

Nature as a Design Element in Small Urban Public Spaces

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ABSTRACT

Historically, urban environments have incorporated nature in their construction and composition. But now, with increased urban densities, space is a premium and small public spaces have become a focus for building nature into cities. Literature on nature as a design element is reviewed and observations of behaviour recorded in four small public spaces. Time lapse photographic records of stationary users were mapped using GIS (Geographic Information System). Subspace analyses, comparisons between subspaces in each location, and comparisons between similar subspaces across locations, were analysed according to age, gender, type of activity, and length of stay. While natural design elements and social activity were related, non-used natural elements like vacant grass or vacant edges indicate design elements in small urban public spaces should have functional value integrated into the design context.

Keywords: Nature; Public space; Design elements, GIS; Behavior mapping.

INTRODUCTION

“A city, as a built place, is often seen as the antithesis of nature, since buildings and pavements displace forest and fields. Yet in most cities, the artificial human landscape includes elements of living nature selectively woven into its hard fabric” (Lawrence, 1993, p. 90).

Nature has been intertwined with the life of city residents throughout history (McKibben, 1989; Madanipour, 1996). From ancient Persian gardens to today’s pocket parks, nature has been a design element in cities (Migge, 2013). With the industrial revolution and urbanization, the separation between habitation and nature increased (Williams, 2005). In response, in the latter half of the 19th century, large green spaces were created within cities. The isolation of nature within these spaces disconnected nature from other parts of the city. The spaces turned into Sunday gardens, tourist attractions (Madanipour, 2003; Migge, 2013). In the 20th century, urban densities necessitated locating nature in smaller public spaces in compact city centres (Bettencourt et al., 2007; Chiesura, 2004; Forsyth, et al., 2005; Fajardo, 2007; Van den Berg, Hartig & Staats, 2007). These visual-artistic uses of nature created debate in urban design literature (Jordaan et al., 2008; Knox, 2005; Madanipour, 1996; Maruani & Amit-Cohen, 2007; Matsouka & Kaplan, 2008; Golicnik & Thompson, 2010; Van Kamp et al., 2003; Thompson, 2002), even though there is a deficit of research on how natural design elements contribute to the use of public space in urban centres (Nordh, Alalouch & Hartig, 2011; Nordh et al., 2009; Nordh & Østby, 2013).

Natural Design Elements in Public Spaces before Industrialization

The history of green space in urban areas stretches back thousands of years (Dempsey, 2012),

Humana Park (2000 BC) and other hunting parks in Assyria, Nineveh (705 BC), the hanging gardens of Babylon (604 BC), and the Persian paradise (539 BC) are early examples of modified landscapes. The Greeks and Romans brought nature into the social life of its urban residents. The Greeks saw green in the city as a sacred place and a place for civic life. The Romans understood the value of open spaces for the health and happiness of Roman citizens. Roman parks were practical, being used for recreation and entertainment. For example, in Rome Porticus Pompeiana (55 BC) was a large open space with green areas, sheltered areas, and water features, showing a combination of aesthetics and function as a place of entertainment (Jones & Wills, 2005).

Chinese and Japanese gardens were influenced by Taoism and Buddhism with the belief that every landscape element has power and energy, and there is no separation between spirit and matter, man and nature. Islamic gardens on the other hand are symbols of paradise with four rivers that flow out from the middle as the key element (McIntosh, 2005). Religious gardens in Europe under the influence of Christianity and Judaism were enclosed, setting boundaries to foster harmony and order. In churches of the Middle Ages the space outside the church was the place where paradise could exist and a garden was a symbolic place for meditation and prayer, where individual flowers illustrated aspects of Christian faith (Prest & Prest, 1981).

The Italians brought nature into their cities in the 16th century by creating villa gardens with their terraces, groves and ornamental ponds, "... proof of man's superiority" (McHarg, 1969, p.71). In renaissance France, the French imposed new patterns, often very simple and applied at a larger scale to flat landscapes. Here the ornamental qualities of plants in pattern making are more important than the plants themselves (McHarg, 1969). In England in the 17th and 18th centuries nature was evident in parks in large estates, residential squares and in walled house gardens which were mostly a functional space for growing food or herbs. In the large parks belonging to houses of the rich, landscapes were representations of the ideal garden, like the dreams of painters. English gardeners saw all nature as a garden (McHarg, 1969) and wished to create an aesthetic unity that reflected natural processes (Chadwick, 1966, Jones & Wills, 2005). This same approach was later transferred to the large 19th century city parks created for ordinary people.

Borrowing the Italian concept of plaza, residential squares were used by English planners to create open space in new residential neighbourhoods of expanding cities. From the early 18th century onward these open squares were transformed into garden squares and were often enclosed with fencing, becoming semi-private gardens rather than public spaces (Chadwick, 1966; Longstaffe-Gowan, 2012). This elaboration of squares not only introduced nature into the town, reflecting the evolving social and aesthetic functions of the square in the urban fabric, but "... introduced rural landscape values into the urban fabric in ways that continue to shape urban landscape ideas today" (Lawrence, 1993, p. 90).

Green Space after Industrialization

The expansion of urban areas in the industrial revolution exiled residents from nature with distances and time making it difficult to travel out of cities in their free time. This led to working class demands for parks to serve as multi-purpose recreational landscapes, places for sports, social clubs and play grounds (Chadwick, 1966, Jones & Wills, 2005). Up to this time gardens and green spaces were open to specific people but this was the turning point in the use of nature for democratic gathering. Countryside was moved to the city by opening gardens to the public and creating new parks as a place for pleasure and entertainment (Jones & Wills, 2005). Central Park in New York was built (1857-1873) for this purpose and the first pocket park, Bowling Green in 1733 was designed to make the city a more livable habitat for working-class (Dempsey, 2012; Seymour, 1969).

Where social reform in the 19th century created mostly large parks where people could take a relaxing walk or carriage ride, in the 20th century these spaces evolved as open spaces modernized for use by groups and for public functions (Cranz, 1978; Young 1995). This transition has continued into the 21st century with parks and green space becoming more flexible. Valued for where personal and cultural diversity is expressed, as social places, places for refuge and contact with nature, and places as part of an ecological network (Thompson, 2002).

