Restorative components of small urban parks

Restituerende komponenter i små urbane parker

Philosophiae Doctor (PhD) Thesis

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You must not know too much, or be too precise or scientific about birds and trees and flowers and watercraft; a certain free margin, and even vagueness,… perhaps ignorance, credulity, - helps your enjoyment of these things.

Walt Whitman

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My house and garden has meant a lot to me during this process; to cite Abram L. Urban

"... My garden of flowers is also my garden of thoughts and dreams. The thoughts grow as freely as the flowers, and the dreams are as beautiful."

Ås, June 2010. /Helena Nordh

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SUMMARY

The growing body of knowledge about restorative environments shows that nature offers a restorative advantage over common outdoor urban public spaces with regard to recovery from attentional fatigue and stress. There is however a lack of research on the environmental components in natural environments that promote restoration. This detailed knowledge is important to landscape architects, who have a professional responsibility for the development of green structure in cities. The need for this information is perhaps even more important today, as the trend in European city planning is densification. This pattern of urban development is sometimes created at the cost of urban parks. In light of the densification process, this thesis is about the environmental components in small urban Scandinavian parks (pocket parks) that can support restorative experiences for people living and working in an urban setting. The environmental components under study are: hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, and park size. Other people in the park are also of interest as a social component. The empirical research presented in this thesis is based on three different methods: photo ratings with regression analysis, photo ratings with eye tracking analysis and a questionnaire with choice-based conjoint analysis. With this battery of methods the ambition was to demonstrate the potential of quantitative methods that have previously been little used in landscape architecture. The respective strengths and weaknesses of the different methods are addressed in the thesis. The results from the studies converge in showing that people will assign high likelihoods of restoration to even small urban parks. All environmental components except for hardscape contributed to perceived likelihood of restoration. However, the components most important for these judgments were grass and trees. This result is in conflict with the common trend in Scandinavia, where use of hard paving materials such as concrete or granite is growing. Trees and grass take a relatively long time to establish compared to decorative components such as water features and flowers, hence, their use requires long term planning. To conclude, vegetation and in particular trees and grass are important components in small urban parks with regard to anticipated restoration. Despite a restricted park size and the presence of a moderate number of other people small parks can with the right design function as restorative spaces, hence in a longer perspective contribute to public health.

SAMMENDRAG

Den stadig økende kunnskapen om restituerende miljøer viser at natur gir bedre mulighet til å innhente seg fra mental utmattelse og stress enn det urbane miljøer gir. Det finnes imidlertid mindre forskning om hvilke komponenter i naturlige miljøer som fremmer slik restitusjon. Denne detaljerte informasjonen er viktig for landskapsarkitekter som har et profesjonelt ansvar for utvikling av grønnstruktur i byer. Behovet for slik informasjon er kanskje enda viktigere i dag, ettersom fortetting er trenden innen europeisk byplanlegging. Fortetting skjer ofte på bekostning av byparker. I lys av fortetningsprosessen undersøkes det i denne avhandlingen hvilke komponenter i små, urbane, skandinaviske parker som fremmer en restituerende opplevelse for mennesker som bor og jobber i byer. De fysiske komponentene som har blitt studert er; harde overflater, gress, lav markvegetasjon, busker, trær, vann og parkstørrelse. Antall personer som er tilstede i parken er også interessant som en sosial komponent. Den empiriske forskningen som presenteres i avhandlingen er basert på tre ulike metoder, vurdering av parkbilder med regresjonsanalyse, vurdering av parkbilder med øyebevegelsesanalyse og internett-basert spørreundersøkelse med *choice based conjoint* analyse. Med disse ulike metodene var ambisjonen å demonstrere hvordan relativt nye kvantitative metoder innen landskapsarkitektur kunne bidra med verdifull informasjon til denne typen forskning. Metodenes respektive styrker og svakheter er diskutert i avhandlingen. Resultatene fra studiene konvergerer med hensyn på små parkers evne til å muliggjøre restitusjon. Alle komponenter, unntatt hard overflate, bidro til oppfattet mulighet til restitusjon. De komponentene som var viktigst var gress og trær. Dette resultatet er i konflikt med den utviklingen man ser i Skandinavia i dag, der bruken av harde materialer som betong og granitt er økende. Trær og gress tar relativt lang tid å etablere sammenliknet med vannelementer og blomster, hvilket innebærer at langsiktig planlegging blir enda viktigere. Konklusjonen er at vegetasjon, og spesielt trær og gress, er viktige komponenter i urbane småparker. Til tross for parkenes begrensede størrelse, og tilstedeværelse av et begrenset antall andre mennesker, kan disse parkene, med rett design, fungere som steder for restitusjon og dermed være fremmende for folkehelse i et langsiktig perspektiv.

SAMMANFATTNING

Den stadigt ökande mängden kunskap om restorativa miljöer visar att natur, till skillnad från urban utemiljö, erbjuder möjligheter att återhämta sig från mental utmattning och stress. Det är dock en brist på forskning om vilka fysiska komponenter i naturen som gynnar återhämtning. Detaljerad kunskap är viktig för landskapsarkitekter, de som profession har ett ansvar för utvecklingen av grönstruktur i städer. Behovet för denna typ av information är idag kanske ännu viktigare, på grund av att trenden i europeisk stadsplanering är förtätning. Ofta sker detta på bekostnad av urbana parker. I ljuset av förtätningsprocesser undersöker denna avhandling vilka komponenter i små urbana skandinaviska parker som kan stödja en restorativ upplevelse för människor som bor och jobbar i städer. De fysiska komponenterna som studerats är; hårdgjord yta, gräs, låg markvegetation blommande plantor, buskar, träd, vatten och parkstorlek. Antalet personer som vistas i parken är också intressant som en social komponent. Den empiriska forskningen som presenteras i denna avhandling är baserad på tre olika metoder, värdering av parkfoton med regressionsanalys, värdering av parkfoton med ögonrörelseanalys och internetbaserad frågeformulär med *choice based conjoint*-analys. Med detta batteri av metoder var ambitionen att demonstrera hur relativt nya kvantitativa metoder inom landskapsarkitektur kunde bidra med värdefull information till denna typ av forskning. Metodernas respektive styrkor och svagheter är diskuterade i avhandlingen. Resultaten från studierna konvergerar vad gäller små parkers förmåga att möjliggöra återhämtning. Alla komponenter utom hårdgjord yta bidrog till uppskattad möjlighet att återhämta sig. De komponenter som var viktigast var gräs och träd. Detta resultat är i konflik med den trend man idag finner i Skandinavien där användningen av hårda material, så som betong och granit, växer. Träd och gräs tar relativt lång tid att etablera i jämförelse med vattenelement och blommor, vilket innebär att långsiktig planering blir ännu viktigare. För att konkludera; vegetation, speciellt träd och gräs är viktiga komponenter i urbana småparker. Trots parkernas begränsade storlek, och moderat närvaro av andra människor, kan dessa parker, med rätt design, fungera som återhämtande platser och därmed i ett långsiktigt perspektiv främja folkhälsa.

LIST OF PAPERS

I: 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: 225-235

II: Nordh, H., Hagerhall, C.M. & Holmqvist, K. (2010). Identifying restorative components of small urban parks using eye tracking. *Manuscript*

III: Nordh, H., Hagerhall, C.M. & Holmqvist, K. (in press). Exploring view pattern and analysing pupil size as a measure of restorative qualities in park photos. *Acta Horticulturae*.

IV: Nordh, H., Alalouch, C., & Hartig, T. (2010). Assessing the restorative components of small urban parks using conjoint methodology. *Submitted for publication.*

1. INTRODUCTION

Opinion research from Norway has shown that many people prefer to live in green cities with a rich variety of public parks (Tveøy Støm-Gundersen & Bakke Foss 2010). Parks function as spaces where people can meet, perform physical activity, relax and recover from stress. Hence, they are highly valuable spaces for people living and working in urban settings. However, parks are being lost or reduced in size due to pressure for construction of new infrastructure and buildings within city centers. A spatially compact city has been the ideal for many years and it benefits society in terms of sustainability, for example through reduced energy consumption, but densification is usually performed at the cost of urban green spaces (Jim 2004).

For many people, experiencing nature as part of everyday life is important for well-being and contributes to their possibility to recover from stress. It can be caused by, for example environmental conditions associated with urbanicity, such as traffic, noise, and a lifestyle in which people spend most of their waking time indoors (World Health Organization 2008). In the long run a reduction in the number of parks due to densification can be a threat to public health. What is needed is hence evidence regarding park planning for public health purposes in an era of densification in which strong economic powers are fighting for the same spaces within cities.

Landscape architecture as a profession has a responsibility to enhance the green values, such as parks and vegetation, in cities. Through the design of parks that give room for different qualities, the landscape architect can promote and contribute to public health. However, there is a lack of knowledge about the qualities in nature that promote stress recovery and other forms of psychological restoration and how urban green spaces should best be designed to enhance public health and restorative experiences. Research has mainly focused on broad categories of built versus natural environments and given little or no specific guidance to practitioners. This is where my thesis fills a gap. This thesis is about the design of small urban green spaces and more specifically the environmental components that promote restoration. The thesis is written from a Scandinavian perspective, and the samples of parks and people are collected from these countries (Sweden, Norway, Denmark). The physical components under study are hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, park size and other people in the park. These are all components a landscape architect can work with when designing a small urban park. The choice of components also characterizes the outdoor room with a ceiling, represented by tree canopies; walls, represented by bushes or trees; and a floor, represented by grass, low plants, or harder materials (Dee 2003; Rc

Figure 1. The outdoor room with ceiling, walls and floor represented by vegetation.

A landscape architect is commonly seen as the organizer of a project, the "spider in the web," the person who can lead the process and come up with design solutions based on interdisciplinary cooperation. The work in this thesis is analogues in the way in which the profession works. With support from people within different disciplines I have used three different methods when addressing my research questions. A choice of different methods contributes to a more comprehensive set of findings. Through regression analysis of aggregate ratings of park photos, analysis of eye tracking data with some of the same photos, and choice-based conjoint analysis of questionnaire data, I have investigated how people perceive and evaluate different environmental components in small urban parks and open spaces with regard to the likelihood of restoration (for definitions related to restoration, see section 1.1). The interdisciplinary cooperation gives the thesis methodological and theoretical width and strength.

The aim with the thesis is hence twofold. First and foremost, I want to provide the profession with new results that can be implemented in planning and design. However, my ambition is not to come up with a recipe describing the quantities of trees, bushes and other components that are necessary to design a restorative park. It is obviously not that simple. Design is site specific and needs to consider a number of actual conditions. Instead, my ambition is to contribute to the body of knowledge about urban nature as a restorative setting. Through a number of quantitative studies I explore the components in the small urban parks that are likely to be important for restoration. In doing this I hope to bring the discussion of restorative environments a step further, going into greater depth on details about the natural environments available to urban populations. Such knowledge can be applied in the design of restorative parks.

My second aim is to contribute to a methodological discussion and to demonstrate how quantitative methods that are likely to be unfamiliar to many landscape architects can provide potentially useful information. Even though landscape architecture has a long tradition of practice, landscape architectural research is rather young and the methods have been dominated by qualitative approaches.

My research is done within the area of landscape architecture dealing with aspects of human needs, or what Murphy (2005) calls "the human environment". However, the theoretical background represents a mix of literature from landscape architecture, environmental psychology and other disciplines. In addition to this summary, the thesis is comprised of three studies described in four papers (see Table 1).

Study 1	Paper I	*Components of small urban parks that predict the possibility for restoration.*
Study 2	Paper II	*Identifying restorative components of small urban parks using eye tracking.*
	Paper III	*Exploring view pattern and analysing pupil size as a measure of restorative qualities in park photos.*
Study 3	Paper IV	*Assessing the restorative components of small urban parks using conjoint methodology.*

Table 1. An overview of the studies and associated papers.

The structure of the thesis is as follows: In this introduction (Chapter 1), I go on to present some basic definitions, followed by reasons for why I chose to study restorative components of small urban parks. These include for example the importance of parks and nature for public health, the lack of green spaces due to densification and the role of the landscape architect in development and protection of green spaces. The introduction continues with a theoretical discussion of restoration, in which I describe different explanations for preference for nature and ways of measuring restoration. The last part of Chapter 1 is a general introduction to the methods used, with reference to how they have been applied in other studies. The introduction is followed by the statement of the purpose of the thesis (Chapter 2). In Chapter 3, I describe the types of parks and components under study, give an overview of the participants, and introduce the procedures in the different studies. Chapter 4 presents the main results. It starts with findings regarding the components that promote restoration. It continues with a presentation of the strengths and weaknesses of the different methods and an explanation of how they contribute to the thesis as a whole. The thesis ends in Chapter 5 with a discussion of the main findings. Limitations of the present research and possibilities for future research are also addressed there.

1.1. Definitions

First I would like to define a few concepts that are central to the thesis and frequently mentioned throughout the text.

Pocket park

There does not seem to be a unambiguous definition for *pocket park* (Iwashita et al. 1988). However, the term is widely used among landscape architects and appears in different projects all over the world (see for example Enköpings kommun 2010; Northamptonshire County Council 2010). By pocket parks I mean small urban parks and open spaces, from grey ones, square-like, with hard ground cover and some vegetation, to green ones with a lot of vegetation. I decided to use the term pocket park as a concept that refers to both small size (< 3000 m^2) and inclusion of green and grey spaces.

Spaces

I have deliberately chosen to write *spaces* rather than *places* in my papers and in the thesis. This is done because the work is based on a quantitative approach where measurable physical park components are in focus. A space is the physical environment that can be represented on a map or an image (Carmona et al. 2003). It is a measurable surface with boundaries towards the surrounding environment. A place is in contrast to the space related to personal experiences of the place, the identity of the place, and genius loci (Thompson 2003), which is about senses, memories and feelings of belonging (Menin 2003). In my view landscape architects design spaces, creating opportunities for places.

