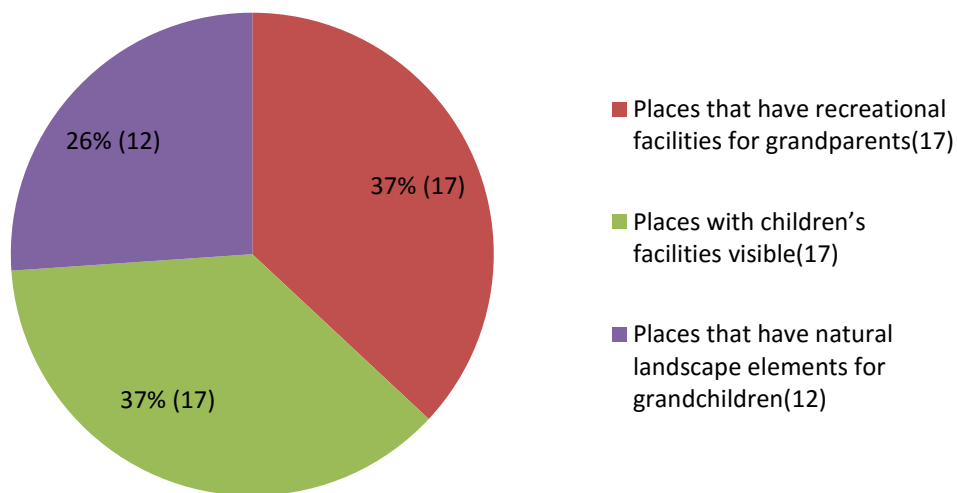


Figure 16 Participants preferences to facilities (from grandparents' perspective)

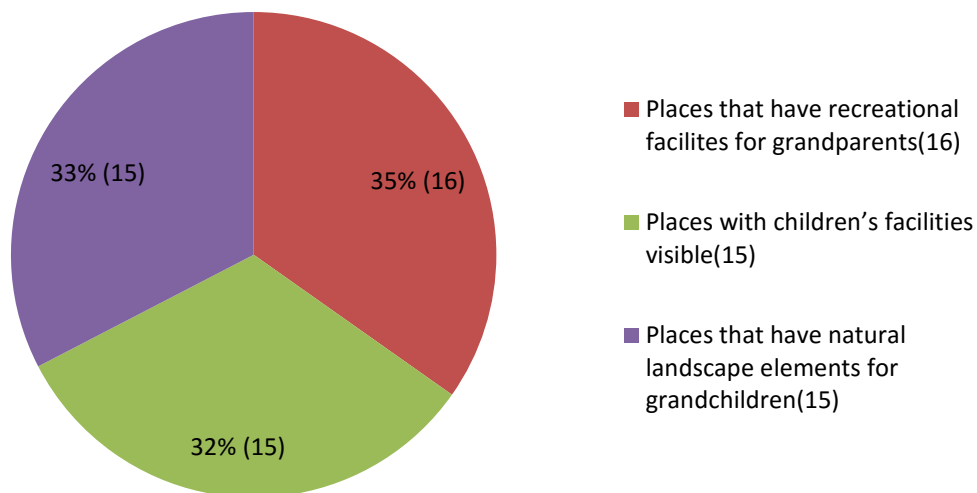


Figure 17 Participants preferences to facilities (from grandchildren' perspective)

### ***Space types with playground***

As shown in Figure 18, 46% (n=21) of participants prefer “an active space next to a playground” when they are watching their grandchildren play while 30% (n=14) of participants prefer “a passive space next to a playground.” 24% (n=11) of participants like “a

passive space that is physically separated from a visible playground.” The results show that the majority of the participants prefer the style of space that has an active space next to the playground when they are watching their grandchildren.

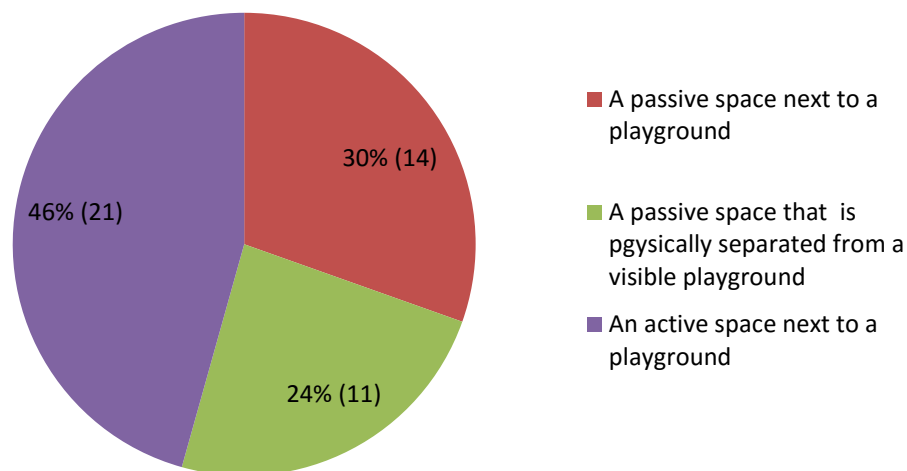


Figure 18 Percentage of participants preferences to different space types with playgrounds

### *Space size for grandparents' activity spaces*

Figure 19 represents the preferred size of space of all participants. 33% (n=15) of participants preferred “a space which can accommodate 3-5 people,” 28% (n=13) preferred “a space which can accommodate 5-10 people,” and 26% (n=12) preferred “a space which can accommodate 1-3 people.” The least popular space size was “a space which can accommodate more than 10 people” and was selected by 13% (n=6) of participants. The result shows the most popular suitable space size for grandparents who watch over their grandchildren is 3-5 people.



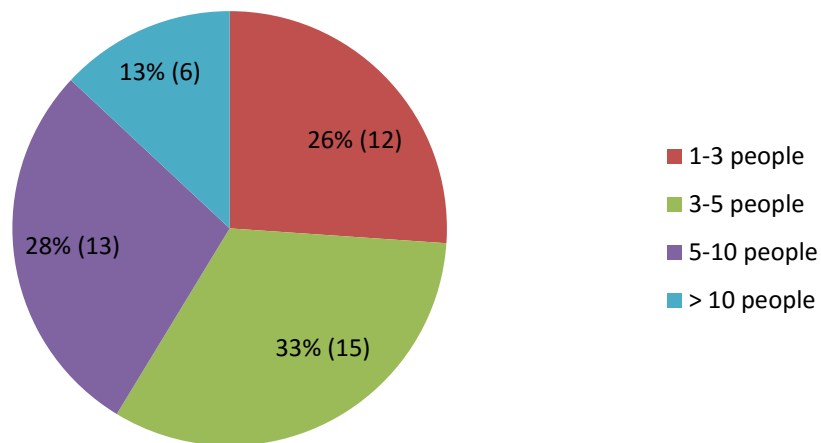


Figure 19 Space size that the participants liked

**Access Attribute**

*Distance*

Figure 20 displays the maximum time that participants reported that they were willing to spend walking with their grandchildren to an open space in their residential communities. 70% (n=32) of respondents were willing to travel to an open space within 10 minutes of their home. 28% (n=13) of respondents were willing to walk between 10-30 minutes away from home, and 1 participant was willing to spend 30-60 minutes walking to an open space with their grandchildren. The results indicate the majority of participants prefer to walk a short distance, within 10 minutes, from their home to an open space (See Figure 20).