Increasing interest in Small Urban Spaces

The large scale modifications of the environment that came with industrialized urbanization separated nature from people and converted rural land for urban uses (McKibben, 1989; Mumford, 1969; Pickett et al., 2008; Williams, 2005). Infrastructure costs and loss of landscape for ever expanding urban developments raised awareness of sustainable development and increased demand for green space in the life of urban residents (Bettencourt et al., 2007; Budruk, et. 2009; Chiesura, 2004; Lapage, 2007; UNDoE, 2006; Van den Berg et al., 2007). Urban planning policies preserved untouched areas, created large green open spaces and urban parks to address ecological concerns (Nilsson et al., 2011; Schipperijn, et al., 2013; Stigsdotter et al., 2010, Forsyth, et al., 2005). With pressures on land in growing cities and increasing land prices, these spaces are seen as opportunities for development (Chiesura, 2004). Pocket parks, which have their design roots in the enclosed urban gardens of the 17th and 18th centuries, have been shown to have an ecological benefit (Forsyth, Musacchio & Fitzgerald, 2005) and are more likely to be used than larger parks because they are more immediately related to the work place or the home (Gold, 1977; Grahn & Stigsdotter, 2003; Neuvonen, et al., 2007; Peschardt & Stigsdotter, 2013).

Migge argues that the urban gardens of the city centre or midtown where people work and live, should not be Sunday gardens. They should be actively used on weekdays and weekends, outdoor rooms with a human scale. People don't want shrub and "... tree museums in the park that belongs to them" (Migge, 2013; p.75). Accessible spaces used for recreation, rest, play, gathering, gardening and restoration for people living and working in the area. In the context of sustainable development, the space should provide an "... optimal configuration that offers leisure areas, an oasis for contemplation or an ideal meeting spota place to "breath", "relax", stroll, and for outdoor activities which cannot be done at home [or work], precisely for a lack of space" (Fajardo, 2007, p.6: brackets added). Important in themselves, not an incidental adjunct or treated waste space of office developments or housing projects (Seymour, 1969).

In this context which emphasizes managing resources wisely as a way to meet the needs of society for a considerable period of time (Pearce et al., 1990), the design of small urban space is crucial. However, even before sustainability became a mainstream idea, preferences for contact with nature, use of nearby open places in everyday life for social interaction, and the lack of land in urban environments, have highlighted the important role of small green spaces in the city (Forsyth, et al., 2005; Mumford, 1969).

Measuring Success of Public Space

This question of non-use or under use of neighbourhood parks was first raised by Jacobs (1961). Public space was seen as successful when a destination used by individuals and groups for diverse activities (Gehl, 1987; Whyte, 1980, Carmona, 2010; Lennard & Lennard, 1995). Coley et al. (1997) found that adding trees and grass transforms residents' preferences of local areas from dislike to like. This study also found time spent in a space is related to the presence, location and number of trees. In addition to increasing the numbers of users, having a greater number of trees was also found to attract larger groups. Kuo, et al. (1998) also found a positive correlation between the

density of trees and preferences. Huang's (2006) investigated five outdoor spatial categories of design elements in neighbourhood high-rise housing: 'seating space', 'scenic space' (containing landscape elements with visual significance), 'circulation space', 'activity space', and 'vague space'. More social interactions were observed in activity spaces and scenic spaces with a visual focus (water features, sculptures) and green elements (trees, shrubs, flowers). Trees are a design element that can define a subspace and unify the overall site. Sitting under trees provides a sense of enclosure, protection and safety in a territory defined (Lang, 1994; Lennard & Lennard, 1995).

A well maintained presence of green elements enhances use of space, brings physical comfort, relieve feelings of stress, and contributes to a sense of safety and beauty (Carr et al., 1992; Gehl, 1987; Kaplan, 1983; Kuo et al., 1998; Lang, 1994; Lennard & Lennard, 1995; Mehta, 2006). In addition, study of New York plazas found sunlight the greatest attractant and emphasized the role of water in enhancing people's use of space (Whyte, 1980). People's behaviour is positively influenced by visually attractive environments (Sherrod & Downs, 1974; Nasar, 1994) and water is an especially attractive natural element that holds attention and interest (White, et al., 2010).

The move toward compact cities increases the need for well-designed small open spaces (Chiesura, 2004). Although it is clear that natural elements are associated with social activity in public space and work to form meeting places in modern city parks and plazas, the influence of natural elements occurs in combination with other design elements. However, there is a lack of research on combining natural elements with other design elements. What combinations work in small public spaces in urban centres? Are there age groups differences, differences between individuals and groups in the opportunities natural elements provide in small urban public spaces?

BEHAVIOR MAPPING

Behaviour mapping (Ittelson, et al., 1970) is a method for documenting how designs work by linking human activity with physical settings (Bechtel & Zeisel, 1987). In buildings and spaces, the number of users, the busy and quiet times, frequency of movement, and stationary behaviour have been recorded using counters, pencil and paper, behaviour matrices and marking up printed maps (Golicnik & Marusic, 2012). If the space is large or crowded, new behaviours can be missed and the details of observed activity limited. Film and time-lapse photography enables the researcher to accurately record behaviour in a physical setting (Marcus & Francis, 1998). Observable aspects of behaviour can be captured without loss of information, the process is quick and a skilled observer is not needed to record behaviour in physical settings.

GIS is increasingly being used to store, manipulate, analyse, manage, and present data (Golicnik & Marusic, 2012). Use of GIS enables researcher's insights into different dimensions of usage, including how often a certain activity has happened at a particular location, how intensively it has occurred per temporal unit, and how the patterns of each activity can be differentiated with regard to the presence of others (Golicnik & Marusic, 2012). The GIS records of physical space can include multiple sources of data and be updated with more information as it becomes available. Information such as type of activity, duration, the direction participants are facing, etc., can be captured accurately and mapped in sufficient detail to be analysed in relation to design elements and enable comparisons with natural elements like sun and shade. A combination of still photographs and GIS (Geographic Information System) coding of time-lapse photographic records provides an accurate and reliable tool to map behaviour in the small and sometimes crowded public spaces in urban centres (Forsyth, et al., 2005; Golicnik & Thompson, 2010; Porta et al., 2008, 2009).