Restoration

There are two often-cited theories about restorative environments that provide different views of restoration; the attention restoration theory (ART) of Steven and Rachel Kaplan (Kaplan & Kaplan 1989; Kaplan 1995) and the psycho-evolutionary theory of Roger Ulrich (1991). The Kaplans explain restoration as the process of recovering from mental fatigue, while Ulrich and colleagues (1991) explain restoration as recovery from stress caused by challenge or threat of harm (see section 1.3.3 for an extended description of these theories). Hartig (2004) has provided a definition of restoration that covers the processes of interest to both the psycho-evolutionary theory and attention restoration theory, as well as other potential theories about restoration. According to Hartig (2004 p. 273) restoration is, *"The process of renewing, recovering, or reestablishing physical, psychological, and social resources or capabilities diminished in ongoing efforts to meet adaptive demands."* My thesis is concerned with restoration in that people are asked to judge how likely it is that they would rest and recover in pocket parks presented in images or with text. I assume a broad restoration concept when soliciting people's judgments of restoration likelihood, but when studying the mediating role of experiential qualities I take more specific guidance from ART (Kaplan & Kaplan 1989; Kaplan 1995).

1.2. The importance of parks and nature for public health

Research on restorative experiences has shown that nature is an important setting for restoration. However, the span of what is included in the nature concept varies widely across different studies, from highly managed park environments to wild forests. Natural environments in environmental psychology studies are commonly treated as the opposite of built structure (see for example Hartig et al. 2003; Herzog et al. 2003). As Tveit el al. (2006 p. 245) write,*"Perceived naturalness is context dependent in the sense that what is perceived as naturalness in an urban setting might not be seen as such in a more natural context."* The use of the term natural differs across empirical studies. It can for example be about the amount of vegetation (Tennessen & Cimprich 1995), sometimes rated as greenness (Kuo & Sullivan 2001), or as presented in the review by Tveit et al. (2006), it can be about the absence of human management, and so be more related to a biological definition. In most studies the words "natural" or "nature" are often used for vegetation in general. Nature can for example be gardens, parks, residential landscaping or green spaces outside work places (see for example Chiesura 2004; Kaplan 2001; Kaplan 2007; Korpela & Ylen 2007).

In different studies presented during the last years, urban nature and parks have been addressed as important settings for a number of reasons related to public health, such as social values (Seeland et al. 2009), physical activity (Hansmann et al. 2007; 2006) and restoration (Hartig et al. 2003; Staats et al. 2003). People living in relatively green areas or visiting public parks perceive themselves as healthier (de Vries et al. 2003), less aggressive (Kuo & Sullivan 2001) and less stressed (Grahn & Stigsdotter 2003). They are more satisfied with their surroundings and are more physically active (Björk et al. 2008) as compared to people living in areas with less green space.

Many people visit parks to find peace and quiet, and to be able to relax and recover (Burgess et al. 1988; Chiesura 2004; Hayward & Weitzer 1984; Jim & Chen 2006; Tyrvainen et al. 2007). However, there are a few barriers that can prevent the use of parks for relaxation, some of which are discussed in the following section.

1.2.1. Barriers to the use of parks and nature

To rest and recover it is important that one feels safe. People would not consider entering a park to relax if they felt unsafe or threatened there. Dense vegetation, such as bushes or groups of trees, might make some people feel unsafe and threatened because of the risk of someone hiding in the vegetation waiting to conduct an assault (Nasar & Jones 1997). Openness and visibility which allow detection of threats and announce the possibility for easy escape if danger appears are thus important. But as presented by Kuo and colleagues (1998), high tree density can also be positively correlated with safety. The presence of a pocket park can contribute to the feeling of safety (Kirkebøen 2010) if it attracts people, the presence of which in itself can induce safety (Nasar & Jones 1997).

The relation between restoration and safety is a rather unstudied area. Staats and Hartig (2004) investigated the opportunity for restoration when visiting a forest compared to an urban area alone or in company with a friend. In the forest, company had a positive influence on restoration because the respondents felt safer, but this was not the case in the urban setting. If safety was not a concern, being alone was preferred even in the forest. Although safety is an important issue, I have not explored it in this thesis. Instead I have controlled for it in the methods used (see section 3.4.1.).

Another barrier that can prevent people from using parks is cold weather (Thorsson et al. 2004). Due to low temperatures or snow, parks in Scandinavia are mainly used between April and October. During the cold season, however, parks might still be pleasant to look at, encouraging restorative experiences through, for example, views to nature from a window, at home or in the workplace (Kaplan 2001; Tennessen & Cimprich 1995). These types of micro- restorative experiences can have importance for attention restoration (Tennessen & Cimprich 1995) or even recovery after surgery (Ulrich 1984). As Whyte (1980) came to believe after years of observing people’s behavior in urban spaces, just the glance of a small park on the way to work can have a positive influence on mood.

In Scandinavia, where half of the year is relatively dark, spending time outdoors in the sun is important for well-being. This has been illustrated by for example Hartig and colleagues (2007), who found support for the argument that poor weather during the summer months could have a negative impact on restorative outdoor activities and as a consequence lead to greater use of antidepressants. People commonly choose to sit on the benches located in the sun during the summer months in Sweden (Thorsson et al. 2004), which is in contrast to southern Europe and many other warm places in the world, where people visit parks to sit down in the shadow to cool down from hot summer temperatures (Lafortezza et al. 2009).

A potential disadvantage with compact cities, at least in Scandinavia, is that buildings can continuously shadow small parks. As a result these parks become dark, cold and unused and can also be experienced as unsafe. By opening up one side of the park towards, for example, a road, more light is brought into the park and it will also be experienced as less private and isolated. However, compared to other regions of Europe, the height of the buildings in Scandinavia is relatively low. The call for sunlight, air and space between the buildings has been an ideal characterizing Scandinavian urban planning for many years; however, due to densification and sustainability concerns these qualities are nowadays set aside (Halvorsen Thorèn & Falleth 2010). Other aspects of densification are further discussed in the following section.

1.2.2. A lack of green space due to densification

Since the end of the 19th century there has been an increasing degree of urbanicity in Europe (Antrop 2004). About 80% of the population in most European countries now live in cities (Antrop 2004). Cities are expanding and natural areas are declining in size and are located further away from city centers. City planning has been highly influenced by the climate change and sustainability discussion during the last ten to twenty years, and as a result the trend in European city planning is densification (Beatley 1999). Compact cities, in this context cities with a dense central core (Jim 2004), are thought to be more sustainable than spread out cities, so-called sprawling cities. A compact city promotes, among other things, lower energy consumption and increased possibilities for effective public transport due to the greater number of people per square meter. It also means better possibilities for developing social services and meeting places. The above mentioned aspects are all very important from a planning perspective, but because the focus in this thesis is on the likelihood of restoration and the design of pocket parks, I will not go into depth on issues related to sustainability in general.

Compact cities are usually created at the expense of access to large urban green areas. Therefore there is a conflict between construction of new buildings and leaving space for public parks where people can meet and relax (Jim 2004). Parks are usually lost or reduced in size due to high political pressure for the construction of roads and buildings (Sandström 2002). The reason for this is in most cases economic. Experience from planning practice is that parks are "unused" open land that does not bring in any money. Hence, buildings are economically defensible in comparison to parks. However, seen from a wider perspective parks can contribute to public health, and in the long run this can result in a healthier population and lower costs for healthcare.

Knowledge from different research disciplines about the importance of green spaces has influenced political decision making. This can be seen in the European landscape convention (Council of Europe 2000), in which one of the aims is to acknowledge *"that the landscape is an important part of the quality of life for people everywhere: in urban areas and in the countryside, in degraded areas as well as in areas of high quality, in areas recognised as being of outstanding beauty as well as everyday areas".* The European landscape convention is signed by all the Scandinavian countries (Council of Europe 2010) and will be, when ratified, a legally binding document. However, implementation of the convention in practice is not unproblematic. As Sevenant (2010) points out, the European Landscape convention is written in an imprecise way that leaves room for interpretation. This means that practitioners' and politicians' individual knowledge and interest for green qualities become crucial in the planning process, in which values are weighed against each other. Lack of concrete information is as pointed out by Velarde and colleagues (2007) also an issue in research on restorative environments. The common procedure of comparing built versus natural settings or scene types does not bring applicable knowledge to practice. The categories compared are too broad. To support practice with knowledge there is a need for detailed information on which components of the natural environment are the most important.

To enhance and defend the green values in a community undergoing densification, many municipalities in Sweden and Norway have started to make green structure plans part of the mandatory structure plan (Sandström 2002). The green structure plan documents existing green structure and includes analysis of and plans for future development of existing and new spaces (Tallhage Lönn 1994). The green structure plan includes parks, urban forests, church yards, rivers, ponds and other natural features. However, further steps may be required before policymakers and politicians consider the values of parks and urban nature equal to other values; before they see the green spaces as a necessity rather than a luxury (Groenewegen et al. 2006).

1.2.3. Small green alternatives

As a result of densification, smaller green alternatives such as pocket parks, roof gardens and boulevards are likely to become important settings for restoration. As found by Talbot and Kaplan (1986), a large park is not always better than a small park. The intimate and small park close to home is usually the most valued green area (Burgess et al. 1988) and the shorter the distance from one's dwelling to a park, the more often it will be visited (Grahn & Stigsdotter 2003). Having parks close to home is especially important for children and elderly who are not very mobile (Halvorsen Thorén 2005). A five-minute walk for children or pensioners might mean a distance of about 200 meters compared to double the distance for adults (Nielsen & Hansen 2006).

Thwaites et al. (2005) conceptualize a network of small parks, linked with green corridors to create a mosaic/network of urban green structure. They base their idea of sustainable ecological societies on landscape ecological principles, with patches, corridors and matrices. The small parks can work as important restorative spaces within the network and attract both humans and wildlife (Thwaites et al. 2005). A green mosaic structure can also facilitate social interaction by creating meeting points and passages, which may encourage people to walk or use bicycles. It will contribute to a livable city (Gehl 2007) as well as public health through physical activity (Halvorsen Thorén 2005).

A pocket park is usually not seen as a space for recreation in the same way as a larger park. A pocket park might be a space that one passes on the way to work or the small outdoor room where one spends the lunch break or walks the dog (Forsyth et al. 2005). The small park cannot compensate for a larger park, due to its limited size and hence restricted functionality, but it is a complement that will increase the availability of everyday experiences of nature. In a study by Tyrvainen et al. (2007), locals were asked to map their favorite places in Helsinki. Not surprisingly, the bigger parks, more forest-like spaces, were mentioned as the most important. However, one could argue that this might be a result of people not thinking of small parks as spaces for activity. A large park can contain more qualities so it is likely to attract a greater variety of people with different interest (Berggren-Bärring & Grahn 1995). On the other hand, many small parks will together form a greener city that will enhance both ecology and human health.

Some of the small parks that I have studied are not found in city maps or aerial photos. They are somehow hidden spaces due to their small size, which was something I experienced when planning the field survey to sample photos for Study 1. In the aerial photos these small spaces could be hidden by a large tree canopy covering most of the space, which means it is difficult to see if there is a dedicated park space under the tree or if the tree is just part of a tree row along a road without park space (see Figure 2).

Figure 2. An example of a pocket park presented in a map, an aerial photo, and a photo from within the park. Due to its small size and the small amount of vegetation, the pocket park was hard to find on the map or in the aerial photo.

Cullen (2006 p. 80) describes this type of small hidden space in a poetic way:

> T*he little park is just by the Thames between Chelsea Embankment and Cheyne Walk. It is a delightful place with lovely old trees, shrubs, rock garden, seats, statues of famous men and an unobstructed view of an old pub called "The King's Head and Eight Bells". In short, it is well worth a visit. You can enjoy the green leaves and rest for a while in the pleasant company of the people of Chelsea. But when you try to find it on the map you begin to wonder. For where exactly is the park in your otherwise reliable atlas of London, which is a large scale affair in a bulky tome of 131 pages? It must be there for here is the bridge, here is the embankment, and here – yes, there it is, that little object the size of a very small pine-needle, down in the left-hand corner under the word "Walk". That is the entire park.*

1.2.4. Park development and health - an historical retrospective

Parks and gardens as spaces to rest and recover have a long tradition dating back to the Middle Ages, when many monasteries and hospitals were built in natural environments, with a courtyard designed for recreation (Barnes & Marcus 1999). Due to technical development and new medicines, the link between nature and health gradually weakened in health care and natural components came to be seen more as decoration than a resource in the rehabilitation process (Barnes & Marcus 1999). However, interest for the outdoor environment and its healing functions is growing in both research and practice, see for example the theses by Ottosson (2007), Stigsdotter (2005) and Thorsen Gonzales (In press).

The design of public parks as spaces for recreation and socialization started as a reaction to the poor living conditions in cities during the 19th century (Hall 2002; Lawrence et al. 2003). Due to rapid urban population growth with industrialization, living conditions for people became extremely unpleasant in cities; dwellings were small, sewage systems did not work, the air was polluted and epidemics occurred (Lawrence et al. 2003). The "green" trends had important early milestones in the USA and Great Britain. Fredrik Law Olmsted was one of the early American landscape architects who brought up ideas about healthy cities with open spaces, parks, trees, wider streets and light (Lawrence et al. 2003). Olmsted even talked about restorative qualities of viewing nature (Ulrich et al. 1991). In Great Britain Ebenezer Howard is known for consolidating ideas like those Olmsted applied in USA. According to Hall (2002), Howard promoted a dense inner city rich in parks and gardens. In his book *Garden Cities of Tomorrow,* written in 1902, Howard describes his ideas about the garden city, combining natural benefits from the country side with social benefits from the city (Howard 1902).

In her thesis, Bucht (1997) describes how the trends from Europe and USA gradually reached Scandinavia. She notes that the following park development in Scandinavia was a bit different. Due to the low number of inhabitants compared to USA and Great Britain, and great assets of untouched nature, much existing nature was kept as a resource within the cities. An important forerunner in Swedish green structure planning was Holger Blom. Around the mid-1920s, he was the park director in Stockholm. To create a healthy city, in which the green qualities are protected, Blom argued for parks and green areas as part of the general city plan. He addressed the need for regulations and standards so that the green qualities would not be overbuilt (Bucht 1997).