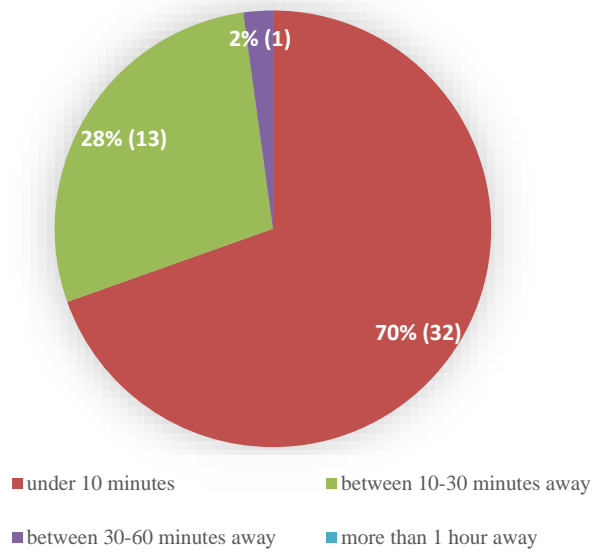


Figure 20 Preferences of distances walked to go to an open space

## Comfort Attribute

### *Visual interest*

### *Activity sites near grandparents' activity spaces*

91% (n=42) of participants preferred “a space with less activity space” rather than “a place with more activity space.” Only 9% (n=4) of participants selected “a place with more activity space” (See Figure 21). According to the results, less activity space was more attractive than more activity space for the participants.

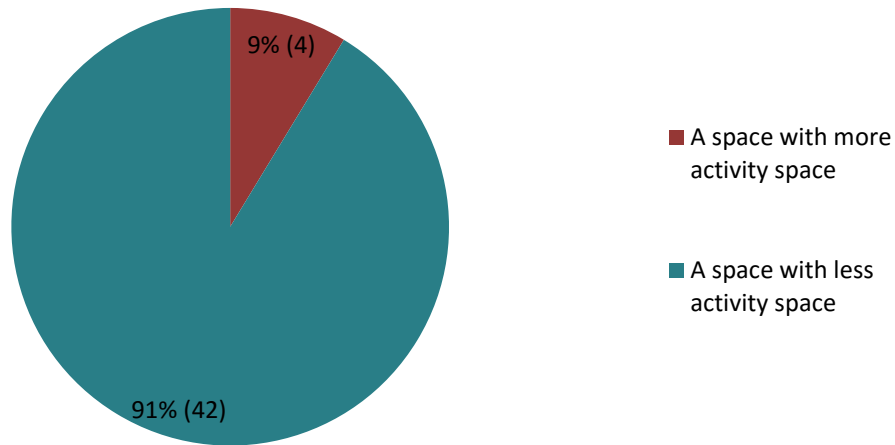


Figure 21 Participants preferences to places with different activity types

**4.2.2. What is the relative importance of landscape elements for grandparents who watch over their grandchildren?**

**Potential sensory elements: compare *water feature (Acoustic element)*, *sculpture (Aesthetic element)*, *plants (Aesthetic element)*, and *landscape wall (Tactile elements)***

A bar chart was used to show the importance of landscape elements to distinguish the frequency of each response. The design element “plants” and “a peaceful water pool” were considered most important, followed by “water fountain in a plaza” and “sculptures.” The least important design element was “tactile landscape walls.” These results show “plants” and “a peaceful water pool” are preferred more by the participants than water fountains, sculptures and tactile landscape walls (See Figure 22).

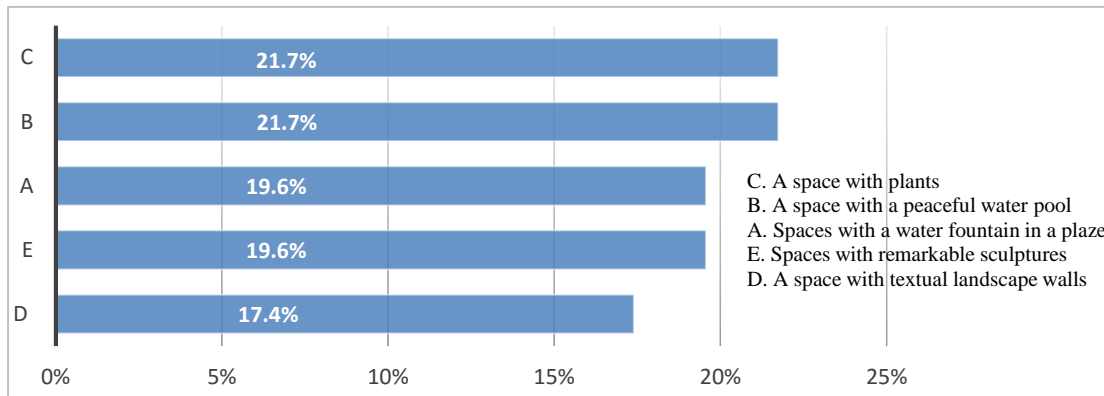


Figure 22 Relative importance (%) of the different design elements relative to potential sensory elements in residential communities

**Access attribute:**

*Local services*

A mean measurement was used to analyze the average scores of preferences regarding local services. These local services included supermarkets, restaurants, pharmacies, stores, post offices, and recreational amenities and were presented in a 7 point Likert-type scale. Each participant selected one answer. The mean measurement of the ratings for these local services is presented in Table 5. Results are listed in the order in which they appeared in the survey. Among all of the local serves, participants most preferred “places that have access to recreational amenities,” followed by “places that have access to a supermarket” and “places that have access to stores.” The least popular responses were “places that have access to a pharmacy,” “places that have access to restaurants,” and “places that have access to post offices.”