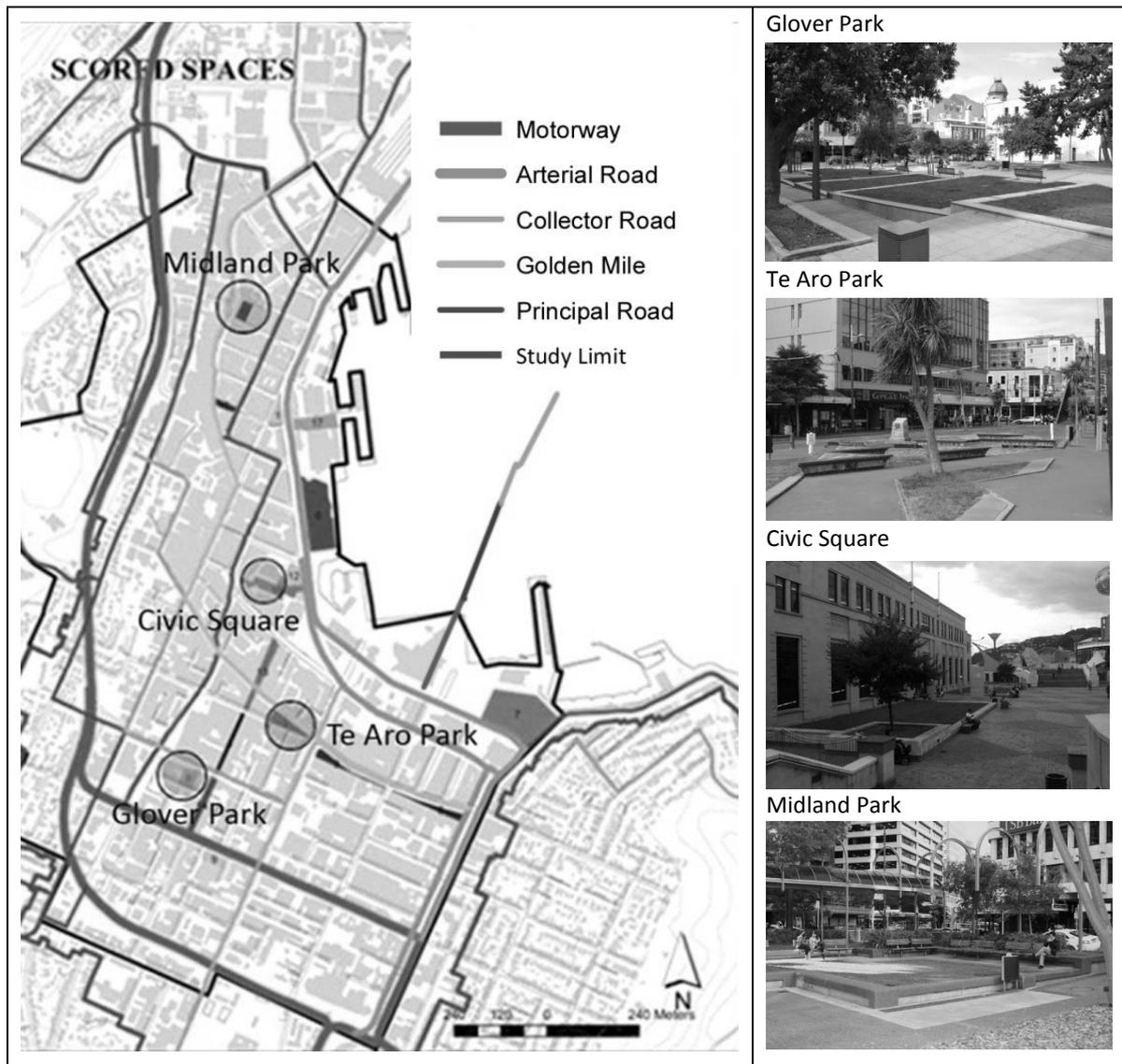


Figure One: Data selection sites

Photographic records of behaviour were recorded in four public spaces in the city centre of Wellington, New Zealand (Figure 1) (Ghavampour, 2014). Each location was divided into subspaces according to function, form and access, with natural and artificial design elements identified. Form described subspace through structural size, complexity, order, style, etc., which can be created by landmarks, level change or edge, or shape by its content like maintenance or style (Nassar, 1994). Functional design elements like seating or trees with shade was used to describe another group of subspaces. Subspaces were also created through their location within the space and how they link to the surrounding environment: Edges, entrances, pathways, etc. Observation points were identified to cover each subspace and the four locations were photographed on sunny mid-week days at 12 minute intervals from 8.00 to 17.00. A total of 3088 photos were taken across the four days. The photographic data of stationary activities were coded into GIS, with each group represented by a dot on the base map in Arc map 10.1. Persons transiting locations were not included in the data analyses. Attributes attached to each dot include whether a person was alone or in a group, size of group, gender, age, activity, first time observed and last time observed.

RESULTS

The results of the data analyses are divided into four parts: (1) Summaries of each location; (2) Comparison between subspaces within sites, (3) use of subspaces by gender, and (4) comparisons between similar subspaces across sites. Hourly summaries were compiled from five rounds of data for number of users, age, gender, length of stay, and occupancy maps for each subspace.

Four locations

The observations mapped 1404 stationary users in Midland Park, 395 in Civic Square, 291 in Te Aro Park and 276 in Glover Park. As expected a large proportion of users visited the parks at lunch time (midday – 2pm), but Midland Park with 70% had a higher number of users use between midday and 2pm compared to others with 50%. Glover Park had a second peak in the afternoon and stayed active for a longer time. Equal numbers of female and male users were observed in three parks, apart from Te Aro Park with more males than females. Most users were alone or with one other person. Civic Square had the highest proportion of solo users with four the largest group size observed. Larger groups of five and six were observed in the other parks. Groups in Te Aro Park for short stays with 75% of groups observed only once, and no group observed more than four times. In Civic Square, 75% of users were observed once (similar to Te Aro), but some users of this space were also observed 7, 9 or 11 times.

Sitting and eating dominated activity in the four locations, with reading also a popular activity in Glover and Midland parks. The grass in Glover Park afforded activities more diverse than other locations, with sleeping to vigorous activity represented. Standing and brief activities while standing, like smoking, were observed occasionally in the park. Similar to Glover Park, Te Aro was used mostly for sitting and eating, but mobile users were observed more than Glover. Smokers were observed at the edges towards the street and the benches around the water which also afforded different type of activities (sitting, reading, etc.). Smoking was also a frequent activity in Midland Park. Phones or laptops were frequently observed in Civic Square and people were resting on the grass area.