The Danish architect and urban designer Jan Gehl is another influential person in Scandinavia. He has had, and still has, great influence on urban planning. Gehl has studied city life and the use of urban open spaces in Copenhagen over several decades. His book "*Life between buildings - using public space* " (Gehl 2006) was first published in 1971 and is still a highly cited and used book among landscape architects and planners. The book is about the relation between architecture and public life and focuses on the human scale. Gehl (2007) also talks about how the city in the 21st century is seen as a meeting place where social interaction is highly important. His focus on the spaces between the buildings is meant to promote city structure where walking and biking become more important means of moving in comparisson to taking a car. These spaces and activities not only encourage social contact but also physical activity.

The early "green" trends that developed in the USA and Great Britain are still highly relevant in urban planning. New concepts evolved towards the end of the 21st

century, such as *New Urbanism*, which involves promoting high density, pedestrian friendly cities with parks and tree-lined streets (Forsyth et al. 2005; Song & Knaap 2003). This design strategy is assumed to be both socially and ecologically friendly. A further development of New Urbanism called *Green Urbanism* has the vision to promote highly ecological and sustainable cities. According to Beatley (1999), the author of the book *Green urbanism: learning from European cities*, part of the vision is to make nature visibly present through the creation of public parks, making the city not only green but livable. He takes a holistic view when he describes a healthy lifestyle as a situation where people can choose to live without a car, which is easier given a well-developed green space structure integrated with alternative transportation options such as walking and biking.

1.2.5. The role of the landscape architect

Although there is a long tradition of park design, landscape architecture as a profession is rather young. Influenced by Fredrik Law Olmsted, formal education in the profession started in the USA, where Harvard University was the first university to qualify landscape architects (Jørgensen & Suneson 1999). In Europe, Norway was the first country to establish an educational program, at the Norwegian University of Life Sciences in 1919 (Jørgensen & Suneson 1999). According to Murphy (2005 p. 2), landscape architecture is now defined as: *"... the discipline devoted to understanding and shaping the landscape and, as a profession, provides site planning, design, and management advice to improve the landscape for human benefit."* In my point of view, landscape architecture is not only for human benefits. It should also take into account principles concerning ecological sustainability, in line with Green Urbanism.

Landscape architecture is one of the professions that, among other things, is responsible for the development and protection of green spaces within the cities. Decisions made by the profession have an impact on an urban inhabitant's daily life, which in turn has an impact on his or her health. The design of the outdoor environment is of special importance in highly urbanized areas where people are frequently exposed to stress factors. Many people living in urban areas have few possibilities for directly influencing their nearby environment. They have to rely on planners and landscape architects to create environments that can enhance psychological restoration. To cite Bourassa (1991, pp. 118-119):

> *…landscape is a form of art that is imposed on the public. It must therefore be more socially responsible than other art forms, such as painting or literature, which can easily be avoided. This means that environmental designers require much greater discipline, to insure they produce designs that either conform to the existing context or improve upon it or perhaps even create a new context.*

1.3. Psychological restoration

The thesis has until now outlined the importance of urban green spaces in light of a densification trend. This section will focus on restoration. I will introduce the reader to links between preference and restoration, introduce theories about restoration and discuss different ways of measuring experiences related to restoration. My thesis assumes a broad restoration concept, but I take more specific guidance from ART when studying the mediating role of experiential qualities (Kaplan & Kaplan 1989; Kaplan 1995). To put restoration into a wider perspective I would also like to describe the psycho-evolutionary theory (Ulrich et al. 1991).

1.3.1. Links between preference and restoration

As presented in a number of studies, comparing built versus natural scene types, there is a link between expressed preferences and ratings or judgments about the likelihood or potential for restoration (Herzog et al. 2003; Purcell et al. 2001). One explanation for this is that people in need of restoration might have higher preference for places that support restoration, and nature is seen as such a place (Staats et al. 2003). Restoration can also be a mediator of preference; this statement is supported by van den Berg et al. (2003), who found that affective restoration partially mediated the relation between the natural environment and beauty.

Methodologically there are also similarities. A number of studies measuring restoration likelihood have adapted the common procedure in preference studies, presenting groups of people with photos asking them to rate the photos in terms of preference or restoration likelihood (for further description of ways of measuring restoration see section 1.3.4.).

Research on the assessment of landscapes began to take off in the 1960s (Zube 1974). There has long been a discussion on whether landscape quality or beauty lies in the environment itself, or if it lies in the observer of the environment (Lothian 1999). It has also long been discussed whether preferences for environments differ between experts and non-experts (Sevenant 2010). As found by other researchers, landscape architects can have different preferences than lay people (Buhyoff et al. 1978). From a professional point of view it is hence highly important to base design decisions on people's preferences. The research presented in this thesis demonstrates the use of different methods for collecting preferences ratings and judgments of the likelihood of restoration from the general public. Results can be of use in creating small urban parks that most people will like and find to be restorative in practice.

1.3.2. Cultural and biological explanations for preference

As mentioned earlier, people tend to prefer natural over urban environments. But what causes preferences for nature? Some have pointed to cultural explanations, such as Tuan (1974), who developed the concept of topophilia. According to Tuan, our cultural background, age, gender and hobbies shape our preferences. In Scandinavia, nature romanticism is generally rather strong and this is thought to affect Scandinavians' preferences for nature (Tuan 1974). To put it simply, in Scandinavia as in other regions, nature is seen as good while cities are seen as necessary evils (van den Berg et al. 2007). How cultural differences affect preference has been discussed and explored by many researchers. In a meta-analysis based on 107 references, Stamps (1999) found relatively few differences between demographic groups such as for example students versus lay people. However, most studies within this field represent Western cultures (Ulrich 1993) and are not generalisable for all people.

Others have explained preference for nature as a result of our evolutionary history (Appleton 1975; Kaplan & Kaplan 1989; Orians 1986; Ulrich 1993). These theories point to particular landscape structures or details in the environment as bases for preferences. For example, one line of research has considered whether people give high preference scores to the savannah-like, semi-open, landscape where prehistoric humans are thought to have lived (Orians 1986). Savannah trees have a typical shape with low trunk and wide canopy, optimal to climb and take refuge from predators and this type of tree has been found to be highly preferred (Lohr & Pearson-Mims 2006). Studies have also shown preference for scenes with water (White et al. In Press) which can be explained with reference to the necessity of water for survival (Ulrich 1993).

One of the most cited evolutionary theories is the prospect-refuge theory (Appleton 1975), which deals among other things with aspects of enclosure. Having a space with enclosure on two or three sides creates a refuge from where people can look out without being seen themselves. The preference for prospect-refuge spaces is thought to be related to inborn reactions to landscapes, originating from our time as hunters and gatherers (Appleton 1975). Today this pattern of behavior can be seen in preference for seating with cover behind our back, as suggested by Gehl (2006).

The biophilia hypothesis (Kellert & Wilson 1993) explains preference for nature in a broader perspective. According to Wilson (1993), biophilia is about an inborn preference for other living things. However, preference for nature is also a result of what Wilson (1993) calls a gene-culture co-evolution. Inborn feelings for nature are transferred through language to for example myths and symbolism representing culture. This means that seen over a long period both culture and nature affect preference.

Recent research has favored the explanation that humans form preferences based on an expression of both genetic and cultural processes (Bourassa 1991; Hartig 1993; Kellert & Wilson 1993). In line with the biophilia hypothesis (Kellert & Wilson 1993), people have genetically based preferences that are constantly challenged and changed by cultural influences. Our landscape preferences thus become a combination of biology and culture (Bourassa 1991; Hartig 1993).

1.3.3. Theories about restorative environments

As mentioned in the definition section, there are at present two dominant theories about restorative environments: the attention restoration theory of the Kaplan's (Kaplan & Kaplan 1989; Kaplan 1995) and the psycho-evolutionary theory of Ulrich (1991). Both theories assume that human evolution in natural environments continues to have implications for environmental preferences and other aspects of human psychological functioning. But they have different views on conditions from which a person needs restoration.

The psycho-evolutionary theory

According to Ulrich (1991), stress can be caused by challenges or fearful situations that can result in emotional reactions such as anger and sadness. The psychological reactions are expressed physiologically in terms of, for example, raised blood pressure, heart rate and muscle tension. These reactions reflect mobilization to be able to cope with the threatening situation. Visual stimuli, including nature contents such as vegetation and water, can evoke positive feelings and block negative thoughts, which in turn can reduce the level of psychophysiological and emotional arousal. The change in stress level can be a rapid process and can occur within a few minutes. Spending time in a restorative setting increases one's possibility to relax and hence be ready for new challenging situations.

Attention restoration theory (ART)

ART is concerned with cognitive activity rather than emotional reactions as in the psycho-evolutionary theory. According to Kaplan (1995), restoration is the process of recovering from mental fatigue. This involves a depleted capacity to direct attention. When concentrating and focusing on a task, for example reading a paper or driving a car, people use their ability to direct attention. If something distracts people, for example hearing voices from other people talking or a telephone ringing, they will have to force themselves to keep focused on what they are doing. This act, also called directed attention, demands effort. To react to changes and events in the immediate surroundings, that is, distractions, would have been important for survival during human evolution. In modern society, however, there are many things that may distract a person even when it is most important to concentrate. Having to sort through the incoming information for what is relevant at the moment can in the longer run result in mental fatigue.

To avoid becoming attentionally or mentally fatigued, people need to rest the inhibitory mechanism on which directed attention depends. Nature is particularly likely to promote restoration because it is an environment that affords the four components of a restorative experience described by Kaplan (1995). The first and most central component is *fascination*, or effortless attention engaged when an environment catches one's interest. This can be engaged by patterns in the landscape, flora and fauna, and other features of the environment, as well as by exploration of the surroundings. The second component is *being away*, which refers to psychological distance from the demands and routines in which a person uses the directed attention capacity. It can involve being away physically or conceptually from the everyday environment. The third component is *extent*, which combines both the degree of order or coherence in the environment and the scope for exploration. Kaplan (1995) refers to a high level of extent as a feeling of a whole other world. It is rich in elements to engage one's mind. It opens up for exploration and allows you to rest from other thoughts. The fourth component is *compatibility.* This refers to the degree with which the environment matches your expectations/purposes with the visit. It is also important that the environment signals what one can do at the site.

The different theories play a role in this thesis by providing a means of understanding how visits to parks can promote health in the long run. ART in particular also was used to support the empirical work in different ways. First, it guided the development of the scenario used to frame the tasks undertaken by participants in the different studies. Second, in Study 1, I explore how restorative qualities of person-environment encounters as described in ART mediate the relations between park components and restoration likelihood.

1.3.4. Measurement of restoration, restoration likelihood and restorative quality

Research on restorative environments has used a variety of different measures. These include measures of actual restoration, restoration likelihood, and restorative quality or potential. An explanation of each type of measure will be given in the following pages, together with some examples. Except for measures of pupil size in Paper III, the empirical work presented in this thesis is based on measures of the likelihood of restoration.

Actual restoration

Actual restoration, involves the changes characteristic of restoration that take place in a person during the time they spend in a discrete experience (see Hartig 2007). It is typically measured using physiological measures and self-reports of emotions, in accordance with the psycho-evolutionary theory, and/or with behavioral measures of directed attention, in accordance with ART. For example, in a lab study by Ulrich (1991), actual restoration was measured as physiological reactions such as heart rate, skin conductance and muscle tension. Participants were presented a scary film to induce psychophysiological stress, and then watched different videos during a period allowed for recovery, while physiology was measured continuously. Actual restoration has also been measured in the field. For example, Ottosson and Grahn (2005) measured elderly people's blood pressure, heart rate and powers of concentration after a one hour break in a garden or an indoor room. The researchers found no differences across the environments in blood pressure or heart rate though powers of concentration increased in the garden group.

Actual restoration has also been measured in accordance with ART. In several studies students have been exposed to mental load through an attentionally demanding task, such as the Stroop task (see Hartig et al. 1991). This has been done to create a potential for attention restoration. The ability to direct attention has been tested before and after the participants have been presented a video or photos of natural or urban environments or after spending time in a natural environment.

Actual restoration should be distinguished from self-reports concerning the amount of decline in stress or improvement in focus that a person believes has occurred during a period spent in some activity in some environment (Hug et al. 2008). This type of measurement can be called perceived restoration. Whether actual restoration is measured through physiological measures, behavioral measures, or perceived restoration, it presupposes that there is a need for restoration. Otherwise, restoration could not occur; there would not be anything to restore from.

Likelihood of restoration

Another measure used in this research area concerns how likely the participants think it is that they would rest and recover in some setting that they could come to enter. It is in contrast to actual restoration not a measure of whether restoration actually occurs but rather it is a measure of how likely it is that restoration could occur, as judged by a subject. It is hence dependent on the subject's capacity to imagine being in the setting presented in the stimuli.

To provide a standardized, plausible and relevant context for the rating task, participants are typically given a scenario, where they are asked to imagine being in need of restoration (see for example Herzog et al. 1997; Herzog et al. 2003; Staats et al. 2003).

Rating scales are commonly used when evaluating restoration likelihood. The range differs between studies, for example Hartig and Staats (2006) used a 7-point scale while Herzog et al. (2003) used a 5-point scale. In my first two studies I use an 11-point scale (0-10) which is also used in the *Perceived Restorativeness Scale* developed by Hartig and colleagues (1997). A larger number of scale points allows for more differentiated responses.

Measures of the likelihood of restoration are suitable when one wants to explore how large number of different type of environments could contribute to a restorative experience. It is also suitable from a landscape architects perspective designing future parks where people can restore.