Table 5 Mean rating for presences of local services

Question 11	Mean
A. Places that have access to a supermarket	5.91
B. Places that have access to restaurants	5.04
C. Places that have access to a pharmacy	5.28

D. Places have access to stores	5.56
E. Places that have access to post offices	4.60
F. Places that have access to recreational amenities	6.28

***Compare access to local service, a looped pathway, seats along walkway, seats with weatherproof covers and places that have non-slip pavement***

Mean ratings for a series of design elements that are associated with the accessibility attribute are presented in Table 6. Based on the mean preference scores, “places that have non-slip pavement” was the most preferred design element, followed by “seats that are alongside the paths which connect to the residential open spaces.” The three least preferred design elements were “places that have access to local services,” “seats with covers alongside the walkway,” and “places that have a looped pathway.”

Table 6 Mean rating for preferences for a series of design elements that are related to an accessibility attribute

Question 12	Mean
A. Places that have access to local services	5.78
B. Places that have a looped pathway	5.52
C. Seats that are alongside the paths which connect to the residential open spaces	5.86
D. Places that have seats with covers alongside the walkway	5.73
E. Places that have non-slip pavement	5.89

**4.3. Is there any relationship between preferred landscape elements/characteristics and social-demographic and individual variables?**

Fisher’s Exact Test and a One-way ANOVA were used to test the existence of a relationship between preferred landscape elements and characteristics, social demographics, and individual variables based on the six hypotheses. Fisher’s Exact Test was used for testing

different categories, such as travel time and age groups. The One-way ANOVA test was used for testing two and more scores and categories, such as mean scores and age groups.

#### 4.3.1. Differences in Individual Characteristics (age, gender and living situation) and Travel time /Visibility

Fisher’s Exact Test is a statistical significance test used in the analysis of contingency categories. For this study, the test was used to test differences in the travel time and age groups, differences in travel time and living situation, differences in gender and visibility, and differences in gender and potential sensual elements.

#### Differences in Travel Time Among Age Groups

Table 8 displays the results of the Fisher’s Exact Test and shows that there was a correlation between age groups and the maximum time the participants were willing to spend on traveling to open spaces. In other words, the age of participants made a difference in how far away from home they were willing to walk ( $p=.003$ , Fisher’s Exact Test). Table 7 shows that the older participants are, the longer time they prefer to spend walking to an open space.

Table 7 Test for the relationship between age groups (question 13) and travel time (Question 4)

**Q13 \* Q4 Cross tabulation**

		Q4			Total
		1.0	2.0	3.0	
Q13	Count	6	0	0	6
	1.0 % within Q13	100.0%	0.0%	0.0%	100.0%
	% within Q4	18.8%	0.0%	0.0%	13.0%
	Count	13	2	0	15
	2.0 % within Q13	86.7%	13.3%	0.0%	100.0%
	% within Q4	40.6%	15.4%	0.0%	32.6%
3.0	Count	5	5	0	10

	% within Q13	50.0%	50.0%	0.0%	100.0%
	% within Q4	15.6%	38.5%	0.0%	21.7%
	Count	6	3	0	9
4.0	% within Q13	66.7%	33.3%	0.0%	100.0%
	% within Q4	18.8%	23.1%	0.0%	19.6%
	Count	2	2	1	5
5.0	% within Q13	40.0%	40.0%	20.0%	100.0%
	% within Q4	6.3%	15.4%	100.0%	10.9%
	Count	0	1	0	1
6.0	% within Q13	0.0%	100.0%	0.0%	100.0%
	% within Q4	0.0%	7.7%	0.0%	2.2%
	Count	32	13	1	46
Total	% within Q13	69.6%	28.3%	2.2%	100.0%
	% within Q4	100.0%	100.0%	100.0%	100.0%

Question 13. How old are you?

- 1.0. <60 years old.
- 2.0. 60-65 years old.
- 3.0. 65-70 years old.
- 4.0. 70-75 years old.
- 5.0. 75-80 years old.
- 6.0. >80 years old.

Question 4. What is the maximum time you are willing to walk with your grandchildren to an open space to play in your residential community?

- 1.0. Places that are close to your home and under 10 minutes away.
- 2.0. Places that are close to your home and between 10-30 minutes away.
- 3.0. Places that are close to your home and between 30-60 minutes away.
- 4.0. Places that are close to your home that is above 1 hours away.

Table 8 Fisher's Exact Test for difference in travel time among age groups

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	10.261 <sup>a</sup>	4	.036	.034		
Likelihood Ratio	11.796	4	.019	.030		
Fisher's Exact Test	9.658			.030		
Linear-by-Linear Association	7.604 <sup>b</sup>	1	.006	.006	.004	.002
N of Valid Cases	46					

a. 7 cells (70.0%) have expected count less than 5. The minimum expected count is 1.83.

b. The standardized statistic is 2.758.

Because of the warning under the Chi-Square Tests Table, “7 cells (70%) have expected to count less than 5”, the p-value of this test cannot be used. This warning means the sample is too small for the Chi-Square Test to be considered valid. Generally, the Chi-Square Tests is used to test a larger sample size. Instead, the p-value of Fisher's Exact Test was used due to its ability to test a small sample size.

### Differences in Travel Time and Living Situation

The results shown in Table 10 indicate a significant difference between Travel Time and Living Situation ( $p=.013$ , Fisher's Exact Test). That is, the living situation of the participants had a significant impact on the amount of time they preferred to spend walking with grandchildren. Table 9 shows those living alone preferred to devote more time to walking rather than those living with someone else.



Table 9 Test for the relationship between travel time (question 4) and living situation (Question 16)

**Q16 \* Q4 Cross tabulation**

		Q4			Total
		1.0	2.0	3.0	
Q16	Count	4	7	1	12
	1.0 % within Q16	33.3%	58.3%	8.3%	100.0%
	% within Q4	12.5%	53.8%	100.0%	26.1%
	Count	18	3	0	21
	2.0 % within Q16	85.7%	14.3%	0.0%	100.0%
	% within Q4	56.3%	23.1%	0.0%	45.7%
	Count	10	3	0	13
	3.0 % within Q16	76.9%	23.1%	0.0%	100.0%
	% within Q4	31.3%	23.1%	0.0%	28.3%
Total	Count	32	13	1	46
	% within Q16	69.6%	28.3%	2.2%	100.0%
	% within Q4	100.0%	100.0%	100.0%	100.0%

Question 16. What is your living situation?

- 1.0. Living alone.
- 2.0. Living with spouse.
- 3.0. Living with extended family.

Question 4. What is the maximum time you are willing to walk with your grandchildren to an open space to play in your residential community?

- 1.0. Places that are close to your home and under 10 minutes away.
- 2.0. Places that are close to your home and between 10-30 minutes away.
- 3.0. Places that are close to your home and between 30-60 minutes away.
- 4.0. Places that are close to your home that is above 1 hours away.