Seating was the popular design element at all four sites while other subspaces were used differently. In Glover Park grass and a ledge on the edge of the grass (sitting wall beside benches) were used heavily. The shade under trees and subspaces close to trees in Glover Park were well used throughout the day (Figure 2a). In contrast, in Te Aro Park areas with grass and trees were left vacant. Benches and seating around the water feature attracted the most users, followed by edges and sitting walls. There was no physical interaction between users and water, and those that sat on benches around the water feature faced outwards towards the park instead of facing the water feature (Figure 2b). In Midland Park, with its diverse subspaces and most users, some subspaces were left vacant outside the peak lunch time usage. Here, sitting walls by grass, edges of walking path, shelters and benches were used heavily. Grass was less popular than seating around water and edges toward streets (Figure 2c). In Civic Square, the benches, sitting wall and entrance area accommodated most users, while separated spaces and stairs were used at lunch time. The grass area did not attract many users at lunch time or through the afternoon (Figure 2d).

Comparison between subspaces within parks

Glover Park

Glover Park is an open space situated close to the main pedestrian street. It has several mature trees which create shade for terraced grasses. Benches in the main walkway with a sculpture in the middle are the main non-artificial subspaces. Natural elements form more than 70% of the park and all were heavily used. Grassed area, spaces under trees and sitting wall close to grass were preferred

locations. Trees not only enhanced use of grassed areas but also influenced use of benches and sitting walls. Benches under shade of trees were used constantly while others show decreased use. The sitting wall adjacent to trees was used from early morning when sun may be more pleasant. Apart from the grassed areas which evidenced increased use in the afternoon, other spaces evidenced a decrease in use after lunch time (peak use of park) (Table1). Sun had a positive impact on use, sunny grassed areas and areas shaded by trees were used well, whereas grass under shade of building was left vacant. The occupancy maps indicated the grassed area accommodated more groups of larger size for longer periods of time, with teenagers and young adults the main users. Edges and the entrance were only used at lunch time.

Te Aro Park

In contrast with Glover Park, Te Aro is an island between two roads, has a triangular shape with only one mature tree that is a home of birds which causes some maintenance issues. It is surrounded by bars and pubs with a public toilet in the vicinity. The park was designed by an artist and has few subspaces, with grass, water, and trees dominate natural design elements. The most popular subspaces are the benches, a sitting wall next to the grass and seating around a water feature (Table 1). Interestingly, the people seated around the water feature faced toward the road, a more interesting visual landscape. The grassed subspace is exposed to the road frontages, lacked natural shade and was left vacant mostly. The outside edge was used by smokers for short breaks. The triangle benches proved more popular spots in the park, although they are fixed, the design provides an opportunity for multiple users to face different directions. Larger groups used multiple benches to face each other and solo users sat at different angles to avoid direct eye contact with people beside them. The activities in Te Aro Park were not diverse as Glover Park and more than 70% of users spent less than 12 minutes in the park.

Midland Park

Midland Park is located on the main shopping street in the urban centre with lots of food and cafés around. Highly visible, this place attracts many users every day. The park has a variety of subspaces, with mature trees around its edge and a water feature in the middle. Benches and sitting walls are spread throughout the park and there are also some shelters to protect users from sun and rain. Midland Park attracted the most users of the four parks, with sitting walls and sheltered spaces the two most used subspaces, though use of these areas decreased after lunch time (Table 1). Preference of natural shade over artificial is not clear here as user of passageway and sheltered subspaces were different. In the later shelter was preferred over sitting wall by grass and in the former, natural shade over artificial. Grassed areas were not as popular as sitting walls and mostly used in the afternoon by groups of teenagers. Edges and entrance received the most users at lunch time. There is no difference between the numbers of males and females in the park. In contrast with Glover Park here there is no clear line between use of natural and artificial elements. The space is overcrowded with most users coming here in their short lunch break.

Civic Square

Civic Square has a built character with only 20% soft landscape. It has a large paved area in the middle that is used for public gatherings and festivals and serves as a path connecting the city to the waterfront. It lacks mature trees and its two large grassed areas are under shade of buildings. Between the natural subspaces, only the sitting wall by grass is well used, with grass the least used space. The grassed areas were used for extended periods of time in the afternoon when they get some sunshine space, either by groups for a chat or solo users to rest. The sunny wall with its recesses was fully occupied at lunch time and the entrance and benches were constantly occupied

from early morning (Table 1). Similar to Glover Park and Midland Park, grass were territory of teenagers and young adults. Benches were always occupied and the square were used by both genders in equal number.