Restorative quality

Restorative quality has typically been measured in terms of being away, fascination, coherence/extent, and compatibility as set out by ART. When one wants to measure the restorative quality of an environment the common procedure is to use a set of questions or statements about the environment, called items, which have a common content. The set of items is called a scale. A number of scales have been developed based on items related to the Kaplans (Kaplan & Talbot 1983; Kaplan & Kaplan 1989) four components; *The Perceived Restorativeness Scale* by Hartig et al (1997) is widely used by other researchers and has been translated into a number of languages (see for example Hidalgo et al. 2006; Purcell et al. 2001; Tenngart Ivarsson & Hagerhall 2008; Thorsen Gonzalez et al. 2009). Other examples of scales are the *Restorative Components Scale* by (Laumann et al. 2001) and the *Restoration Scale* by Han (2003). Bagot (2004) has also developed a restoration scale for children the *Perceived restorative components scale- for children*. Finally, Pals (2009), has proposed a scale for restorative characteristics of zoo attractions, the *Perceived Restorative Characteristics Questionnaire.*

1.4. Methodological rational

The triangulation approach I have used contributes to a more comprehensive set of findings (Macheridis 1995) in which the results of the different studies complement each other. The weaknesses of one method are complemented by the strengths of another method and together they form a more convincing whole. Under the headings below I will give a general introduction to the different methods. I will provide further information on the implementation of these methods in Chapter 3, and a discussion of their respective strengths and weaknesses in Chapter 4.

1.4.1. Ratings of photos – regression analysis

With ratings of photos, groups of people are presented with visual stimuli or images, such as photos of parks, that vary in different ways, such as in the amount of grass or trees shown. Ratings of the stimuli are given on scales for the variables of interest, such as preference, fascination, being away, and restoration likelihood. By presenting groups of people with different environmental stimuli one can determine people's appreciation for different environmental components (Sundli Tveit 2007), hence in my case predict, using multiple regression analysis, how changes in the park will affect judgments about the likelihood of restoration.

The landscape preference research deals with subjective issues about what people prefer/like. Since preferences are subjective, one could expect them to vary greatly. However, as presented in my studies and supported by other researchers (e.g. Sundli Tveit 2007), some of the findings are rather robust across studies, such as the tendency to prefer scenes with greater amounts of vegetation (see for example

Herzog et al. 2003; Kaplan 2007). As Lothian (1999 p. 195) writes, the method is *"scientifically and statistically rigorous, is replicable and objective, reflects the preferences of the community…".* However, as Stamps (2004) points out, the number of studies comparing built versus natural scenes types have a high degree of heterogeneity in stimuli. In my studies the stimuli represents variation in scenes of a relatively limited type of environment, the pocket park, containing photos with a lot of vegetation as well as ones with only a single tree.

As mentioned earlier there is a link between preference and restoration, and most studies about restorative environments have adapted the method used in preference studies to assess people's likelihood for restoration in different settings. In these studies, usually performed within environmental psychology, people have been asked to imagine being fatigued (Herzog et al. 2003; Staats et al. 2003), after which they have been presented with images of different environments to rate. The environments have commonly been built versus natural settings. After stimuli exposure, likelihood of restoration is measured.

1.4.2. Rating of photos – eye tracking methodology

Vision is the most dominant sense (Gratzer & McDowell 1971). Through looking at stimuli people are able to take rapid decisions about preference for the environment. As stated by Bell (1999), this rapid process of analyzing an environment was important for survival in prehistoric time and remains important still. When looking at an image or a landscape our attention wanders between areas or features that attract us, that are interesting to us (Duchowski 2007). This pattern of behavior is expressed in free viewing which is when the participants explore photos without being given a task or a question to answer (Yarbus 1967). When presented with a stimuli and being asked a question the eye searches for objects and locations that are relevant to the task (Henderson & Ferreria 2004).

To explore peoples view pattern I applied a method called eye tracking. Eye tracking was developed already in the beginning of the 20th century (Duchowski 2007). It is a method commonly used in cognitive linguistics and psychology, but it has seen relatively little use in landscape architecture and environmental psychology. I found only a few studies on landscapes in my literature search (Berto et al. 2008; De Lucio et al. 1996; Gratzer & McDowell 1971; Keul et al. 2005; Wenger & Videbeck 1969).

While presented with stimuli, the eye tracker apparatus registers fixations or gaze positions held still for a longer period, and saccades, or the gaze movements from one fixation to another. Eye movements are registered and data are transferred to an analysis program. As with photo ratings, described in the previous section, participants can be asked to evaluate the photos in terms of a psychological measure such as preference or restoration likelihood. Through correlating what participants gaze at with ratings they make on a scale, one can get a direkt, objective, link between the stimuli and the subjective response.

1.4.3. Questionnaire data – choice-based conjoint analysis

Conjoint analysis is a method that has mainly been used in marketing research in the development of new products (Orme 2009). However, its use has extended to span a wide range of fields such as in understanding architects' priorities in hospital design (Alalouch 2009), understanding peoples preferences for type and location of housing (Leishman et al. 2004), and elderly preference for different flooring (related to safety perception) (Zamora et al. 2008). In my case, the park is the "product," elaborated in terms of different park components, such as the amount of trees or grass or the presence of features such as a fountain.

There are three primary systems within conjoint analysis: conjoint value analysis (CVA), adaptive conjoint analysis (ACA) and choice based conjoint (CBC) (Orme 2009). CVA is the traditional conjoint analysis. It applies a full profile set up, which is suitable for low number of components. A full profile set up involves the presentation of all components, rather than a subset of component, and the participants are asked to rate the preference for the alternative using a scale.

ACA is suitable for a large number of attributes (Orme 2009). In ACA the participants first give preference ratings to individual components. These responses are then used in the creation of choice alternatives. ACA must hence be conducted via a computer.

CBC is a technique that involves having participants choose between different choice alternatives. It can either be full or partial profile. Instead of asking about preferences for different park components, this technique forces a person to make a choice based on the different levels of components. In Study 3 I decided to adopt (CBC) with a full profile (Orme & King 1998; Orme 2009). This means that each park component of interest was presented at some level in a given park alternative (e.g., many trees, a few trees or no trees).

In CBC participants are presented with pairs of park alternatives which differ in the levels of different components. The participant's task is to choose the alternative that is best for him or her (e.g., with reference to finding a place to sit and rest). The method provides a setup that reminds of real world choices; it creates a realistic choice situation that people can relate to and make trade-offs from. It supports the researcher with findings regarding relative importance of different components and levels of components.

2. THE PURPOSE OF THE THESIS

2.1. Finding the restorative components

There is a lack of literature concerning which environmental components are relevant for designing restorative opportunities in urban parks and open spaces. In many theoretical papers on restoration or health this issue is addressed as a topic for future research (e.g. James et al. 2009; Velarde et al. 2007). The variety of photos used in published studies of preference or restoration likelihood is limited and in most cases not shown to the reader, leaving a gap in information about the content and design of the environment. My intention with this thesis was to go from broad categories of urban versus natural environments to study details, components, in pocket parks that are of importance for restoration likelihood.

Landscape architecture and park design have been performed in practice for a long time, but surprisingly little of the design literature within the field is based on research. This thesis is a first step in the direction of deepening our knowledge about the importance of different environmental components, such as trees, bushes, and water, when designing pocket parks that will promote restoration. The components under study were more or less the same in all three of the studies included in this thesis. They are as follows: hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, and park size.

2.2. Methodological exploration

Within the landscape architecture discipline there has for a long time been a tradition of using qualitative approaches with a focus on site-specific case studies. My ambition with this thesis was to expand the methodological perspective, contribute to the methodological discussions, and demonstrate how quantitative methods and tools could be useful in landscape architecture research.

Photo ratings with regression analysis (used in Study 1) can be seen as a standard approach in environmental psychology, although it is less common to use scenes as cases, with the group mean rating as the value for each variable for each case. Eye tracking (study 2) and conjoint analysis (study 3) are both relatively uncommon in this research area and it was of interest whether some of the main results from Study 1 would be reinforced with the results obtained with those methods.

Using a quantitative approach my hope was also to get more general results that could be applied in the planning and design of small urban parks all around Scandinavia.

2.3. The objectives of the different studies

The objectives of the different studies are rather similar, but the methods used are different. Table 2 gives an overview of the papers from the different studies in terms of methods, stimuli and research questions.

	Paper I	Paper II	Paper III	Paper IV
Method	Photo ratings - Regression analysis	Photo ratings - Eye tracking analysis	Photo ratings - Eye tracking analysis	Questionnaire - Conjoint analysis
Stimuli	Photo	Photo	Photo	Text
Research questions	What environmental components predict restoration likelihood? Do being away and fascination mediate the effects of the components on restoration likelihood?	Which of the park components in Study 1 draw the most attention? What links are there between what people look at and their judgments of restoration likelihood? Is there a direct link between the size/ amount of the components and how much time people look at them?	Which park components do people look at when judging if a park, presented in a photo has restorative qualities? Are there relations between pupil size and judgments of restoration likelihood?	What environmental components and levels of components are most important to people when looking for somewhere to sit down and restore?

Table 2. An overview of the different methods, stimuli and research questions in the thesis.

3. METHODS

This thesis is as already mentioned based on three methods: photo ratings with regression analysis (Study 1), photo ratings with eye tracking analysis (Study 2) and questionnaire data with choice-based conjoint analysis (Study 3). Photo ratings are based on visual judgments where participants are presented with images being asked to rate them in terms of an outcome. In Study 1, ratings of restoration likelihood, preference, being away and fascination were treated as outcomes, regressed on environmental components gained through quantification of park components in photos. In Study 2, participants rated restoration likelihood for a sample of the photos used in Study 1 while their eye movements were registered. The ratings on restoration likelihood were correlated with the amount of time the participants had gazed at the specific component under study. This gave a direct link between the subjective ratings and objective measures concerning perception of the stimuli. In this study view pattern and pupil size were also explored.

To complement the visual studies and strengthen the thesis as a whole, the last study was based on text stimuli instead of photos. I found choice-based conjoint analysis to be an appropriate method for working with components and combinations of components presented with text. Choice-based conjoint analysis is a method in which participants are presented with text that presents combinations of components at different levels in different choice alternatives. The participant's task is to choose the alternative that is best for him or her. In Study 3, "best" was framed in terms of the possibility for needed restoration. This approach relies on the participants ability to imagine the different alternatives by referring to their own experiences. This study is also the most extensive one in the thesis with regard to the number of participants.

In the following sections in this chapter I will describe the different methods in somewhat more detail; however, for still more specific details about procedure, stimuli and material, I must refer the reader to the individual papers and other study materials, which are given in the appendices. Before further describing each method, I will address the choice of parks, components and participants in the different studies.

3.1. Choice of pocket parks represented in photos

The 74 park photos used in Study 1 were of pocket parks in the capital cities Oslo, Stockholm, and Copenhagen, as well as a few other Scandinavian cities. Of these 74 photos, 38 were also used in Study 2. The sampling of parks was limited to Scandinavian cities to ensure that the type of vegetation represented would be similar across parks. The sample represents most of the central pocket parks in the capitals. To find pocket parks for the study, I used city maps and aerial photos and systematically walked through the same areas. A list of criteria was developed for the sampling of parks to be included in the study. The criteria are as follows:

- *Size.* When walking through the cities, registering pocket parks, I found that most of the small parks were smaller than 1500m^2. However, to expand the number of parks, I decided to include pocket parks up to a size of 3000m^2 which represents the size of a small block in the cities I visited. As another standard of comparison, this size is smaller than half of a football (soccer) field.
- *Location.* The pocket park had to be located between buildings and/or roads. At least one side of the park had to be facing a public road.
- *Space***.** The pocket park had to be a well-defined area with relatively clear borders.
- *Surrounding*. The facades surrounding the pocket park had to be at least three stories high.
- *Seating*. There had to be some kind of seating opportunities in the park.
- *Vegetation***.** The pocket parks did not have to be completely "green". Square-like parks with only a single tree were also included.
- *Management***.** Pocket parks that appeared to be unmanaged or untended were excluded from the sample.

The parks were documented with both sketches/maps and photos (see Figure 5 for an example). Photos were taken from eye level in daylight. They were taken from one side of the park to get as large a view as possible and so give an observer a general idea of the overall design of the park. Some photos were also manipulated in Photoshop to erase for example disturbing elements, such as obvious waste in the foreground.

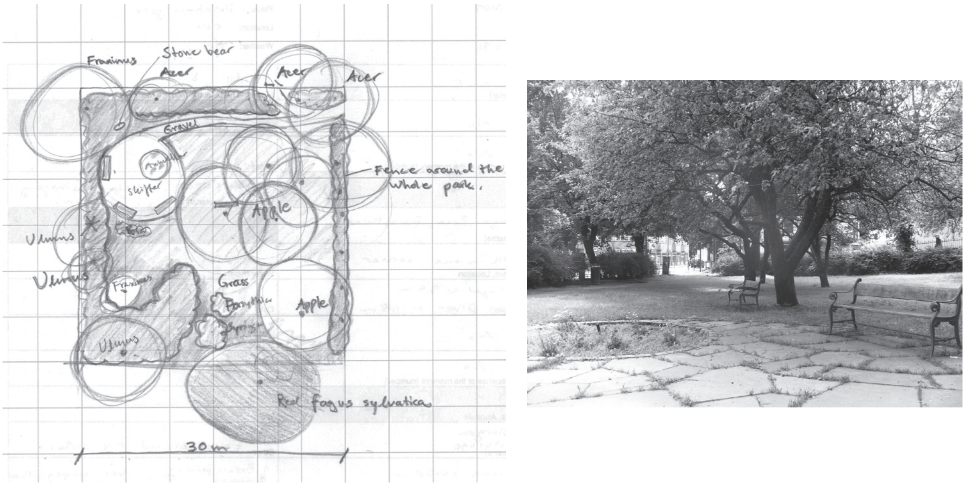

Figure 5. An example of a park documented with photo and sketch/map.