Table 10 Fisher's Exact Test for difference of the travel and living situation

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	11.401 <sup>a</sup>	4	.022	.008		
Likelihood Ratio	11.164	4	.025	.022		
Fisher's Exact Test	10.447			.013		
Linear-by-Linear Association	5.954 <sup>b</sup>	1	.015	.018	.011	.008
N of Valid Cases	46					

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .26.

b. The standardized statistic is -2.440.

### Differences in Gender and Visibility

The results shown in Table 12 indicate a significant relationship between gender and the visibility attribute ( $p = .021$ , Fisher's Exact Test). Males and females reported different preferences for visibility of an activity space. Table 11 indicates that males are willing to stay in an activity area with good visibility by other people, but females prefer to stay in an activity area that is hardly visible by other people.

Table 11 Test for the relationship between gender (question 14) and visibility (Question 3)

		Q3				Total
		1.0	2.0	3.0	4.0	
Q14	Count	2	3	11	6	22
	1.0 % within Q14	9.1%	13.6%	50.0%	27.3%	100.0%
	% within Q3	66.7%	18.8%	57.9%	75.0%	47.8%
	Count	1	13	8	2	24
	2.0 % within Q14	4.2%	54.2%	33.3%	8.3%	100.0%
	% within Q3	33.3%	81.3%	42.1%	25.0%	52.2%
Total	Count	3	16	19	8	46
	% within Q14	6.5%	34.8%	41.3%	17.4%	100.0%
	% within Q3	100.0%	100.0%	100.0%	100.0%	100.0%

Question 14. What is your gender?

- 1.0 Male
- 2.0 Female

Question 3. Which of the following described scenes do you prefer, particularly regarding the visibility of the activity area in residential communities?

- 1.0. Activity areas cannot be visible by other people.
- 2.0. Activity areas are hardly visible by other people.
- 3.0. Activity areas have good visibility by other people.
- 4.0. Activity areas are easily visible by other people.

Table 12 Fisher’s Exact Test for difference of gender and visibility

<b>Chi-Square Tests</b>						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)	Point Probability
Pearson Chi-Square	8.987 <sup>a</sup>	3	.029	.023		
Likelihood Ratio	9.560	3	.023	.030		
Fisher's Exact Test	8.994			.021		
Linear-by-Linear Association	4.007 <sup>b</sup>	1	.045	.053	.033	.019
N of Valid Cases	46					

- a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 1.43.
- b. The standardized statistic is -2.002.

#### **4.3.2. Differences in Local Services/Accessible landscape elements and Age Groups (grandparents’ age group and grandchildren’s age groups)**

The One-Way ANOVA is used to determine whether there are any significant differences between the means of two or more groups about local services/accessible landscape elements and age groups.

#### **Differences in Local Services among Age Groups**

The results shown in Table 13 indicate a significant difference existed in preferences regarding local services among age groups. There was a strong relationship in preferences of

the participants among age groups. The three strongest relationships of local services with the age groups can be ranked in descending order: “places that have access to recreational amenities” among age groups ( $F=3.208$ ,  $p=.016$ ), “places that have access to a supermarket” ( $F=2.552$ ,  $p=.043$ ), and “places that have access to post offices” ( $F=2.466$ ,  $p=.049$ ).

Table 13 One-Way ANOVA Test for difference local services among grandparents’ age groups

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
A	Between Groups	3.786	5	.757	2.552	.043
	Within Groups	11.867	40	.297		
	Total	15.652	45			
B	Between Groups	2.046	5	.409	1.181	.336
	Within Groups	13.867	40	.347		
	Total	15.913	45			
C	Between Groups	2.571	5	.514	.904	.488
	Within Groups	22.756	40	.569		
	Total	25.326	45			
D	Between Groups	.815	5	.163	.450	.811
	Within Groups	14.489	40	.362		
	Total	15.304	45			
E	Between Groups	6.823	5	1.365	2.466	.049
	Within Groups	22.133	40	.553		
	Total	28.957	45			
F	Between Groups	4.959	5	.992	3.208	.016
	Within Groups	12.367	40	.309		
	Total	17.326	45			

Question 11. Which of the following places do you prefer to visit in your residential community?

- A. Places that have access to a supermarket.
- B. Places that have access to restaurants.
- C. Places that have access to a pharmacy.
- D. Places that have access to stores.
- E. Places that have access to post offices.
- F. Places that have access to recreational amenities.

### Differences in Landscape Characteristics Related to Accessibility Attribute among Age

## Groups of Grandparents

The results shown in Table 14 indicate a significant difference in a series of landscape characteristics that are related to the accessibility attribute among age groups. There was a strong correlation between the preferences of “places that have access to local services” ( $F=3.346$ ,  $p=0.013$ ) among age groups.

Table 14 One- Way ANOVA Test for difference of landscape elements among grandparents’ age groups

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
A	Between Groups	6.437	5	1.287	3.346	.013
	Within Groups	15.389	40	.385		
	Total	21.826	45			
B	Between Groups	.989	5	.198	.352	.878
	Within Groups	22.489	40	.562		
	Total	23.478	45			
C	Between Groups	3.395	5	.679	1.524	.204
	Within Groups	17.822	40	.446		
	Total	21.217	45			
D	Between Groups	1.614	5	.323	.748	.592
	Within Groups	17.256	40	.431		
	Total	18.870	45			
E	Between Groups	4.901	5	.980	2.005	.099
	Within Groups	19.556	40	.489		
	Total	24.457	45			

Question 12. What types of place do you prefer when you consider accessibility of residential community spaces?

- A. Places that have access to local services.
- B. Places that have a looped pathway.
- C. Seats that are alongside the paths that connect to the residential open spaces.
- D. Seats with weatherproof coverage
- E. Places that have non-slip pavement.

## Differences in Landscape Characteristics Related to Accessibility Among Age Groups of

### Grandchildren

According to Table 15, the results indicate a significant difference existed in some landscape characteristics related to the accessibility attribute among age groups of grandchildren. Moreover, there was a significant difference in the preferences for “places that have access to recreational amenities” ( $F=2.813$ ,  $p=0.038$ ) among grandchildren’ age groups, followed by “places that have access to local services” ( $F=2.712$ ,  $p=0.043$ ) (See Table 15).