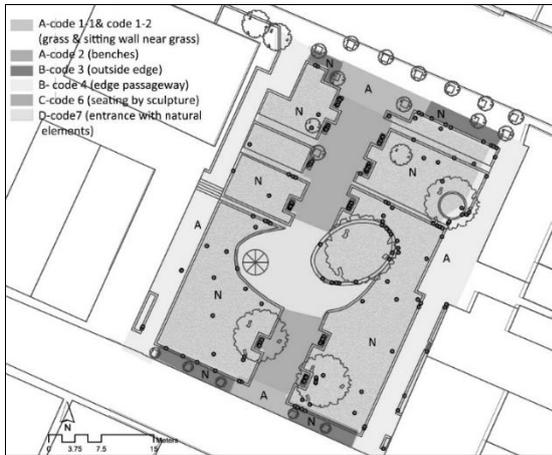


Figure 2a: Total use of Glover Park

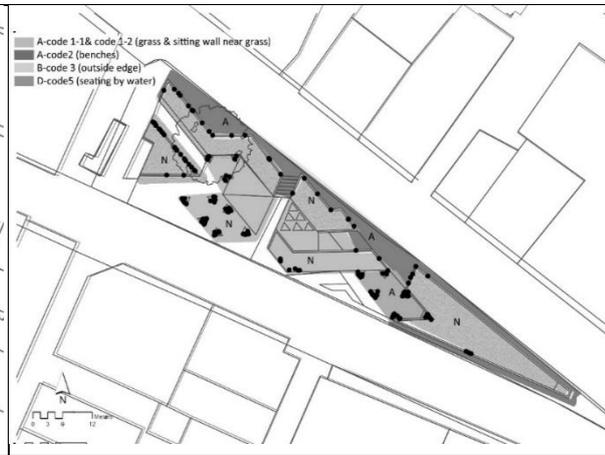


Figure 2b: Total use of Te Aro Park



Figure 2c: Total use of Midland Park

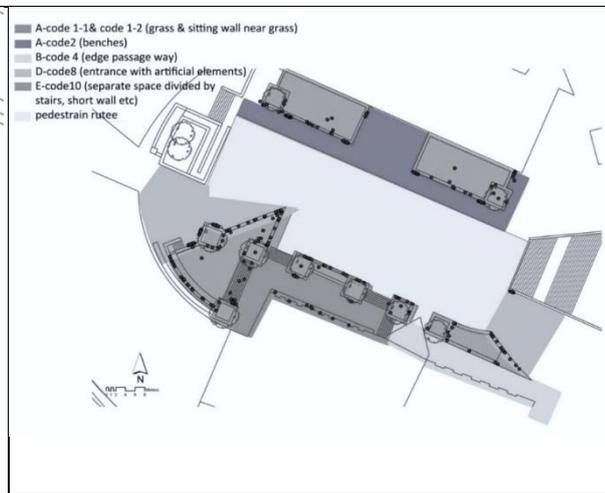


Figure 2d: Total use of Civic Square

Use of subspace by gender

Equal numbers of male and female users were observed in Glover Park, but there were more female groups than male groups in the park (Figure 3). The female groups frequented the grass or outside edge, places that were less frequented by solo males. The sitting wall by the grass and the grass was most popular with solo males and solo females. The outside edge was less popular with males alone who preferred the subspaces within Glover Park. In Te Aro Park, observation of single gender groups and solo users indicated a preference for the seating around the water feature over the sitting wall by grass (Figure 4). In comparison with Glover Park, where the sitting wall by grass was the most popular subspace for solo users, in Te Aro where there was a choice of seating near a water feature, this was the preferred subspace.

Mapping of single gender groups and solo users in Midland park indicated a fairly even spread across subspaces. This park is particularly crowded at lunch time. Users have less choice in available space and spread through the park. However, this pressure on space did not prevent males alone using subspaces within the park. Consistent with the findings at Glover Park, the entrance subspace was least preferred by males alone. No difference was seen for male groups or between females alone and in groups for all subspaces. In civic square, the sitting wall was the preferred location for male

individuals followed by the entrance and benches. For females alone, the entrance being the most popular followed by seating and sitting wall by grass. Although female groups did not use grass, there were more female than male groups in the remaining subspaces.

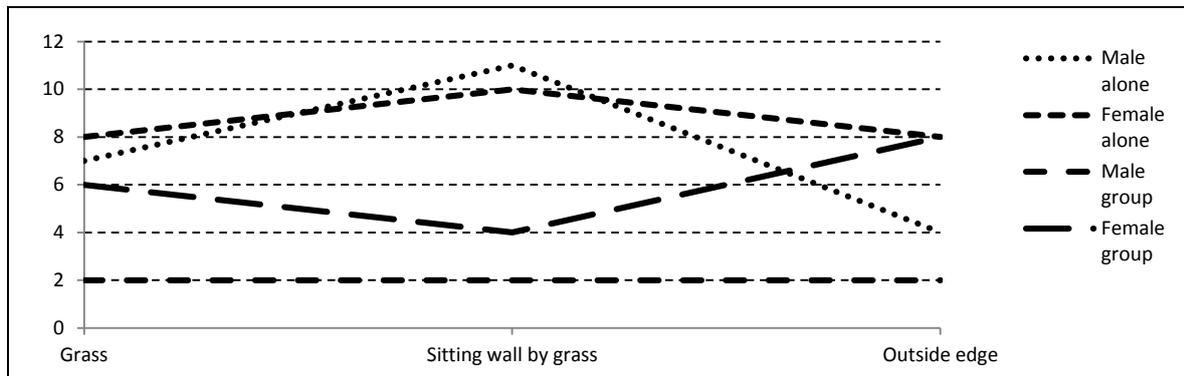


Figure 3: Single gender groups and solo users in Glover Park

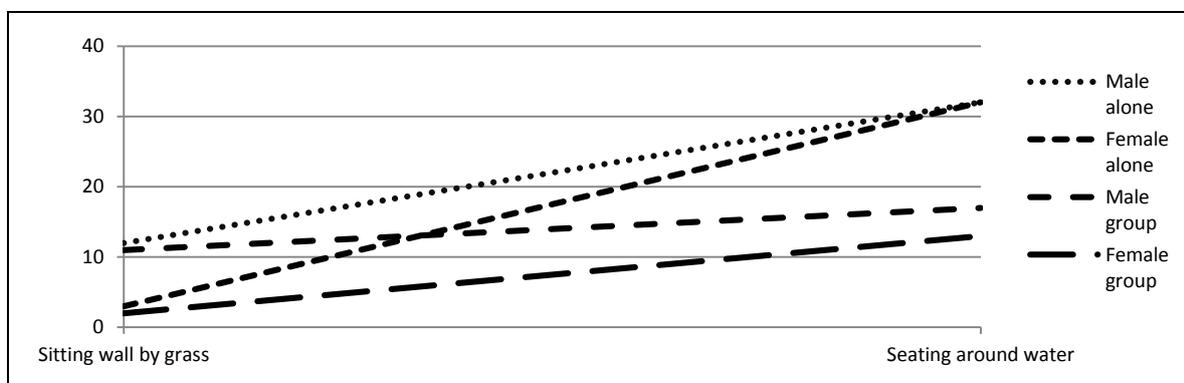


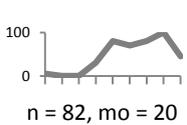
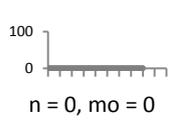
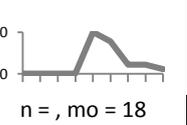
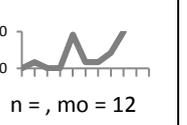
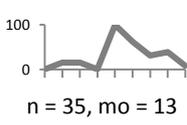
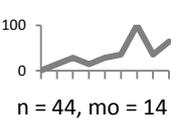
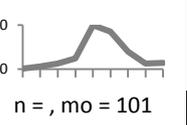
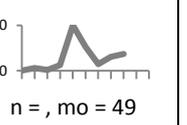
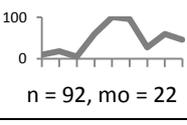
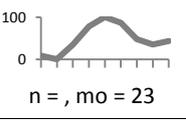
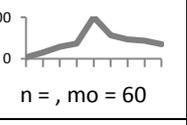
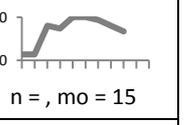
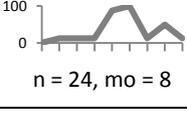
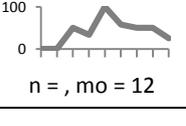
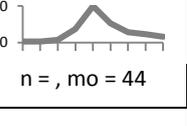
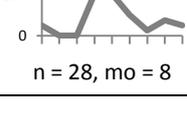
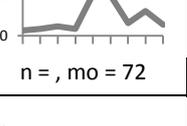
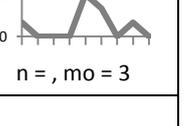
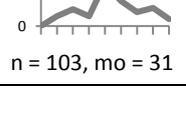
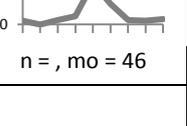
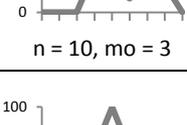
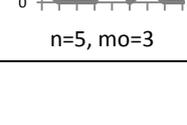
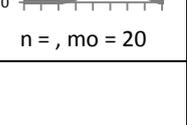
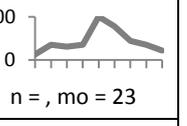
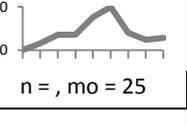
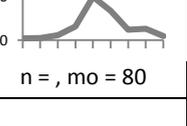
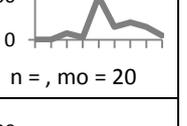
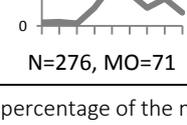
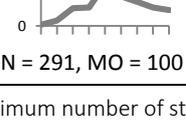
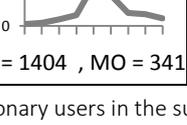
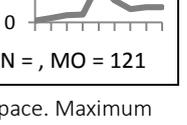
Figure 4: Single gender groups and solo users in Te Aro Park