3.2. Choice of park components

By park components I mean physical (mainly natural) environmental features that a landscape architect can work with when designing parks. In Table 3 I give an overview of the different sets of components considered in the different studies.

	Study 1 Paper I	**Study 2 Paper II**	**Study 3 Paper IV**
Hardscape	x	x	
Grass	x	x	x
Lower ground vegetation	x	x	
Flowering plants	x	x	x
Bushes	x	x	x
Trees	x	x	x
Water	x	x	x
Predicted park size	x		
Other people	x	x	x

Table 3. An overview of the components studied in the different papers.

I chose rather broad categories of components, and did not divide them into details such as species, shape, size, or color. This was done for a number of reasons. First, this study can be seen as an initial step in going from broad categories of natural versus urban scene types to focus on a narrower category of scene type, "urban pocket parks," in which the content varied in terms of a variety of environmental components, including natural ones. Second, my sample of parks is from Scandinavia, hence the type of vegetation is similar. Third, during the short exposure of photos in the relevant studies (10-15 seconds), the chance that participants would perceive different species would have been limited. The participants were mainly lay people with no expert knowledge on nature, hence their interest was not likely to have been for the individual species. Fourth, I wanted to keep the number of components (variables) low to retain power for statistical analysis.

The choice of components reflects what normally can be found in pocket parks in Scandinavia. These are also components a landscape architect works with when designing parks and open spaces. A landscape architect creates a park by working with its ceiling, represented by tree canopies; its walls, represented by bushes or trees; and its floor, represented by grass, low plants, or other harder materials (Dee 2003; Robinson 2004). As decoration in the park, a landscape architect can for example include water features or flower beds. I also chose to add the two components size and other people in the park, as both are relevant to the issue of densification in cities.

There are three components (dominant elements within the park, benches, and objects outside the park) that I decided to include in Study 2 because they are likely to draw people's attention and hence interfere with the components of interest. Dominant elements within the park can be, for example, garbage bins, signs, and ventilation systems. Objects outside the park can be for example signs on buildings and cars. Because these components are specific to Study 2, they will be described in the overview of the methods for that study rather than in the following.

3.2.1. Size

A highly relevant concept in this thesis is the size of the park, which is usually synonymous with scale. As the concept pocket park indicates, the parks considered in this thesis are rather small spaces, < 3000m^2, or smaller than an ordinary Scandinavian city block.

In the first study, I take size into account by using photos of pocket parks of different sizes and by including perceived size, given by a group of raters, as a predictor in a regression model. The perception of size is dependent on the relation between horizontal space and vertical height (Alexander et al. 1977; Dee 2003). A space surrounded by multi-story buildings is perceived as smaller than a space surrounded by a one or two story houses (see Figure 6). The experience of size can differ from openness, which is usually a rather positive concept, to claustrophobic experiences, being too narrow hence negative spaces. In that sense the size overlaps with enclosure, a variable often studied in environmental preference research (Stamps 2001). To limit the effects of big differences in building heights on perceived park size, all of the selected parks had surrounding buildings equal to or higher than three stories. Due to convincing results in Study 1, I did not go further in exploring the size variable in Studies 2 and 3, but instead informed each participant that the study was about small urban parks.

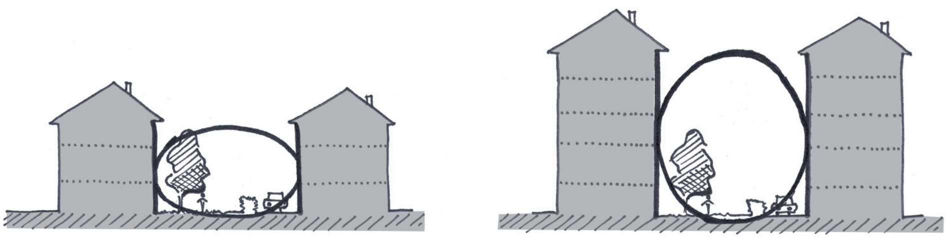

Figure 6. The experience of park size is influenced by the height of surrounding buildings.

3.2.2. Ground cover

As ground cover variables, I use the components hardscape, grass and lower ground vegetation. Hardscape includes all hard materials such as asphalt, gravel and paving stone. Grass in this urban context represents a cut lawn, and lower ground vegetation includes perennials, annuals and ornamental grass.

In a number of studies, photos with a few trees spread on a cut lawn are among the most preferred scenes (see for example Herzog et al. 1982; Herzog et al. 2003; Kaplan & Austin 2004). In a Norwegian study by Nyhuus and Halvorsen Thorén (1996), having a few trees on a cut lawn was presented as the dominant tendency in Norwegian parks. Grass of itself is found to positively influence preference (Talbot & Kaplan 1886). However, in Sweden, the trend toward using more hard materials such as concrete or granite is growing (Wahlsten et al. 2008). This is mainly due to demands for low management costs.

Lower ground vegetation was included as a variable because it is a common component in small urban parks. It is not a surface one walks on, hence, it can be considered more similar to a decorative element contributing to the overall greenness of the park.

3.2.3. Walls and ceiling

The walls and ceiling of the pocket park have importance for feelings of enclosure and privacy, and so may promote the feeling of being away as described in ART. In the pocket parks studied here, the walls and ceiling are represented by the surrounding facades, bushes and trees. By bushes I mean both hedges and free growing solitaries and by trees I mean all type of trees, independent of shape, size or pruning. One of the key components mentioned in many studies of urban nature is the presence of trees (Harrison et al. 1987; Jim & Chen 2006; Schroeder 1982; Ulrich 1993). The interest in trees can be seen in the number of studies investigating different aspect of trees, such as preferences for different canopy shapes (Lohr & Pearson-Mims 2006), densities (Schroeder 1986), and types (Tyrväinen et al. 2003), as well as spatial perception with the arrangement of trees (Serpa & Muhar 1996) and their symbolic values for people (Sommer 2003).

3.2.4. Decorative components

I included water and flowering plants because these two components commonly appear in the type of pocket park under study. By water I mean small ponds and fountains. Water is a component that usually prompts high scores on restorative potential or likelihood (Berto 2005; Laumann et al. 2003; Purcell et al. 2001;

White et al. In Press). However, in most studies, water is mainly represented by natural features such as lakes, the sea, or rivers, and little is known about urban water features such as ponds and fountains.

Flowering plants have been mentioned as an important and preferred component of urban nature (Burgess et al. 1988; Harrison et al. 1987). From an evolutionary perspective, one might explain preference for flowers as biologically prepared because they signaled the availability of food, nuts and seed relevant to survival of pre-humans (Kellert & Wilson 1993); however, there may also be cultural bases for preferences (e.g. Bringslimark et al. 2009). Flowers are also plants that the municipalities spend a lot of money on, hence it is interesting to include them. In Study 1 and 2, all flowers were marked as flowers in the image, including flowers on bushes and trees as well as flowers in pots or on the ground. However, in Study 3, only the presence versus absence of flower beds is referred to in the choice alternatives.

3.2.5. Other people in the park

The presence of people is not a physical feature that a landscape architect can design with, other than by creating seating opportunities and other attractions that draw people into a park. However, the number of people is a relevant "component" in the urban context and in the type of pocket parks that I have studied. People are also expected to influence the likelihood of restoration (Ulrich et al. 1991).

3.3. Participants

Table 4 gives an overview of the participants in the different studies.

Participant Characteristic	Study 1 (Paper I)	Study 2 (Papers II, III)	Study 3 (Paper IV)
Number	52	33	154
Mean age (years)	26	23	43
Gender	75% women	73% women	67 % women
Nationality	92% Swedish	97% Swedish	98% Norwegian
Type	Students	Students	General public
Location	Uppsala (Ultuna), Sweden	Lund, Sweden	Oslo, Norway

Study 1 and 2 were performed with university students. The use of students can be criticized for not providing a representative sample of the population; however, a meta-analysis by Stamps (1999) showed strong correspondence ($r = 0.83$) between environmental evaluations from student and non-student groups. This said, I wanted to explore how a broader segment of the Scandinavian public responded to the different components. I thus turned to residents of Oslo, Norway for Study 3. I segmented the 154 participants into subgroups according to age, gender, earlier work or study experience with parks/nature, and frequency of park visits. Those participants with earlier study/work experience and those who visit parks frequently represent types of expert group for which other researchers have found differences (Buhyoff et al. 1978; Tveit 2009) compared to those who do not have such experience and those who do not visit frequently.

The participants in all studies were living in or nearby a large Scandinavian city (Uppsala, Lund, or Oslo), hence, they were presumed to be familiar with the type of pocket parks in focus. They were likely to experience the urban environment on a daily basis, and to be able to imagine the scenario used in the different studies to introduce the task that they were to complete. The scenarios referred to being on a walk in a large town, looking for somewhere to sit down and rest for a little while.

The choice of cities covers a rather wide geographical area with people from the south and central part of Scandinavia. However, university students do not come only from the local area, so one can assume that the students in Studies 1 and 2 come from all around Sweden.

3.4. Summary of the methods in the different studies

This section gives a summary of the methods in the different studies. Each method is divided into the same subheadings: preparation of stimuli (or questionnaire), procedure and data analysis. For more details of each method see the individual papers in the appendices.

3.4.1. Study 1 - Paper I

Preparation of stimuli

For each park photo, some of the park components (hardscape, grass, lower ground vegetation, flowering plants, bushes, trees) were quantified using an approach first applied by Shafer et al. (1969). Working in Photoshop, a grid pattern of 588 (21 vertical x 28 horizontal) squares was laid over each photo. Each square covered by more than 50% of a given component was marked and counted and the percentage of that variable in relation to the total image was calculated. The quantification gave an objective measure of the amount of different components. For the ground cover variables, different quantification metrics were used, including "% of the image", "% of the total ground surface of the park", and "% of the visible ground surface of the park". The different variables correlated strongly, and I decided to use "% of the total ground surface of the park".

Some of the perennials representing lower ground vegetation were in fact growing more like bushes. For these images I only quantified the squares covering the ground because it was most appropriate in relation to the ground cover category. Flower pots were not part of the lower ground vegetation variable because the plants did not grow directly on the ground. However, squares including flowers from pots were counted as flowers belonging to the flowering plants variable rather than the lower ground vegetation variable. Water and other people were not quantified as the other variables. Water was treated as a dichotomous variable (i.e., presence or absence of water). The presence of other people was quantified in a number of ways (number of people standing, number of people sitting, total number of people, and presence/absence of people). To control that safety would not be a concern I erased most graffiti and litter in the park photos and mentioned in the scenario used to introduce the rating task that it was daytime, so that darkness would not be of concern.

Procedure

The groups of participants were first presented with a scenario:

> *Imagine that it is midday and you are walking alone in a large town like Stockholm/Oslo. You are mentally tired from intense concentration at work and are looking for somewhere to sit down and rest for a little while, before going back to work.*

Photos were presented with a laptop computer and projector on a large screen and arranged in a new random order for each session. Each photo was shown for 15 seconds. During that time, each participant was to provide a rating on one of the psychological variables, that is, being away, fascination, likelihood of restoration or preference. 11 data collection sessions were completed.

Data analysis

Using multiple regression techniques, the analyses focused on estimating the strength of the relationships between the quantified park components and, in alternate models, the rated likelihood of restoration and preference, as well as the extent to which perceptions of being away and fascination mediated those relationships. The choice of including fascination and being away follows from recognition that extent and compatibility were restricted in important respects by materials and procedures.

It is important to emphasize that the units used in the regression analysis were not the individual people rather the individual parks. By having different people evaluate each park on only one variable, using group means as the data for each park, and then using parks as unit of analysis in the regression, one eliminate problems such as single-source bias.

The logic of mediation tests proposed by Baron and Kenny (1986) was applied. The models tested are depicted in Figure 7. Mediation is established if the independent variables affect both the mediator and the outcome and if the relationship between the independent variable and the outcome is significantly reduced when including the mediator.

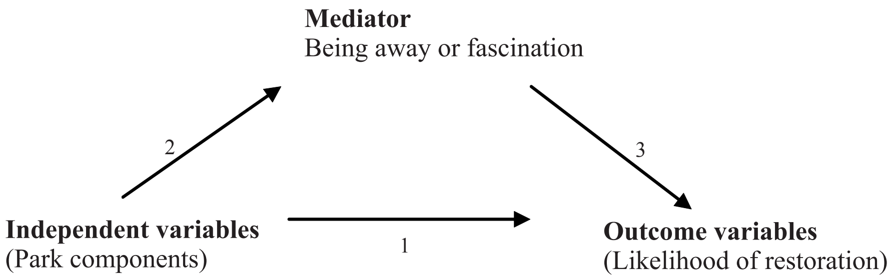

Figure 7. The test of mediation according to Baron and Kenny (1986). Step one, the outcome were regressed on the independent variable; step two, the mediators were regressed on the independent variable; step three, the outcome were regressed on both the mediator and independent variable.

To illustrate the potential combined influence of different park components on restoration likelihood, I also calculated a cumulative exposure measure based on the various components (cf. Evans 2003). Doing this, I wanted to present variation in restoration likelihood as a function both of the number of components present at particular levels and of park size (see Figure 5 in Paper I, in Appendix 1).

3.4.2. Study 2 - Papers II and III

Preparation of stimuli

From the 74 park photos in Study 1, 19 with high restoration likelihood ratings (mean > 5.55) and 19 with low ratings (mean < 3.82) were chosen. The areas representing the same park components as in Study 1 were marked in the photos with polygon shapes, so called area of interest (AOI). Three variables were also added; benches, people and dominant elements in the park. This was done because all these components were likely to draw the participants' attention in during the eye tracking procedure.