Table 15 One-Way ANOVA Test for difference of landscape elements among grandchildren’ age groups

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
A	Between Groups	4.567	4	1.142	2.712	.043
	Within Groups	17.259	41	.421		
	Total	21.826	45			
B	Between Groups	1.385	4	.346	.642	.635
	Within Groups	22.094	41	.539		
	Total	23.478	45			
C	Between Groups	4.127	4	1.032	2.475	.059
	Within Groups	17.090	41	.417		
	Total	21.217	45			
D	Between Groups	1.724	4	.431	1.031	.403
	Within Groups	17.145	41	.418		
	Total	18.870	45			
E	Between Groups	5.266	4	1.317	2.813	.038
	Within Groups	19.190	41	.468		
	Total	24.457	45			

Question 12

- A. Places that have access to local services.
- B. Places that have accessible paths around them.
- C. Seats that are alongside the paths that connect to the residential open spaces.
- D. Seats with weatherproof coverage

*E. Places that have non-slip pavement.*

#### **4.4. Summary of Results**

A questionnaire was designed based on existing research to test their findings within the population of Chinese grandparents responsible for grandchildren. Additionally, this study collected demographic information and performed statistical tests in order to assess any influence on relative preferences of landscape characteristics. Six hypotheses were proposed to examine the relationships between the relative importance of various landscape elements, demographics, and individual characteristics.

Forty-six participants took the survey. Among the participants, the male to female ratio was almost equal. Most of the participants ranged from 60 to 75 years old and had a high school education. The data shows that almost half of the participants (46%) lived with a spouse, and more than half of the participants (59%) lived with grandchildren. Among those who did not live with grandchildren (41%), the majority of the participants took care of grandchildren in their home (84%). More than half of the participants (70%) usually took one child at a time outside, and 70% of the participants regularly visited open spaces within the residential communities in the morning.

An overwhelming majority of the participants would like to socialize with other adults or grandchildren (98%). Based on this, it is worthwhile to explore which environmental attributes influence their preferences. The data indicates that the percentage of participants who preferred “an activity area that has good visibility” and who preferred “an activity area that is hardly visible” are very similar. The results of inferential statistical analysis revealed

that females preferred “an activity area that is hardly visible” and that males preferred “an activity area that has good visibility.” The results show that the participants are willing to visit socializing areas near indoor activity sites. Additionally, 78% of them thought “socializing areas near indoor activity sites” is very important.

Of the participants, 70% of them were only willing to spend 10 minutes walking to an open space, while 28% of participants were willing to spend 10 to 30 minutes walking to an open space. The interesting finding is that the two aspects of age group and living situation play an important role in their preferences to the travel time. Specifically, the older the participants were willing to travel for a greater amount of time. In addition, those who live alone preferred to spend 10 to 30 minutes walking to an open space. However, those who lived with someone else were only willing to spend less than 10 minutes walking.

The data also shows that “places with recreational amenities” was the most attractive landscape characteristic for the participants, compared to other local services. Among a series of accessible landscape characteristics, “places that have non-slip pavement” and “places that have access to local services” were preferred more than other choices. According to the inferential statistical analysis, age groups did make a difference in which local services they most preferred to visit within their community, including “places that have access to recreational amenities,” “places that have access to a supermarket.” Furthermore, there was a significant difference in the importance of “places that have access to local services” among age groups.



As for opportunities of meeting, Participants reported that either “the recreational facilities for grandparents” or “children’s facilities in an open space” most attracted them to public open spaces. At the same time, they preferred “an active space next to a playground.” Moreover, “a space with less activity space” was most preferred by participants. Finally, yet importantly, spaces able to accommodate 3 to 5 people was the most common response regarding space size. The results from the data also revealed that peaceful water pools and plants were preferred the most by the participants.

Based on these findings and results, a discussion is necessary to understand further the association between findings in previous literature reviews and findings in this study. Some design recommendations will be suggested to promote the enhancement of quality of residential communities in the light of grandparents’ needs.

## Chapter 5. Discussion

The findings indicated that 98% of the participants were willing to socialize with other adults and children when watching their grandchildren play. Since the grandparents need to rebuild new social ties after retirement (Harry R. Moody, 2010), it is important that these spaces containing the following features provide ample opportunity for socialization (Kazmierczak 2013).

### Access attribute

#### *Distance*

Results showed that the majority of the participants preferred to travel to open spaces in under 10 minutes, but a few respondents would like to take 10-30 minutes to go for a walk. These results coincide with findings from (Turel et al., 2007), who claimed that a short distance to recreation areas is desirable to the older population. To test for a relationship between distance, living situations, and age groups previously suggested by (Alves et al., 2008), this article proposes six hypotheses. In Fisher's Exact Test, two categories that influenced results the most were age and living situation. Results showed that both living situation (living alone or living with someone else) and age groups influenced individual choices.

Those living alone preferred to walk a greater distance from home to an open space (10-30 minutes), compared with those respondents living with someone else, who preferred to travel a shorter distance to an open space (<10 minutes). This result underlines that categorization of two types of attributes: those "in open spaces" versus those "on the way to

open spaces.” It is possible that the respondents living alone are less likely to have access to visit an open space, so they consider the journey to the open space to be quality time, too. Thus, distance plays a significant role in their preferences.

In contrast, for those living with a spouse or extended families, there may be a stronger focus on the destination. The results are similar to the previous research by Susana Alves (2008). Similar results were obtained when design guidelines produced by English Nature were followed (Handley & Nature, 2003). It stated that individuals should have green space no further than 300m, or a five-minute walk away from their home if they are to visit open spaces regularly. Therefore, it is important to provide an adequate number of open spaces or green spaces near residential buildings within 10 minutes, and open spaces further from home within 10-30 minutes.

The results of the survey also suggest it is preferable that open spaces are located near residential buildings. Therefore, it is vital that both quality of the route and quality of open spaces are considered, based on differing travel preferences related to individual demographic characteristics.

Additionally, results of the analyses showed a significant difference between age groups regarding individual choices of travel time. Older respondents were willing to spend a larger amount of time walking to an open space (See Table 7). This willingness may be due to increased awareness of the necessity of exercise throughout the aging process.

*Access to local services, a looped pathway, seats alongside walkway, seats with weatherproof covers alongside walkway, non-slip pavement*

Participants preferred recreational facilities more than other accessible local services, including supermarkets, restaurants, pharmacies, stores, and post offices. This result is consistent with an earlier study which showed that access to recreational amenities and local shops provide older adults with places to walk and to meet others (Michael et al., 2006). Additionally, analysis suggested that age groups did make a difference in the preferences of recreational amenities, supermarkets, and post offices.

However, local services were not considered to be the most important design element, when compared to others such as, “places that have a looped pathway,” “seats that are alongside the paths which connect to the residential open spaces,” “seats with covers alongside walkways,” and “places that have non-slip pavement.” Of five possible types of open spaces, with different accessibility landscape characteristics, “places that have non-slip pavement” ranked first in average means among preferences of respondents (See Table 5). This preference is likely due to safety concerns for both themselves and their grandchildren. Statistical analysis showed a difference between age groups of grandparents and preferences for “places that have access to local services.” However, age groups of grandchildren influence preferences for “places that have access to local services” and “places that have non-slip pavement.” It is likely that the younger the grandchildren are, the more likely it is that grandparents prefer “non-slip pavements.” Many studies explored a range of landscape elements/characteristics related to accessibility attributes.