Comparison of similar subspaces between parks

Comparison of similar subspaces across the four data collection sites indicates that behaviour in relation to natural design elements, particularly grass, is dependent on its combination with other features. Sitting walls next to grass were well used across all sites and only in Glover Park grass was used more than the sitting wall. Benches were occupied in most locations. Benches attract fewer groups and for shorter stay except, triangle benches in Te Aro. Uses of seating around water was not a great success. The water subspace in Midland Park had some visitors but compared to other subspaces was not well populated. The Te Aro Park water feature also failed to be an attractive environment. Use of other subspaces was mostly depended on the time of the day, edges had their peak at lunch time and were preferred for short breaks.

Patterns of preferred use differed across the four data collection sites (Table 1). In Glover Park benches in paved area, grass, sitting walls by grass and seating by sculpture were the four preferred subspaces. While these were used over the day, entrances, edge passage way and outside edge were mostly used at lunch time. In Civic Square benches and entrance are popular subspaces although sitting walls and separated space divided by steps were also well used, especially at lunch time. Grass and edge passage way were less used. In Te Aro Park benches and seating around water attracted more users, with outside edge and sitting walls used less and grass never used. In Midland Park sitting walls, separated space divided by artificial design elements, benches and edge passage way were the favourite subspaces. Outside edge, seating by water and the separate space divided by natural elements were also used. Grass and entrance area were used least. This is in contrast to Glover Park, where grass was more used, especially by people in groups.

Table 1: Hourly use of subspaces as a percentage of maximum occupancy (08:00 to 17:00)

Subspace	Glover Park	Te Aro Park	Midland Park	Civic Square
Grass	 n = 82, mo = 20	 n = 0, mo = 0	 n = , mo = 18	 n = , mo = 12
Sitting wall	 n = 35, mo = 13	 n = 44, mo = 14	 n = , mo = 101	 n = , mo = 49
Benches	 n = 92, mo = 22	 n = , mo = 23	 n = , mo = 60	 n = , mo = 15
Outside edge	 n = 24, mo = 8	 n = , mo = 12	 n = , mo = 44	
Passage way edge	 n = 28, mo = 8		 n = , mo = 72	 n = , mo = 3
Seating by water		 n = 103, mo = 31	 n = , mo = 46	
Seating by sculpture	 n = 10, mo = 3			
Entrance with natural elements	 n=5, mo=3		 n = , mo = 20	
Entrance with artificial elements				 n = , mo = 23
Space separated by natural elements			 n = , mo = 25	
Space separated by artificial elements			 n = , mo = 80	 n = , mo = 20
Total	 N=276, MO=71	 N = 291, MO = 100	 N = 1404 , MO = 341	 N = , MO = 121

NOTE: Hourly use is a percentage of the maximum number of stationary users in the subspace. Maximum Occupancy (MO) of Grass in Glover Park was 20 between 15.00-16.00, sixteen people were observed between 12.00 and 13.00 which is converted to a percentage of MO $(16/20) * 100 = 80\%$

DISCUSSION

Natural design elements in small urban public spaces were observed with respect to user activity, the number of users, their age and gender, group size and length of stay. The observations indicated that activity in relation to natural design elements is dependent on the type of element and context within which it is embedded. Grassed areas are used for the extended stay, are active spaces and attractive to groups, but size, location and shape are critical, and the grassed area has to be well maintained. Trees and their natural shade encourage use of design elements (benches, sitting walls) in their area and longer lengths of stay. However, trees need to be mature to provide territory. Immature trees provide insufficient enclosure and shelter, and small grassed areas with irregular shape are not used by groups. Also, the presence of purely decorative water features did not add to use of the space. This conflicts with studies which claim water is an attraction small urban public spaces (Sherrod & Down, 1974; Nasar, 1994) and could relate to the absence of an interactive experience with this feature.

In Glover Park, the inclusion of trees related to use of design elements within their proximity throughout the day. The results suggest the effect of trees is not limited to shade but suggests they provide a more intimate space with enclosure and territorial definition for solo users and for groups to gather. Comparison of morning and afternoon use of the grass in Glover Park indicates the effect of sun is not as strong as the effect of trees, as places shaded by trees are used even in early morning and late afternoon when people might be looking for the warmth of the sun. Further support for natural shade was found in Glover Park where the area shaded from an adjacent building was never used and grass under building shade in Civic Square attracted only a few people.

In Te Aro Park, the mature trees did not attract users to the grassed areas. The grassed areas remained completely vacant. With the park located close to bars and being a bird destination, this suggests mature trees need to be positioned adjacent to well-maintained surfaces to be successful. A finding consistent with previous research linking surface maintenance with activity in a public space (Kuo et al., 1998). Where surfaces are well maintained, the park's exposure along two road frontages could impact on the sense of enclosure/comfort provided by the trees in grassed areas. With similar reason grass in Midland Park that was surrounded by crowded sitting areas only started to be used in the afternoon when the space was getting quieter. In Glover Park the level differences divide the grass into smaller subspaces and trees add enclosure to these popular spaces. Attractive spaces for diverse activities by larger groups over longer time frames. While the number of users of this park is lower than the other locations, the configuration of natural design elements in this park's subspaces sustained activity in the subspaces.