Procedure

The data collection was done individually, with a new random order of the photos for each subject. Arriving at the laboratory, the subject first provided socio-demographic and background data. A short briefing followed, introducing the procedure and the eye tracking equipment (see Paper II for photos of the equipment). Thereafter the participants were presented the same scenario as in Study 1. After calibration of the eye tracker, photos were presented followed by a rating task on restoration likelihood. The time for stimuli exposure was reduced from 15 seconds, in Study 1, to 10 seconds in this study. This was done because of an interest in the immediate reactions to the stimuli. The rating task was about restoration likelihood and was phrased as follows: *"I would be able to rest and recover my ability to focus in this environment".* By using the mouse of the computer the subject could mark, on a scale (0 = not at all; 10 = completely), the extent to which they agreed with the statement. Eye movements were registered for each photo, using fixations of the left eye. The total time required for the whole procedure, including calibration, was 10-15 minutes.

Data analysis in Paper II

To determine which areas of interest drew the most attention, the dwell time variables were calculated looking across all of the parks. These variables represent the amount of time that all of the participants looked in the given area of interest (AOI) in relation to the sum of dwell time in all the other areas of interest marked in the image. Dwell time for each component was then summarized across parks. To explore the relations between what the participants gazed at and their ratings of restoration likelihood, the dwell time variables were correlated with the restoration likelihood judgments looking across the parks. Of interest was also whether the photos with a large picture area of a certain park component automatically also had a higher dwell time in that area. To explore this, quantification data from Study 1 was imported, leaving out the data for four variables (i.e., benches, people, dominant elements, and water, on which there were no quantification data). The correlation analyses were then repeated as partial correlations between restoration likelihood and dwell time for each area of interest, controlling for the amount of each park component.

As a last step in the analysis, relations between number of fixations and responses on the restoration likelihood statement were assessed, to test the hypothesis that photos low on restoration likelihood would have a higher number of fixations (Berto et al. 2008).

Data analysis in Paper III

This paper is mainly based on visual analysis of heat maps (two-dimensional color maps that show the parts of the image that have most fixations, so-called hot spots) and scan paths (films of the eye movements, presenting order and lengths of fixations and saccades), see Paper 3 for photos of the visual analyses. The individual data were combined into one heat map for each park photo. This was done to explore patterns in the group as a whole. All hot spots in each heat map were counted and frequencies for different components were calculated. All scan path films were visually analyzed on an individual basis. The three photos having the highest values on restoration likelihood and the three photos with the lowest ratings were analyzed in depth.

As a complement to the visual analysis, the correlation between restoration likelihood ratings and pupil size was explored. A mean value of the pupil size for each person's fixations for every photo was calculated. The mean pupil size per photo and person, was then correlated with each person's rating on restoration likelihood for each park photo.

3.4.3. Study 3 - Paper IV

Preparation of questionnaire

Choice-based conjoint analysis involves the presentation of successive pairs of park alternatives, in this case each with six components at different levels. The components under study were grass, bushes, trees, flower beds, water, and the amount of other people in the park. This choice of components represents a sample of the most important components in Studies 1 and 2. The levels of each component, except for water and flowers, varied from none to many in three steps (e.g. no trees, a few trees, many trees). The participants were to take into account all six park components when weighting the two alternatives against each other to determine which was best, given that they had to find somewhere to restore. The questionnaire was built up as a web based survey and efficiency tests were done to ensure adequate statistical power (for more information on the questionnaire, see Paper III).

Procedure

Participants could log on to the survey from any computer with a web connection. Following a brief introduction to the questionnaire, they were asked about background data such as age and gender. They were then presented the same scenario as in the previous studies in the thesis, that is, they were asked to imagine being tired and looking for somewhere to sit down and rest for a little while. The participants then proceeded to the series of choice tasks that comprised the greater part of the questionnaire. After completion of 15 choice tasks the participants were asked to rate how easy they found it to imagine the scenario, and how easy they found it to imagine the different parks on the basis of the presented features, among other background questions. The whole survey took approximately 11 minutes.

Data analysis in Paper IV

To explore which levels of components were most important to people, average utility values were calculated using individual utility calculations gained from the hierarchical Bayes (HB) estimation performed by Sawtooth CHC/HB software. Utilities represent the degree of worth or preference assigned to a park component. Utility values cannot be compared between components. Instead, within-component differences in utility are used to derive the importance of each component (Orme 2009). Non-parametric independent sample tests were used to check for differences between levels as well as between components.

To analyze how different groups of people responded to the choice of components, a segmentation analysis was conducted with respect to age, gender, earlier involvement through studies or work with parks or natural environments, and frequency of park visits. Nonparametric independent samples tests were used to check group differences.

4. RESULTS

This chapter is divided into two parts, representing the two aims of the thesis. The first part focuses on the park components; I describe the main findings in this regard referring to the different studies. Evidence concerning each component and its individual importance for restoration likelihood is presented.

The second part of this chapter is a discussion of the different methods and their relative contribution to understanding the relations between the given park components and restoration likelihood. Each method's strength and weaknesses are addressed.

4.1. Park components that predict the likelihood of restoration

The components under study were hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, size and other people. Below follows the results for each component based on findings from the different studies.

4.1.1. Size

Park size is a variable treated in Study 1. Results from the study shows that within the sample of small parks the largest ones were more preferred and had the highest ratings of restoration likelihood; however, some very small parks had preference and restoration likelihood values similar to those of larger parks. This means that the possibility for restoration is not only a matter of the size of an available park; it is also about design and which components are used to create that park.

4.1.2. Hardscape

As shown in both Studies 1 and 2, this component had a negative association with restoration likelihood. This means that parks with a lot of hard materials were perceived as less restorative compared to parks with grass. Hardscape is in my studies the opposite to grass, hence it was highly correlated with grass. To avoid multicollinearity, hardscape was not used in the regression models in Study 1. In Study 3, I found that grass was the most important of the components for the choice of a park alternative. This indirectly strengthens the results from Study 1, indicating that hardscape is seen as restricting the possibility for restoration.

4.1.3. Lower ground vegetation

Lower ground vegetation had, in Study 1, a positive association with restoration; however, in Study 2, the longer the participants gazed at lower ground vegetation the lower the restoration likelihood. This negative correlation was however not significant. Looking at the dwell time variable in Study 2, one could also see that the participants did not spend so much time watching lower ground vegetation.

4.1.4. Bushes

In Study 1, bushes were found to have a strong association with restoration likelihood. As presented in Study 2, bushes were also a component that the participants spent a relatively long time looking at. However, the correlation between dwell time for bushes and restoration likelihood was negative, though not significant, meaning that the longer the participants gazed at bushes the lower the restoration likelihood ratings. The amount of bushes was the component that contributed the least to the choice of park alternative in Study 3.

4.1.5. Trees

In Study 1, the amount of the image covered by trees was found to have a strong association with restoration likelihood. As presented in Study 2, trees were also the component that the participants spent the most time looking at. However, the correlation between restoration likelihood and dwell time for trees was negative, though not significant, meaning that the longer the participants gazed at trees the lower the restoration likelihood. In Study 3, trees were the second most important component relative to the others. Results from the segmentation analysis in Study 3 also showed that the participants with earlier experience in working with or studying parks or nature found trees more important than people without earlier experience.

4.1.6. Flowering plants

As presented in Study 1, flowers did not have a strong association with restoration likelihood. Flowers also drew surprisingly little attention in the eye tracking study and the variable had a negative association with dwell time for restoration likelihood, though not significant. In Study 3 I found that having flower beds was preferred over no flower beds. However, flower beds were the second least important component of the components under study. As found in the segmentation analysis in Study 3, flowers were a component more preferred by older people and women.

4.1.7. Water

In Study 1, water had a positive association with restoration likelihood. A similar result was found for the relation between dwell time and restoration likelihood in Study 2; however, the number of images with water was small and great emphasis cannot be put on the result. Water drew surprisingly little attention in the eye tracking study. In Study 3, the presence of a water feature contributed to choices of park alternative, but not strongly so in comparison to the contributions of grass, trees and other people. The difference between no water and water feature (mirror pond or small fountain) was significant, but the difference between mirror pond and small fountain was not significant. This indicates that people were most interested in the absence or presence of water, not the type of water feature. In the segmentation analysis I found that water was more important to older people and people with earlier experience in working with or studying parks or nature.

4.1.8. Other people in the park

In Study 1, the presence of other people did not have a significant association with restoration likelihood. In Study 2, other people drew a lot of attention; however, compared to the other environmental components the participants did not spend much time looking at other people. The correlation between dwell time for the area of interest variable "other people" and the restoration likelihood ratings was negative but not significant. In Study 3, the number of other people was the third most important of the six components. However, the component had an inverted u-shaped relationship with preference; the middle alternative, a few people, was preferred above no people and many people.

4.2. Mediation of components

Mediation analysis is a correlational technique that can be used to describe the underlying mechanisms driving the relationship between the environmental components (the initial predictors) and restoration likelihood (Baron & Kenny 1986; Judd et al. 2001).

When testing whether being away mediated the relationship between the park components and likelihood of restoration in Study 1, I found that the influences of grass, water and size were partially mediated and those of lower ground vegetation, bushes, and trees were fully mediated. That is to say, previously significant relationships between the components and restoration likelihood were reduced in size when being away was included in the analysis, either partially or to the degree that they did not differ statistically from zero. Moreover, the influences of bushes and size were partially mediated by fascination and those of lower ground vegetation, trees and water were fully mediated. The contribution that being away and fascination made to their respective regression models was also confirmed when examining the R^2 values. When being away and fascination were added to their respective regression analysis, explained variance increased by 10% and 15%, respectively. Conceivably, this increase in explained variance means that fascination and being away do not only mediate the associations between the individual environmental components and restoration likelihood, but also the combined or interactive effects of the components. Being away and fascination were found to have somewhat different sets of predictors, hence each variable may mediate the relationships between the environmental predictors and restoration likelihood in a somewhat different way.

To illustrate what the theoretical process of mediation could mean to park design I would like to give an example. Imagine a park mainly characterized by lower ground vegetation, bushes and trees and another park mainly characterized by flowers and water. The first park alternative has qualities fully mediated by being away, a variable that is predictive of restoration likelihood. It can be the combination of components or structures that triggers being away. This park will most likely be rated higher on restoration likelihood than the other park alternative, because its components trigger some underlying mechanisms related to restoration likelihood. If one wants to design a park that promotes restoration, then one should take particular interest in components that are strong predictors of restoration likelihood and are significantly mediated, partially or fully, by the restorative quality variables.

4.3. Learning from the different methods

As written in Chapter 2, in this thesis my intention was not only to explore which environmental components predict restoration, but also to demonstrate how quantitative methods can be applicable in landscape architecture research. This section of the results is hence a more qualitative consideration of the strengths and weaknesses of the different methods.

The use of photo ratings with regression analysis, as in Study 1, is a common method which indicates those variables that independently are most predictive of the likelihood of restoration. It would have been of interest to estimate the interactive effects of the different components; however, this was not possible due to the small sample size (N = 74 parks) and the large number of potential interactions. As a partial solution to this problem, I depicted the potential influence of combinations of components through a cumulative exposure measure inspired by Evans (2003). Put simply, this analysis indicated that the more components present to a high degree in a park (with the exception of people), the greater the rated likelihood of restoration.

In using regression analysis it was also possible to explore whether being away and fascination mediated the relationship between the park components and likelihood of restoration. The mediation analysis was relevant from a theoretical perspective; I wanted to find out whether two of the four components of restorative experiences specified in ART (Kaplan 1995) helped to explain the relationship between the environmental components and restoration likelihood.

Results from Study 1 raised questions about how people perceive and visually analyze photos. For example, which of the park components draws the most attention? What links are there between what people look at and their ratings of restoration likelihood? Finally, what links are there between the size/amount of the component and how long the participants look at it? These questions could be addressed with the help of the eye tracking methodology. As in Study 1, the participants in Study 2 were presented with a sample of the same park photos. They were asked to rate the photos in terms of restoration likelihood while their eye movements were registered. To correlate ratings from the participants with what components they had looked at, I marked the same components quantified in Study 1 with polygon shapes and calculated how long time the participants looked at each component.

Analysis of eye movements added information about how the participants had analyzed the photos and what components of the photos drew the most attention. It was hence a valuable complement to Study 1, in that it linked the participant's behavior, the rating task and the photo. However, the use of eye tracking as a tool for assessing qualities in different environments is still under development. The relationships between what people look at and what ratings they make on the restoration likelihood scale could be interpreted in several ways, an issue that is addressed in Paper II. Results from Studies 1 and 2 regarding values on restoration likelihood assigned to the parks by the two different samples of participants showed high consistency, $r = 0.96$, $p = 0.01$. This indicates that there was a high degree of agreement on the relative restorativeness of the different parks in the park sample used in both studies.

The method used in Studies 1 and 2 was based on ratings of photos. A critique of using photos is that it is difficult to judge if a space has restorative qualities when one cannot see the surrounding environment, hear the sounds there, take in the smells, and so on. Photos represent visual environments where other sensory values are set aside. However, one study cannot cover all possible aspects that might influence restoration likelihood. Hence, this thesis must be seen as one among other studies contributing to the body of knowledge about restorative environments. Photo ratings and eye movements are affected by the composition or contrasts in the photo that can impact the participants perception. Eye tracking data is especially sensitive to this, particularly pupil size measures (Gratzer & McDowell 1971; Henderson 2003). However, the qualities of the photos were examined by technical staff in the eye tracking laboratory and no worrying differences in brightness/contrasts between photos were found.

As Purcell et al. discuss (2001), even though a rating of a photo is a judgment of the visual array, people also consider the functional aspects of what they see. To explicitly direct the participants to rate the images (in Studies 1 and 2) and park alternatives (in Study 3) in relation to restoration likelihood, I gave them a scenario asking them to imagine being tired and in need of restoration. With this set up the type of function was already given. In terms of ART, the requirements for compatibility were specified (recall the discussion about compatibility in section 1.3.3.).