### **Visibility attribute**

Many studies have correlated visibility to fears of crime and violence, which has resulted in adequate spaces going unused (Franck and Paxson, 1989). According to results from data analysis, gender plays an important role in preferences regarding visibility of activity areas. The results indicate that females prefer hardly visible activity areas. In contrast, males prefer easily visible activity areas.

This result confirms the proposal of Franck and Paxson (1989) which stated that gender plays an important role in using open spaces. A possible reason for this difference between gender groups is that men and women have different levels of perceived personal safety. Therefore, both areas with good visibility and areas with lower levels of visibility should provide for grandparents who watch over their grandchildren in residential open spaces.

## **Opportunities for Meeting**

### *Facilities*

An analysis of preference regarding facilities revealed that both “places that have the recreational facilities for grandparents” and “places with grandchildren’s facilities visible” were preferred at similar levels by grandparents; there was no difference between the two when considering what made open spaces attractive to them. This result is supported by the notion of many previous studies (Kaźmierczak, 2013; Marcus et al., 1986; Sugiyama & Thompson, 2008). They presented that playgrounds not only support contact between children but their guardians, too (Kaźmierczak, 2013; Marcus et al., 1986). Additionally, Sugiyama & Thompson (2008) reported that recreational facilities promote the elderly’s health.

The relatively low number of responses for “places that have natural landscape elements for grandchildren to explore while being supervised” was surprising. This result contrasts the findings of Moor and Wong (1997), that noted nature materials and environments are important features involved in the promotion of childhood growth and development. The disparity between previous literature and these results may be due to a fear of accident or injury in a natural landscape.

However, when facilities were considered from the grandchildren’s perspective in the survey, results showed that “places that have the recreational facilities for grandparents” was most highly preferred. This could mean that the grandparents hope to exercise as well as supervise their grandchildren, or that they hope to find others of a similar age with which to socialize within the recreational areas.

#### *Space types near playgrounds*

Concerning space types, results of the analysis indicate that “active space next to a playground” led to participants wanting to stay longer in an open space. This finding contradicts previous studies. For example, Marcus & Francis (1997) stated that places with opportunity for more passive exercise can encourage the use of these areas by the elderly. These results suggest that grandparents prefer to socialize with other older adults who are taking care of their grandchildren as well.

#### *Size of spaces*

According to Marcus & Francis (1997), in order to support a close, intimate relationship between a few friends, a small intimate space should be provided to the elderly. However, there are no articles that mention what size space the elderly prefer. In this study, a small space, one that can accommodate 3-5 people, is the most comfortable space for the elderly to spend time in and socialize with other people.

#### *Socializing areas near indoor activity sites*

The result confirms the arguments of (Marcus & Francis, 1997; Zhong, 2008), who stated that socializing areas near indoor activity sites are important for this specific population.

#### **Potential Sensory Elements**

An analysis of a variety of landscape elements indicated that plants and peaceful water pools were the most important design elements when compared to other options. These landscape elements were categorized as the visual interests category, but there was some overlap with the potential sensory elements group. According to Marcus & Francis (1997), of visual, auditory, and tactile stimulation, tactile clues are particularly important. Results from this study do not support this claim.

As Shu-Shun Lucy Hang (2006) reported, plants, water features, and sculptures in outdoor spaces can attract people to remain in spaces longer and stimulate their conversation. Similarly, preference for plants and peaceful water pools tied as the most popular option. However, sculptures, tactile landscape walls, and a water fountain in a plaza did not rank as

highly. These results could be linked to a desire to experience nature, as participants live in urban residential communities. It is likely that the data was collected in high-rise buildings that are located in urban areas.

## **Comfort**

### *Social activity sites*

Previous research stated that people and human activity are the greatest objects of attention and interest for people (Jan Gehl, 1998). Visibility is an important aspect to consider when attempting to create opportunity for social interaction in open spaces. According to Marcus & Francis (1997), areas for more passive exercise can also encourage use by the less able. The result in this study confirms Marcus & Francis's (1997) argument. The majority of the participants prefer "a space with less activity space."

The findings of this study have implications for the promotion of access to and use of an open space. Additionally, these findings can promote the increased duration of visits to open spaces. To encourage this population to spend time in open spaces, it is important to focus on enhancing quality. This can be achieved by creating improved access, comfort, visibility and opportunities for meeting. Results are displayed in Table 13, including comparisons between previous studies and preferred landscape elements/characteristics found in this study.

Through this comparison, the findings can be used not only as the continuation of previous research literature but also the basis for a more theoretical synthesis for future literature.



## **Chapter 6. Conclusion**

This chapter consists of four parts: a summary of the study, implications of the study, limitations and suggestions for future studies, and guidelines. These four sections systematically elaborate the development process of the study and suggest directions that future studies may take.

### **6.1. Overview**

This paper aimed to explore social activities of grandparents in public open spaces. Due to the enlargement of the aging population within China, the number of grandparents and grandchildren using community open spaces has gradually increased. Since social interaction is beneficial for this population, open spaces in residential communities should consider the needs and preferences of grandparents and grandchildren. This paper studied the environmental attributes of open spaces in communities that can promote social interaction and improve well-being.

An extensive literature review was conducted to identify important environmental attributes and supporting landscape elements/characteristics that promote physical activity and social interaction in open spaces. Existing landscape elements and characteristics were determined and compiled in a framework to test previously studied Western preferences against the preferences of Chinese grandparents and their grandchildren. Some already existing landscape elements were too general. A questionnaire was formulated to provide clarity regarding these elements as well as assess their preferences concerning public open spaces.

This study also explored the relative importance of landscape elements/characteristics for grandparents. Research was conducted on the association between different landscape elements and characteristics and personal and social characteristics in a sample of grandparents in residential communities in Shanghai, China. This was done in order to provide a better understanding of making outdoor environments for grandparents and grandchildren (Alves et al., 2008). Through the exploration of relationships between relative importance of landscape elements/characteristics and personal and social characteristics, design suggestions were proposed considering varying individual characteristics, such as age, gender and living situation.

Subsequent survey questions were designed based on the four aspects listed above. The questionnaire was distributed in selected residential communities in Shanghai, China to grandparents who were using open spaces or strolling in open spaces with their grandchildren. The results from the survey were analyzed using simple descriptive statistical analysis and inferential statistical analysis with Fisher's Exact Test and One-Way ANOVA. Survey results led to the final production of a set of design guidelines for grandparents who take care of their grandchildren in residential open spaces.