Observation in this study was limited to one sunny day in each location. Different weather conditions or seasons might have resulted observed differences in use of the spaces. Shelter, rain, damp surfaces, wind and wet grass could mediate the influence of natural design elements in use of public space. While this study focused through the lens of natural elements, there are many other design elements that also enhance social activity. While history indicates that natural elements have a long standing connection with use of public space, artificial design elements may capture short term use which may develop over time.

CONCLUSIONS

Coding of time lapse photography mapped in GIS was introduced here as a methodology for behaviour mapping. With this method it was possible for a single observer to accurately record and map detail behaviour in the sometimes crowded public spaces. The GIS mapping of small urban

public spaces indicated:

- The context of design elements influences how public space is used.
- Natural design elements are associated with use of public space when combined with other design elements.
- Although natural design elements may not be used directly, informal sitting walls next to grassed areas and benches next to a water feature were the most popular subspaces.
- In addition to manual pedestrian counts, factors such as size of group and length of stay should be measured to gauge use of public space.

Natural design elements are linked to activity in small urban public space, yet the reason for this connection remains unclear. Is there a theoretical explanation for this association? The results allude to user's preferences and decision making being part of a process leading to activity in public space.

REFERENCES

- Bechtel, R. B., & Zeisel, J. (1987). Observation: the world under a glass. In R. B. Bechtel, R. W. Marans & W. M. Michelson (Eds.), *Methods in environmental and behavioral research* (pp. 11-40). New York: Van Nostrand.
- Bettencourt, L. M., Lobo, J., Helbing, D., Kühnert, C., & West, G. B. (2007). Growth, innovation, scaling, and the pace of life in cities. *Proceedings of the National Academy of Sciences*, 104(17), 7301-7306.
- Budruk, M., Thomas, H., & Tyrrell, T. (2009). Urban green spaces: A study of place attachment and environmental attitudes in India. *Society and Natural Resources*, 22(9), 824-839.
- Carmona, M. (2010). *Public places, urban spaces: The dimensions of urban design* (2nd ed.). Amsterdam; Boston: Architectural Press/Elsevier.
- Carr, S., Francis, M., Rivlin, L., & Stone, A. (1992). *Public space*. Cambridge, U.K.: Cambridge University Press.
- Chadwick, G. F. (1966). *The park and the town*. London: Architectural Press.
- Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, 68(1), 129-138.
- Coley, R. L., Sullivan, W. C., & Kuo, F. E. (1997). Where Does Community Grow? The social context created by nature in urban public housing. *Environment and Behavior*, 29(4), 468-494.
- Cranz, G. (1978). Changing roles of urban Parks - from pleasure ground to open space. *Landscape and Urban Planning*, 22(3), 9-18.
- Dempsey, N. (2012). Neighbourhood Design: Green Space and Parks. In S. J. Smith (Ed.), *International Encyclopedia of Housing and Home* (pp. 12-20). San Diego: Elsevier.
- Fajardo, J. (2007). *Small squares: Mini plazas*. Barcelona: Monsa.
- Forsyth, A., Musacchio, L., & Fitzgerald, F. (2005). *Designing small parks: a manual addressing social and ecological concerns*. New Jersey: John Wiley & Sons, Inc.
- Gehl, J. (1987). *Life between buildings: using public space*. Washington, DC: Island Press.
- Ghavampour, (2014). The contribution of natural design elements to the sustained use of public space in a city centre. PhD thesis, Department of Architecture, Victoria University of Wellington, New Zealand.
- Gold, S. M. (1977). Neighborhood Parks the nonuse phenomenon. *Evaluation Review*, 1(2), 319-328.

- Golicnik, B., & Marusic, D. (2012). Behavioral maps and GIS in place evaluation and design. In B. M. Alam (Ed.), *Application of Geographic information System* (pp. 113-138).
- Golicnik, B., & Thompson, C. W. (2010). Emerging relationships between design and use of urban park spaces. *Landscape and Urban Planning*, 94(1), 38-53.
- Grahn, P., & Stigsdotter, U. A. (2003). Landscape planning and stress. *Urban Forestry & Urban Greening*, 2(1), 1-18.
- Huang, S. C. L. (2006). A study of outdoor interactional spaces in high-rise housing. *Landscape and Urban Planning*, 78(3), 193-204.
- Ittelson, W. H., Rivlin, L. G., & Proshansky, H. M. (1970). The use of behavioral maps in environmental psychology. In W. H. Ittelson, L. G. Rivlin & H. M. Proshansky (Eds.), *Environmental psychology: Man and his physical setting* (pp. 658-668). New York: Holt, Rinehart & Winston.
- Jacobs, J. (1961). *The death and life of great American cities*. New York: Vintage Books.
- Jones, K., & Wills, J. (2005). *The invention of the park: recreational landscapes from the garden of eden to disney's magic kingdom*. Cambridge: Polity.
- Jordaan, T., Puren, K., & Roos, V. (2008). The meaning of place-making in planning: historical overview and implications for urban and regional planning: review article. *Acta Structilia: Journal for the Physical and Development Sciences*, 15(1), 91-117.
- Kaplan, R. (1983). The role of nature in the urban context. In I. Altman & K. Christensen (Eds.), *Environment and behavioural studies* (Vol. 6, pp. 127-161). Plenum Press.
- Knox, P. (2005). Creating ordinary places: Slow cities in a fast world. *Journal of Urban Design*, 10(1), 1-11.
- Kuo, F. E., Sullivan, W., Coley, R., & Brunson, L. (1998). Fertile Ground for Community: Inner-City neighborhood common Spaces. *American Journal of Community Psychology*, 26(6), 823-851.
- Lang, J. (1994). *Urban design: the American experience*. New York: Van Nostrand Reinhold.
- Lapage, W. (2007). *Parks for life: Moving the goal posts, changing the rules, and expanding the field*. State College, Pennsylvania: Venture Publishing, Inc.
- Lawrence, H. W. (1993). The greening of the squares of London: Transformation of urban landscapes and ideals. *Annals of the Association of American Geographers*, 83(1), 90-118.
- Lennard, S. H. C., & Lennard, H. L. (1995). *Livable cities observed: a source book of images and ideas for city officials, community leaders, architects, planners and all other committed to making their cities livable*. Carmel, CA: Gondolier Press.
- Longstaffe-Gowan, T. (2012). *The London Square: Gardens in the midst of town*. New Haven: Yale University Press.
- Madanipour, A. (1996). *Design of urban space: An inquiry into a socio-spatial process*. Chichester; New York: Wiley.
- Madanipour, A. (2003). *Public and private spaces of the city*. New York: Routledge.
- Marcus, C. C., & Francis, C. A. (1998). *People places: design guidelines for urban open space* (2nd ed.). New York: Van Nostrand Reinhold.
- Maruani, T., Amit-Cohen, I. (2007). Open space planning models: a review of approaches and methods. *Landscape and Urban Planning*. 81(1-2), 1-13
- Matsuoka, R. H., & Kaplan, R. (2008). People needs in the urban landscape: analysis of landscape and urban planning contributions. *Landscape and urban planning*, 84(1), 7-19.