To connect the content of the image with ratings the participants gave on the scale, I used a quantification technique inspired by Shafer et al. (1969). However, this type of quantification did have some disadvantages. First, the manual quantification process was time consuming. It would have been easier to work with a program that calculated the area in relation to the whole picture area using polygon shapes. There are tools that automatically calculate different textures in relation to the whole image, but because bushes and trees are rather similar in texture, manual quantifications were necessary. Second, I did not discriminate between different type of species, shapes or colors, but as mentioned earlier, the sample of parks were from Scandinavia, so the type of vegetation was relatively similar. Third, quantification of horizontal surfaces turned out to have some challenges. Vertical objects in the foreground of a photo, such as trees, stone walls and benches, could cover or hide part of the surface behind them. Thus, the visible amount of the variable was lower than the actual amount. This issue was addressed by testing three different quantification approaches for variables having to do with a ground surface (i.e., hardscape, grass, lower ground vegetation). Large correlations were found between the quantifications yielded by the different approaches.

Due to the limitations with using photos as mentioned above, I wanted to explore if the findings from Studies 1 and 2 would be supported by a third study that relied on people's ability to imagine parks rather than visual stimuli. To do this, I applied choice-based conjoint analysis. This method enabled examination of preferences for various components and levels of components described in text. Conjoint analysis builds on choices of park alternatives that comprise combinations of components at different levels. Combination of components was an issue that I had already addressed in Study 1. However, the conjoint analysis did not provide results on which components together form the best park but rather on which components were most important in relation to the others. Instead of asking participants what components they think are important for restoration likelihood, it forces them to weigh components against each other in a way that photo ratings do not.

Building on people's imagination rather than presenting them with photos has both strengths and weaknesses. A strength is that people can think of their own favorite tree or bush and are not driven by the type of tree or bush presented in the photo. A weakness is that one cannot know what type of tree or bush (or other component) the participants think of. However, due to the type of components and similarities between the participants regarding nationality, type of setting where one lives and so forth, it is unlikely that people would refer to very different types of vegetation.

In Study 3, the choice of components and levels of components for construction of choice alternatives was based on findings from Studies 1 and 2. This selection process for the components strengthened the set up. In conjoint studies the choice of components and levels of components are highly important. Including the "wrong" levels can influence the importance calculation and bias the result. As shown earlier in this chapter, findings from the different studies converged, and this strengthens the thesis as a whole.

5. DISCUSSION

The choice of topic for this doctoral dissertation was driven by the fact that there is a lack of detailed literature about the physical environmental components that promote restoration. Being part of a profession responsible for the design and management of the outdoor environment of people living in urban settings, I wanted to find out more about the environmental components that support restorative experiences which in the long run promote public health. In light of a densification process in Scandinavian cities, my focus has been small urban parks, also called pocket parks. Through use of different methods such as photo ratings, eye tracking and conjoint analysis, I have contributed to the body of knowledge about restorative environments and the components that are of importance for restoration likelihood. With use of multiple methods I have also contributed to a methodological discussion.

All of the studies in this thesis converge in terms of showing that small urban parks can be perceived as spaces where one can rest and recover from mental fatigue (Kaplan & Kaplan 1989; Kaplan 1995). This result is highly important from a planning perspective, in that it implies that densification needs not to be seen as eliminating the opportunities for restoration (Ståhle 2008). The possibility for restoration is also about design and the components used to create parks in the spaces available in a dense or densifying city. A large park has other values related to function, and such a park is often referred to as a space for recreation. However, as found in my studies, small parks can with the right components and designs, promote restorative experiences.

The components under study were hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, size and other people in the park. All of the environmental components, except for hardscape, contributed to the expectations regarding restorative experience. As mentioned in the introduction, and as reflected in my studies, people in Scandinavian tend to like nature (Tyrvainen et al. 2007). This may be one of the explanations for the preference for parks with a lot of vegetation. Interestingly, the common trend in Scandinavia is toward greater use of hard materials such as concrete or granite (Halvorsen Thorén 2005; Wahlsten et al. 2008). This trend is in conflict with my findings. If pocket parks should contribute to restorative experiences and in the longer run public health, my findings suggest that it is necessary to acknowledge the importance of vegetation.

The discussion of hard material versus grass brings up issues related to management. Hard materials are easier regarding management, for example, no costs for lawn mowing. Small parks also mean many people on a restricted surface, hence, the space will be exposed to wear. Another limitation with vegetation in cities is that it can also be difficult to get it to grow in a small urban space due to pressure related to the type of urban environment, climate, pollution, shade, and other factors (Jim 2004). Due to the importance of vegetation for people's health, the issues mentioned above need to be solved. Budgeting for the additional cost of larger amounts of vegetation could weigh the potential public health value against other priorities.

The components most predictive of restoration likelihood across studies were grass and trees. These two components are frequently found in environmental psychology or preference studies in which they represent urban nature (see for example Herzog et al. 1982; Herzog et al. 2003; Kaplan 2007). As stated in the introduction, these components also represent the most common ones in Norwegian parks (Nyhuus & Halvorsen Thorèn 1996). Grass and trees are structural components representing the floor and ceiling and partly walls of the park. Compared to for example flowers, representing the decorative components, trees and grass take time to establish, hence, they need careful and long-term planning.

Similar to grass, the component lower ground vegetation also results in a green surface. However, compared to grass lower ground vegetation is not a surface to walk or sit on. In Study 1, lower ground vegetation was positively associated with ratings of restoration likelihood. In Study 2, the variable drew little attention, and how long the participants spent looking at it did not show any significant correlation with restoration likelihood. Lower ground vegetation adds to the greenness of the park and can hence be expected to contribute to a restorative experience. However, due to some inconsistency in the findings between Studies 1 and 2, more research is needed to explore the relation between restoration likelihood and lower ground vegetation.

Bushes seem to influence judgments about restoration likelihood and draw a lot of attention. However, results from the different studies show some inconsistency. As presented in Study 1, the bushes component is positively associated with restoration likelihood, and as seen in Study 2 it catches interest, but as presented in

Study 3 it is the least important component of those under study. However, being the least important component does not mean that is not important at all.

Previous research has pointed to water as an important component for restoration (Berto 2005; Laumann et al. 2003; Purcell et al. 2001; White et al. In Press), a result that is in line with evolutionary theory about human aesthetic responses to nature (Ulrich 1993). As presented in both Studies 1 and 3, water seems to be a component that contributes to restoration likelihood. However, little attention was paid to water in the eye tracking study and water was not among one of the components most important in the conjoint study. This means that my findings do not fully support the importance of water as a restorative component. Hence, one can question the value of adding relatively expensive features such as fountains and ponds if vegetation contributes more to the restorative experience. It might be that the type of water features in my images and in the conjoint alternatives represent too small amounts of water-covered area, an issue also addressed by van den Berg et al. (2003), who did not find a significant effect of stimuli with water on restoration. In the studies that connect water to restoration likelihood, water dominates the images. Another explanation can be that water might be a component dependent on sound rather than visual presentation. As found in Study 3, older participants and participants with earlier experience put more emphasis on water. Water is part of the decoration category and maybe older people have a greater need for things that catch interest such as water and flowers. In Study 1, water was highly associated with fascination, which means that water can be a trigger of fascination which in turn is thought to be a trigger of restoration.

As with water, flowers did not have a strong association with restoration likelihood. Flowers also drew little attention in the eye tracking study and the variable had a negative association with dwell time for restoration likelihood, though not significant. Flower beds were the second least important component relative to the other components in Study 3. However, flowers were found to be more important to women and older people. It might be that the decorative components such as water and flowers are more important when using the park on a regular basis or during a longer time. In my study set up the participants were asked to imagine being tired and looking for somewhere to sit down for a little while. If the statement would have been to look for somewhere to sit down during a longer time, the decorative components might have been more important.

It is common practice to exclude people from scenes that are to be evaluated (e.g. Herzog et al. 2003; Hägerhäll 1999). This is done because other people are seen as a disturbing element that can affect the evaluation of the environment. In landscape architecture people are seen as part of the environment, and in design projects people are usually added in sketches and drawings. Adding people is done because one wants the environment to look inviting, lack of people signals that the space is unused hence unpreferred. In my studies I decided to include people in the photos and park alternatives, seeing people as a natural "component" in the environment. I also explored relationships between other people in the park and restoration likelihood. As found in my studies, the presence of other people is obviously a component that affects whether the environment is evaluated as restorative or not. As presented in Study 3, the participants want other people in their parks; however, they want just a few rather than many. This result is highly interesting from a planning perspective. As mentioned earlier the trend is densification, hence more people will use the same spaces, but only to a certain degree will this have a positive affect on restoration likelihood. More green spaces of high quality would give people more choices and hence likely prevent feelings of crowding in each park. However, as presented in Study 3, the presence of other people in the park is most likely important for the feeling of safety (Kirkebøen 2010; Nasar & Jones 1997; Staats & Hartig 2004). As found in Study 2, other people also drew a lot of attention. This is not surprising, but it is noteworthy that the participants did not spend much time looking at other people in relation to the environmental components.

One might criticize this thesis for focusing on components as separate elements and not considering the holistic environment they create. However, in Studies 1 and 2, images where used representing pocket parks where most of the park was seen in the image. Questions were asked about psychological variables (in Study 1, restoration likelihood, preference, being away and fascination; in Study

2 restoration likelihood) and not individual components. In Study 3, each park alternative was represented by a number of components and the choice was hence based on a holistic choice situation where all components had to be taken into consideration. Focusing on the components gives results applicable in practice. However, more research is needed regarding which combinations of components are most strongly connected to restoration likelihood. Further, in future studies it would also be interesting to assess how design, in terms of spatial arrangement, affects restoration likelihood. In preference research I find references to work that has assessed aspects of design and management such as, coherence, visual scale and stewardship (as reviewed by Tveit et al. 2006). In landscape architecture there are a number of books presenting aspects of design, but this type of literature is usually based on practical experience rather than empirical data. Doing research on designs/structures that promote restoration likelihood is not unproblematic. Design is as mentioned site specific and it would be wrong to give specific guidance on how many trees that is important and how densly they should be planted. This type of decisions need to be made by the designer. However, on a higher level, structural aspects such as for example enclosure or openness could be explored in empirical studies, as such research might generate findings that challenge individual designer's assumptions about what people like and how they will behave in a space.

The quantitative approach I have used has been discussed in the chapter on results (see section 4.2.). Each method has its strength and weakness and the evaluation of the different methods applied in the thesis brings valuable knowledge for future research. Seen as a whole, the combination of methods brought a more holistic view of which park components contribute to the likelihood of restoration. For future research a combination of different methods should provide more insight than the use of qualitative methods alone, as has been the case.

The focus in all my studies has been to measure likelihood of restoration. As discussed in Paper I, the likelihood of restoration is not the same thing as actual restoration. The likelihood of restoration is a judgment made by the participant in the study about how likely it is that he or she would restore in a park presented in some stimulus. Actual restoration involves changes that actually take place as the participant spends time in an environment. The measurement of actual restoration is suitable for studies with few environmental stimuli, for example in a comparison of a built versus a natural scene type. It would be difficult and costly to assess actual restoration using a large number of environments. It would also be difficult to assess actual restoration with a large number of photos of environments, because it would be difficult to determine which specific photos presented during the time required for restoration contributed more or less to the restorative experience. Likelihood of restoration is on the other hand suitable for larger numbers of environmental stimuli, each of which is presented for a short period. When assessing results from the studies measuring actual or likelihood of restoration similar results are found. However, as mentioned earlier, the type of environments in the studies of actual restoration are broadly defined, and there is a lack of detailed information about which components that contribute to the restorative experience. What remains to be done is to describe how well judgments of restoration likelihood predict actual restoration. I assume that the correlation between judgments of restoration likelihood and actual restoration is not perfect, but on the other hand, I recognize that people ordinarily make such predictions when they choose to go to one space versus another for restoration (see e.g., Korpela & Hartig 1996; Korpela et al. 2001).

As presented in Study 3, the participants found it relatively easy to imagine being tired and in need of restoration. Hence, the scenario worked as intended. The situation, being tired, in need of restoration, and looking for somewhere to rest for a little while is most likely easy to relate to. With the results from my studies on restoration likelihood, it becomes easier to choose the components and environments in which one in the future can test actual restoration.

In Study 2, Paper III, I explored pupil size in relation to restoration likelihood ratings. This physiological measure showed interesting tendencies. Parks with high restoration likelihood ratings were correlated with a smaller pupil size, a result that can be explained by restoration being the opposite to arousal. As shown in earlier studies, arousal is associated with pupil dilation (Bradley et al. 2008).

The link between pupil size and restoration however needs further investigation with a larger number of participants.

The common procedure in related types of studies is to use students. As found by Stamps (1999), students represent the general population fairly well with regard to aesthetic preferences for environments. However, to broaden the perspective I decided to use a mix of students and general public. The participants in my studies cover a rather wide geographical area; however, I cannot claim that they give a representative sample of the whole population in Scandinavia. As with many studies, there is a risk that only people interested in a topic volunteer to participate. Particularly with Study 3, this means that the sample might cover people that are generally more positive to the use of parks for recreation. However, this can also mean that they pay more attention to the rating task or questions, hence, give more reliable answers.

As mentioned earlier, this thesis is a first step in going from broad categories of comparing natural versus built scene types to details in the environment that are of importance for restoration. In using different methods this thesis deepens the knowledge about different quantitative methods applicable to research in landscape architecture. The findings from my studies do not tell the whole truth about what components contribute to restoration, but they contribute nonetheless to the body of knowledge about restorative environments. They highlight the importance of vegetation in pocket parks and provide evidence that structural components such as grass, representing ground cover, and trees, representing walls and ceiling are more important for the likelihood of restoration than decorative components such as water and flower beds.