## **6.2. Implications**

This study contributes to a new understanding concerning the preferences of Chinese grandparents with grandchildren in residential open spaces in Shanghai, China. It informs where interventions and policy focus can be directed most effectively to increase use of outdoor spaces by grandparents and promote their social interaction in residential open

spaces. This research provides strong evidence to identify important landscape elements that need to be altered to enhance the quality of open spaces in residential communities.

There are three primary aspects of the findings. First, this study identifies a series of specific landscape elements/characteristics preferred by Chinese grandparents who are watching over their grandchildren in residential communities in Shanghai, China. Second, it reveals the relative importance of landscape elements/characteristics regarding potential sensory elements, comfort, and accessibility attributes through comparison of a series of landscape elements/characteristics. Third, it uncovers six relationships between relatively important landscape elements and demographics.

These findings and results serve as a basis for design guidelines. These guidelines can help those involved in the design, planning, and management of outdoor environments to prioritize interventions that maximize preferences of grandparents. Preference maximization can be achieved through enhancement of the quality of open spaces to promote the use of these spaces by grandparents, opportunities for social interaction, and their sense of well-being in residential open spaces.

To the best knowledge of the author, this is the first study to research Chinese grandparents with grandchildren in Chinese residential open spaces, through using inferential statistical analysis to reveal the potential association between the relative importance of landscape elements and personal and social background of the grandparents. Based on these results, the guideline was formed not only from direct responses but their individual features (age, gender, living situation) as well.

## **6.3. Design Recommendations**

### **Access attribute**

#### ***a. Distance***

Since grandparents and their grandchildren prefer a short travel distance, different locations of open spaces should be taken into account to meet different individual needs. Additionally, living situations as well as specific age groups influence their preferences and should be considered.

#### **1) The locations of open spaces**

Design outdoor public open spaces in proximity to residential buildings, no more than 10 minutes away, to provide opportunities for social interaction among grandparents when taking care of their grandchildren outside. However, it is also acceptable to design public open spaces within 10-30 minutes walking distance to accommodate those who are willing to walk longer to open spaces.

#### **2) Pleasing routes**

Design pleasing routes that connect residential buildings and public open spaces within 10-30 minutes, where grandparents can share more time with their grandchildren.

#### ***b. Access to local services***

#### **Design open spaces based on relative importance of accessible local services**

Provide places that have access to local services. The three most important local services, ranked in descending order, are recreational amenities, supermarkets, and stores. Less

essential local services are pharmacies, restaurants, and post offices. These local services not only provide daily activities for grandparents with grandchildren but also increase opportunities for them to social activities in residential open spaces.

*c. Relative importance of accessible landscape elements*

**Design open spaces based on relative importance of accessible landscape elements**

The three most preferred landscape characteristics are places that have non-slip pavement, seats that are alongside the paths which connect to the residential open spaces, and places that have access to local services. Less popular options include places with canopies alongside the paths and places that have a looped pathway.

**Opportunities of meeting**

**a. Space size which can accommodate 3-5 people**

To support an intimate relationship with a few friends, create small, private spaces that can accommodate 3-5 people. This space size makes grandparents with grandchildren feel comfortable and can promote social interaction with grandparents and with other people.

**b. Active spaces next to playgrounds**

Create active spaces next to playgrounds, separate but still in view of the playground.

**c. Less active spaces beside grandparents' activity spaces**

Create less active spaces beside grandparents' activity spaces, which make open spaces more attractive for grandparents with grandchildren.

**d. Recreational facilities for older people and children's facilities**

Provide recreational facilities for older people as well as facilities for children within the playground.

## **Visibility**

It should be noted that male and female grandparents prefer varying amounts of visibility, with males preferring more visibility than females.

### **Two spaces should be provided: high and low visibility activity areas**

Design separate activity areas, one with high levels of visibility by other people and one with lower levels of visibility to accommodate both genders. Ideally, this will result in the choice to spend longer amounts of time within the spaces.

Design activity areas with high visibility by creating a combination of perceived safety and scenic quality, achieved by reducing shrubs and raising tree canopies to improve visibility at ground level (Schroeder & Anderson, 1984).

In contrast, activity areas with low visibility should be designed with an abundance of shrubs, trees, and mounds. Fences and walls can be adopted to increase the privacy of the spaces.

## **Potential sensory elements**

### **The relative importance of potential sensory elements: peaceful water pools and plants**

The most important landscape element in making open spaces attractive to grandparents are plants and peaceful water pools. Less important landscape elements include water

fountains in plazas, remarkable sculptures, and tactile design elements. It is vital to include these potential sensory elements accordingly in order to promote more use of the open space.

## **Design Recommendations**

### **Access attribute**

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Design outdoor public open spaces in proximity to residential buildings, no more than 10 minutes away, to provide opportunities for social interaction among grandparents when taking care of their grandchildren outside. However, it is also acceptable to design public open spaces within 10-30 minutes walking distance to accommodate those who are willing to walk longer to open spaces.

### **4) Pleasing routes**

Design pleasing routes that connect residential buildings and public open spaces within 10-30 minutes, where grandparents can share more time with their grandchildren.

#### ***e. Access to local services***

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### **6.4. Limitation and Suggestions for Future Study**

One limitation of the current study is due to limited statistical analysis techniques. Analysis of significant relationships can only determine the existence of a relationship, not the details of said relationships. For example, a significant difference existed between age groups regarding preferences for “places that have access to a supermarket,” “places that have access to post offices,” and “places that have access to recreational amenities.” Exactly how age groups influence individual choices is yet to be determined.

Further research is warranted, including the examination of additional levels of relative importance of landscape elements. There are more landscape elements/characteristics that play an important impact on in preferences of grandparents concerning social interaction, such as space layout, note, and informal activities spaces for grandchildren. Based on limitations of the survey method, these design elements could not be tested in the survey. The use of observation and interviews would lead to more information on social behaviors among grandparents who are watching over their grandchildren. In addition, some integrative results can be further explored, such as the integration of multiple design elements preferred by grandparents could be tested in the future.