- McHarg, I. L. (1969). *Design with nature*. New York: John Wiley & Sons.
- McIntosh, C. (2005). *Gardens of the gods: Myth, magic and meaning*. London: I. B. Tauris.
- McKibben, B (1989). *The end of nature*. New York: Random House
- Mehta, V. (2006). *Lively streets: exploring the relationship between build environment and social behaviour*. (PhD), University of Maryland.
- Migge, L. (2013). *Garden culture of the twentieth century* (D. H. Haney, Trans. D. H. Haney Ed.). Washington, D.C.: Harvard University press.
- Mumford, L. (1969). The philosophy of urban open space. In W. N. Seymour (Ed.), *Small urban spaces: The philosophy, design, sociology, and politics of vest-pocket parks and other small urban open spaces* (pp. 13-22). New York: New York University Press.
- Nasar, J. L. (1994). Urban design aesthetics the evaluative qualities of building exteriors. *Environment and Behavior*, 26(3), 377-401.
- Neuvonen, M., Sievänen, T., Tönnies, S., & Koskela, T. (2007). Access to green areas and the frequency of visits—a case study in Helsinki. *Urban Forestry & Urban Greening*, 6(4), 235-247.
- Nilsson, K., Sangster, M., Gallis, C., Hartig, T., De Vries, S., Seeland, K., & Schipperijn, J. (2011). *Forests, trees and human health*. Dordrecht: Springer Science, Business Media B.V.
- Nordh, H., & Østby, K. (2013). Pocket parks for people—A study of park design and use. *Urban Forestry & Urban Greening*, 12(1), 12-17.
- Nordh, H., Alalouch, C., & Hartig, T. (2011). Assessing restorative components of small urban parks using conjoint methodology. *Urban Forestry & Urban Greening*, 10(2), 95-103.
- Nordh, H., Hartig, T., Hagerhall, C. M., & Fry, G. (2009). Components of small urban parks that predict the possibility for restoration. *Urban Forestry & Urban Greening*, 8(4), 225-235. doi: 10.1016/j.ufug.2009.06.003
- Pearce, D., Barbier, E., & Markandya, A. (1990). *Sustainable development: economics and environment in the Third World*. UK: Aldershot.
- Peschardt, K. K., & Stigsdotter, U. K. (2013). Associations between park characteristics and perceived restorativeness of small public urban green spaces. *Landscape and Urban Planning*, 112, 26-39.
- Pickett, S. T., Cadenasso, M. L., Grove, J. M., Nilon, C. H., Pouyat, R. V., Zipperer, W. C., & Costanza, R. (2008). Urban ecological systems: linking terrestrial ecological, physical, and socioeconomic components of metropolitan areas. In *Urban Ecology* (pp. 99-122). Springer US.
- Porta, S., Crucitti, P., & Latora, V. (2008). Multiple centrality assessment in Parma: a network analysis of paths and open spaces. *Urban Design*. 13(1), 41–51. *Urban Ecology*, 2, 99-122
- Porta, S., Latora, V., Wang, F., Strano, E., Cardillo, A., Scellato, S., Iacoviello, V., & Messora, R. (2009). Street centrality and densities of retails and services in Bologna, Italy. *Environment and Planning B*, 36(3), 450–465.
- Prest, J. M., & Prest, J. (1981). *The Garden of Eden: The botanic garden and the re-creation of paradise*: New Haven and London: Yale University Press.
- Schipperijn, J., Bentsen, P., Troelsen, J., Toftager, M., & Stigsdotter, U. K. (2013). Associations between physical activity and characteristics of urban green space. *Urban Forestry & Urban Greening*, 12(1), 109-116.
- Seymour, W. N. (1969). An introduction to small urban spaces. In W. N. Seymour (Ed.), *Small urban spaces: the philosophy, design, sociology, and politics of vest-pocket parks and other small urban open spaces* (pp. 3-10). New York: New York University Press.

- Sherrod, D. R., & Downs, R. (1974). Environmental determinants of altruism: The effects of stimulus overload and perceived control on helping. *Journal of Experimental Social Psychology, 10*(5), 468-479.
- Stigsdotter, U. K., Ekholm, O., Schipperijn, J., Toftager, M., Kamper-Jørgensen, F., & Randrup, T. B. (2010). Health promoting outdoor environments-Associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey. *Scandinavian Journal of Public Health, 38*(4), 411-417.
- Thompson, C. W. (2002). Urban open space in the 21st century. *Landscape and urban planning, 60*(2), 59-72.
- UNDoE (2006). World population prospects: The 2004 Revision: Volume I: comprehensive tables. *United Nations Publications, 244-246*
- Van den Berg, A. E., Hartig, T., & Staats, H. (2007). Preference for nature in urbanized societies: stress, restoration, and the pursuit of sustainability. *Journal of Social Issues, 63*(1), 79-96.
- Van Kamp, A., Leidelmeijer, K., Marsman, G., & de Hollander, A. (2003). A monitoring tool for the provision of accessible and attractive urban green spaces. *Landscape and Urban Planning, 65*(2), 5-18.
- White M., Smith A., Humphreys K., Pahl S., Snelling D., Depledge M. (2010). Blue space: the importance of water for preference, affect, and restorativeness ratings of natural and built scenes. *Journal of Environmental Psychology 30*:482-93.
- Whyte, W. H. (1980). *The social life of small urban spaces*. Washington, D.C.: Conservation Foundation.
- Williams, R. (2005). Ideas of nature. In R. Williams (Ed.), *Culture and Materialism* (2nd ed., pp. 67-85). London, New York: Verso.
- Young, T. (1995). Modern urban parks. *Geographical Review, 85*(4), 535-551.