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## APPENDIX A: Survey Questionnaire

### Survey Questionnaire

1. **Do you like to socialize with other adults while you watch your grandchildren playing outside?**
  - Yes
  - No
2. **Do you like to socialize with other children while you watch your grandchildren playing outside?**
  - Yes
  - No
3. **Which of the following described scenes do you prefer, particularly regarding the visibility of the activity area in residential communities?**
  - A. Activity areas cannot be visible by other people.
  - B. Activity areas are hardly visible by other people.
  - C. Activity areas have good visibility by other people.
  - D. Activity areas are easily visible by other people.
4. **What is the maximum time you are willing to walk with your grandchildren to an open space to play in your residential community?**
  - A. Spaces that are close to your home and under 10 minutes away.
  - B. Spaces that are close to your home and between 10-30 minutes away.
  - C. Places that are close to your home and between 30-60 minutes away.
  - D. Places that are close to your home that is above 1 hour away.
- 5a. **What is the most important landscape architecture element when you consider a good space for yourself?**
  - A. Places that have the amenities for grandparents as well as to watch your grandchildren playing.
  - B. Places with children's facilities visible to you.
  - C. Places that have natural landscape elements for grandchildren to explore and while being supervised.
- 5b. **What is the most important landscape architecture element when you consider a good space for your grandchildren?**
  - A. Places that have amenities for grandparents as well as to watch your grandchildren playing.
  - B. Places are with children's facilities visible for you.
  - C. Places that have natural landscape elements for grandchildren to explore while being supervised.
6. **Which following space types do you prefer to sit when you are watching your grandchildren to play?**

- A. A passive space that is designed next to a playground.
- B. A passive space that is physically separated from a visible playground.
- C. An active space that is designed next to a playground.

**7. Is it important to have a play area next to the building for you to sit when you are watching your grandchildren to play?**

- Yes, it is very important
- No, it does not matter

**8. Which of the following spaces do you feel the most comfortable in with your grandchildren?**

- A. A space which can accommodate 1-3 people.
- B. A space which can accommodate 3-5 people.
- B. A space which can accommodate 5-10 people.
- D. A space which can accommodate more than 10 people.

**9. Which of the following spaces do you believe will attract you to take your grandchildren outside?**

- A. A space with more activity space, such as basketball, and tennis courts.
- B. A space with less activity space, such as gate ball court (croquet), chess tables, waterfront for fishing, or a plaza for dancing.

**10. Which of the following landscape architecture elements attract you to and also allow you to supervise your grandchildren?**

- A. A plaza with a water fountain where you can watch your grandchildren play.
- B. A space with a peaceful water pool.
- C. A space with plants (such as fragrant plants, trees and shrubs).
- D. A space with textual landscape architecture elements, such as landscape walls.
- E. Spaces with remarkable sculptures.

**11. Which of the following places do you prefer to visit in your residential community?**

- A. Places that have access to a supermarket.
- B. Places that have access to restaurants.
- C. Places that have access to a pharmacy.
- D. Places that have are access to stores.

E. Places that have are access to post offices.

F. Places that have are access to recreational amenities.

**12. What types of place do you prefer when you consider accessibility of residential community spaces?**

A. Places that have access to local services.

B. Places that have accessible paths around them.

C. Places that have access to a pharmacy.

D. Seats that are alongside the paths which connect to the residential open spaces.

E. Places with shelter.

F. Places that have non-slip pavement.

**13. How old are you?**

A. less than 60 years old.

B. 60-65 years old.

C. 65-70 years old.

D. 70-75 years old.

E. 75-80 years old.

F. > 80 years old.

**14. What is your gender?**

A. Male

B. Female

**15. What is your educational level?**

A. Elementary school

B. High school

C. Undergraduate

D. Master

E. Ph. D.

F. No formal education

**16. What is your living situation?**

- A. Living alone.
- B. Living with spouse.
- C. No formal education

**17. Do you live with your grandchildren?**

- A. Yes (If yes, please do answer number 18 question)
- B. No (If no, please answer number 18 question.)

**18. Do you care for your grandchildren at your house or at their house?**

- A. My house
- B. Their houses

**19. How many grandchildren do you usually take outside at once?**

- A. One
- A. Two
- A. > Two

**20. How old are your grandchild?**

- A. 0-3 years old
- B. 3-5 years old
- C. 5-10 years old
- D. 10-12 years old
- E. >12 years old

If you have more than one grandchild, please list their ages.

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**21. When do you usually take your grandkids outside? Please rank the following four items from the most frequent to the least.**

- A. Morning
- B. At noon
- C. Afternoon
- D. At night

## **APPENDIX B: Consent Form**

### **VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY**

#### **Informed Consent for Participants in Research Projects Involving Human Subjects**

##### **Title of Project**

Preferences of social interaction for environmental attributes among grandparents who are taking care of grandchildren in Chinese urban residential communities

##### **Investigator(s)**

Mintai Kim, PhD (Principal Investigator).

Fan Cao, Master's Degree Candidate (Co-Investigator)

##### **I. Purpose of this Research/Project**

This study aims to examine the environmental attributes preferred for social interaction in neighborhood open spaces by a sample of grandparents who watch over their grandchildren in Shanghai, China. It also aims to explore specific landscape elements relevant to these preferred attributes as well as their connection between the personal and social background of the sample. The research objective is to provide design guidelines for designers and managers. Thus, improving the quality of neighborhood open spaces in urban areas.

##### **II. Procedures**

The survey will be conducted in residential communities in Shanghai, China. If you agree to participate in this study, you will be given a questionnaire. You will answer related questions in the questionnaire's answer sheet. After finishing the questionnaire, you will hand over the questionnaire to the researcher. There will be no further contact with you after the survey session.

Each survey will take 20 minutes. For grandparents who take care of their grandchildren, verbal consent is required to participate in survey. Please be aware that grandchildren are not allowed to participate.

##### **III. Risks**

The emotional risks are minimal. The survey was designed to inform and allow you to avoid graphic images used in the study which could possibly influence your emotion.

#### **IV. Benefits**

The information gathered from this study can be used to help residential managers and decision makers to design better residential environment in the future. Since, this study is purely academic, it has no intention to change current landscape architecture design adopted in residential communities.

#### **V. Extent of Anonymity and Confidentiality**

Your identity will remain confidential and the answers will only be described in ways that cannot be traced back to you. The data obtained from this survey will be stored in a locked drawer in the investigator's office and on personal computer with password required. Only the co-investigator has access. The data will be destroyed at the successful completion of the thesis defense, publication of any scholarly papers, and presentation of results at conferences.

#### **VI. Compensation**

You will NOT receive any compensation if you took the survey.

#### **VII. Freedom to Withdraw**

You may refuse to participate or leave this survey at any time.

#### **VIII. Subject's Responsibilities**

You are encouraged to ask any questions at any time during this survey.

#### **IX. Subject's Permission**

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary verbal consent:

Should I have any pertinent questions about this research or its conduct, research subjects' rights, and

whom to contact in the event of a research-related injury to the subject, I may contact:

**Investigators**

Mintai Kim, ([mkim07@vt.edu](mailto:mkim07@vt.edu) / +1 540-200-8402)

Fan Cao (([cfan85@vt.edu](mailto:cfan85@vt.edu) / +1 585-857-6202)

**Chair, Virginia Tech Institutional Review Board for the Protection of Human Subjects**

David M. Moore, +1 540-231-4991/[moored@vt.edu](mailto:moored@vt.edu)

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