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APPENDICES

- Paper I

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Components of small urban parks that predict the possibility for restoration

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Abstract

In densifying cities, small green spaces such as pocket parks are likely to become more important as settings for restoration. Well-designed small parks may serve restoration well, but earlier research on restorative environments does not provide detailed information about the specific components of the physical environment that support restoration. In this study we assessed the extent to which hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, and size predicted the judged possibility for restoration in small urban green spaces. We took individual parks as the units of analysis. The parks were sampled from Scandinavian cities, and each park was represented by a single photo. Each photo was quantified in terms of the different objective park components and also rated on psychological variables related to restoration. The ratings on the psychological variables being away, fascination, likelihood of restoration, and preference were provided by groups of people familiar with such parks. The variables most predictive of the likelihood of restoration were the percentage of ground surface covered by grass, the amount of trees and bushes visible from the given viewing point, and apparent park size. Formal mediation analyses indicated distinctive patterns of full and partial mediation of the relations between environmental components and restoration likelihood by being away and fascination. Our results provide guidance for the design of small yet restorative urban parks.

Keywords: Design; Pocket park; Landscape architecture; Stress; Restorative environments; Vegetation

Introduction

About 80% of the population in most European countries now lives in cities (Antrop, 2004). Cities continue to expand, so that natural areas at the urban periphery are farther away from city centres. This pattern of development conflicts with the commonly found tendency for people to prefer relatively natural environments, which relates to the possibilities they offer for psychological restoration (van den Berg et al., 2007). The present study addresses this problem by investigating how urban green spaces might be best designed to help people meet their needs for restoration.

Although people's access to restorative nature is decreasing with urbanisation, it is difficult and not necessarily desirable to prevent people from moving to cities. Planners and designers have thus sought to create urban green places that provide opportunities for restoration as part of everyday life. Such opportunities

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involve visual as well as physical access. For example, views to nature from a window at home or in the workplace can support micro-restorative experiences (Ulrich et al., 1991; Kaplan, 1993, 2001; Tennessen and Cimprich, 1995). Just the glance of a small park on the way to work might have a positive influence on mood (Whyte, 1980). Cumulatively, brief and more extended restorative experiences serve health over the long run (Hartig, 2007). Ensuring access to urban green spaces can therefore be seen as a public health priority (de Vries et al., 2003; Health Council of the Netherlands, 2004; van den Berg et al., 2007).

The trend in European city planning is densification (Beatley, 1999). This means that access to green spaces is under threat within urban areas, due to demand for space to construct housing, office buildings, roadways, and other structures. Therefore, small green alternatives such as pocket parks, roof gardens, and tree-lined streets are likely to become more important as settings for restoration (Thwaites et al., 2005).

Even small urban green spaces may have substantial restorative value (Kaplan et al., 1998). Research indicates that a small intimate park close to home is often a highly valued green area (Burgess et al., 1988), and the closer a park is to one's home, the more often it will be visited (Grahn and Stigsdotter, 2003; Nielsen and Hansen, 2006). There is, however, a lack of empirical literature concerning the specific design and components that contribute the most to restorative opportunities in such small spaces (Thwaites et al., 2005). Studies of restorative environments have in general had quite limited environmental variation, and the environments studied have been described only in coarse terms; this has left an important gap in information about the content and design of restorative urban green space (Velarde et al., 2007).

Presumably, the restorative quality of small urban green spaces depends in large part on the amount, kind, and arrangement of vegetation and other materials in the available space. A landscape architect creates a park by working with its ceiling, represented by tree canopies; its walls, represented by bushes or trees; and its floor, represented by grass, low plants, or other harder materials (Dee, 2003; Robinson, 2004). The elaboration with these different components creates a design that most likely influences the likelihood of restoration.

The purpose of the present study is to assess the extent to which these components, individually and in combination, predict the possibility for restoration perceived in small urban green spaces. To understand how they might influence restoration likelihood, we refer to attention restoration theory (ART; Kaplan and Kaplan, 1989; Kaplan, 1995). ART focuses on environmental supports for the restoration of a depleted capacity to direct attention. The theory characterizes restorative experiences in terms of being away, fascination, extent, and compatibility. Being away refers to psychological distance from the demands and routines in which a person uses the directed attention capacity. Fascination refers to the way in which attention becomes captured by elements such as flora and fauna and by the process of exploration. Extent refers to both the degree of order or coherence and the scope for exploration and involvement in the environment. Compatibility refers to the match between what a person wants to do, can do, and must do at the site. These four characteristics of restorative experiences can be described as mediators of the relationship between the physical environment and restoration. Thus, for the present study, we assume that the physical components influence perceptions of these restorative qualities, which in turn influence the perceived likelihood of restoration. We focus here only on mediation by being away and fascination, as we have more substantially constrained variation in extent and compatibility with our environmental sampling and rating procedures.

In sum, with a focus on small green spaces (pocket parks), this study aims to quantify components of urban green structure and their associations with the perceived likelihood of restoration. The environmental components studied are hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, and size. These predictors represent some of the elementary materials that a landscape architect works with when designing outdoor spaces. In the present study, we took existing individual parks, and not people, as the units of analysis. For each of the 72 parks sampled for the study, we assigned values for the physical components of interest, and we obtained ratings for the psychological variables being away, fascination, likelihood of restoration, and preference. The values for the psychological variables were means based on ratings of the parks by groups of observers. We included preference so that we could assess its correlation with restoration likelihood for this category of environments. Preference ratings have previously been given much weight in theoretical and applied research on landscapes and natural environments and it is of interest whether the opportunity for restoration provides a frame of reference for preference ratings (Purcell et al., 2001; van den Berg et al., 2007; Tenngart Ivarsson and Hagerhall, 2008). Following the logic of mediation outlined by Baron and Kenny (1986), we assess the extent to which being away and fascination mediate the relations between park components and the likelihood of restoration.

Method

Park sample and photographic stimuli

Because there is no generally accepted definition for "pocket park", we developed our own criteria. As the term "pocket park" indicates, the focus is on relatively small green spaces ($<3000\,m^2$). For inclusion in our sample, the pocket park had to be a well-defined area. We included only public spaces. We excluded all private, enclosed residential parks, playgrounds, and parks that clearly belonged to a café or restaurant. At least one side of the park had to be oriented toward and have an opening onto a public road to indicate free access. There also had to be some kind of furniture in the park, so that a person could imagine sitting down for a little while. Having somewhere to sit down was necessary in light of the scenario presented to the subjects who provided ratings of the psychological variables.

The height of surrounding buildings influences the perception of the size of a park (Dee, 2003). The perception of size is also dependent on the relation between horizontal space and vertical height (Alexander et al., 1977). To limit the effects of big differences in building heights on perceived park size, all selected parks had surrounding buildings equal to or higher than three stories.

A pocket park does not have to be completely green; for example, the ground material can be asphalt or paving stones. To fit with what we took to be the common understanding of "park", however, there had to be some kind of vegetation, such as trees, bushes, or flowers, in each of the parks sampled for this study. The amount of greenness varied from largely grey, having a hard ground surface (hardscape) with a few trees, to largely green, with grass, flowers, bushes, and trees.

The 72 parks were sampled from the capital cities Oslo, Stockholm, and Copenhagen, as well as a few other Scandinavian cities. The sample was limited to the Scandinavian countries to ensure that the type of vegetation represented with each of the vegetation variables (e.g., flowering bushes) would be similar across parks. The sample represents most of the central pocket parks in the capitals. To find pocket parks for the study, we used city maps and aerial photos and we walked through the same areas.

Photos were taken from one side of the park to get as large a view as possible and so give an observer a general idea of the design of the park. Most of the parks were smaller than $1500\,m^2$, which made it easy to capture most of the park in one photo. For the larger parks in the sample one can see only part of the park in the photos. However, the overarching concern was not to show the totality of the park, but rather to fairly represent combinations of different park components. The photos were collected during daytime hours from June to August, 2007. The weather conditions were rather similar in all photos, with clear to mostly clear skies.

Out of a larger sample, we selected the 74 photographs with the best quality (e.g., in terms of photographic angle, sharpness, and contrast). Each of the 74 photographs was meant to represent a different park. In two cases, however, two photos were from the same park, hence 72 parks. Because they were taken from different angles, the two photographs could not be recognised as coming from the same park. The photos were manipulated in the software Photoshop CS2 (Adobe Systems, Inc.). Changes included erasing litter or other potentially disturbing objects, changing extremes of contrast, and balancing colour and light conditions. We kept people and nearby vehicles in the images; we assumed that having people and familiar objects such as benches, bikes, and cars in the images would help the respondents to perceive park size by relating to the size of the object. We "placed" benches in two parks that otherwise had them only on the perimeter, in keeping with instructions provided for the rating task.

Measurement of physical environmental predictors

For quantification of the physical environment of the pocket parks, we adapted an approach applied by Shafer et al. (1969). Working in Photoshop, a grid pattern of 588 squares was laid over each photo (Fig. 1). Each square covered by more than 50% of a given variable was marked and counted and the percentage of that variable in relation to the total image was calculated. The variables quantified were hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, and water (water/no water). We also added a perceived park size variable because the small parks in our sample did vary considerably in size, despite the upper size limit.

For those variables having to do with a ground surface (hardscape, grass, lower ground vegetation), we

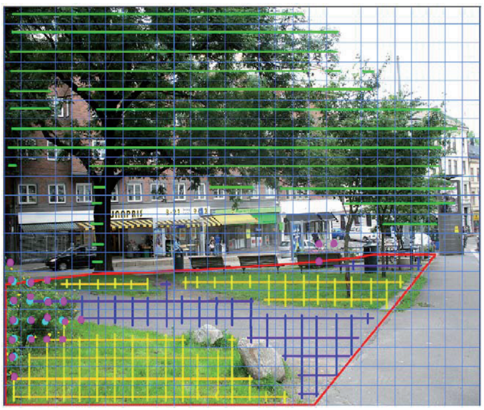

Fig. 1. Illustration of the quantification method.

initially made three different quantifications: "% *of the image*", "% *of the total ground surface of the park image*", and "% *of visible ground surface of the park image*". The different approaches reflect different assumptions about how the photos were perceived by the observers who provided ratings of the psychological variables (i.e., being away, fascination, restoration likelihood, and preference). Vertical objects in the foreground of a photo, such as trees, stone walls, and benches, cover or hide part of the surface behind them. Thus, the visible amount of the variable is lower than the actual amount. We did not want to neglect an observer's capacity to comprehend the environment and interpret what was behind vertical objects; so we complemented a strict image analysis with the two other types of quantifications. The different approaches were as expected highly correlated. For the estimation of the percentage of hardscape, the r-values for the three approaches ranged between 0.69 and 0.95. For grass the correlations were between 0.87 and 0.97, and for lower ground vegetation between 0.89 and 1.00. Given these strong correlations, we decided to choose "% *of the total ground surface of the park image*", which we assumed is the nearest to people's perception of the space, presuming that they can imagine or "fill in" the surface behind vertical objects.

The size variable was also initially quantified in different ways, as actual size and perceived size. Actual size was measured in the field for a subset of the parks while collecting the photographic images for the study. For perceived size, 10 people were asked to rate the 74 photos. Three folders were handed out and the participants were asked to put each photo into one of the three folders: small, medium, or large park. The ratings showed strong consistency (intraclass correlation coefficient = 0.90). The perceived values correlated only moderately with actual size, $r = 0.39$, for those 48 parks for which we had data on actual size. The relatively modest correlation indicated that there is a difference between actual size and perceived park size as represented with photos (Coeterier, 1994). As mentioned before, even within the narrow size range from which we sampled, some of the parks were too big to be captured in one photo, so that an observer could see only a part of the park from the particular vantage point from where the photo was taken. Actual size was therefore not a reliable measure, and we decided to use perceived size in our analyses.

Roughly 57% of the parks contained people. We thus considered including one or more variables to represent the presence of people in the parks; however, none of the variables that we considered (i.e., number of people standing, number of people sitting, total number of people, and presence/absence of people) had a substantial bivariate association with any of the four psychological variables (all r between 0.00 and 0.22). Given this, and to preserve statistical power by keeping the number of variables to a reasonable minimum, we decided to not include a "people" variable in the analyses.

To illustrate the potential combined influence of different park components on restoration likelihood, we calculated a cumulative exposure measure based on the various components (cf. Evans, 2003). For those park components measured as continuous variables, we created a dichotomous variable using a median split (0 = below the median value, 1 = above the median value). We summed these together with the variable already in dichotomous form (0 = no water feature, 1 = water feature). The variable thus assumes that, within small parks, each component contributes positively to the judged likelihood of restoration. We did not include size in the cumulative variable because we wanted to show variation in restoration likelihood as a function of both number of components and park size.

Measurement of subjective variables related to restoration

In contrast with the environmental predictors, for which we obtained values from a quantitative analysis of the park photos, the psychological variables (being away, fascination, likelihood of restoration, preference) were measured by having groups of observers rate the parks. Following a pilot study in which we had a small group of students rate the photos on multiple items for each psychological variable, we decided to use only one statement for each variable. With this we meant to reduce the burden on the participants, who were to rate all 74 photos on only one variable. The statements used to solicit ratings of being away and fascination were taken from the Perceived Restorativeness Scale developed by Hartig et al. (1997). The statement for fascination was, "*There is much to explore and discover here*" and for being away it was, "*This place is a refuge from unwanted distractions*." The statement for the likelihood of restoration was, "*I would be able to rest and recover my ability to focus in this environment*." For preference it was, "*I like this environment*". For each photo, the participants rated the extent to which they agreed with the given statement (0 = *not at all*; 10 = *completely*).

Having each person rate only one variable for each of the 74 park photos simplified the procedure considerably. Importantly, it also meant that the ratings for one variable would be independent of the ratings for the others. Thus, the correlations between the psychological variables would be free of common-source bias; that is, they would not be inflated because the same people gave ratings for both of the correlated variables.

Eleven data collection sessions were completed, each with 2–9 participants. Fourteen participants rated all of the park photos for fascination, another 14 rated them for being away, 13 rated them on preference, and 11 rated them on perceived likelihood of restoration. More than one data collection sessions were necessary for each variable. Photos were presented with a projector on a large screen and arranged in a new random order for each session. Except for the sessions for the preference ratings, the participants first received the following scenario: "*Imagine that it is midday and you are walking alone in a large town like Stockholm. You are mentally tired from intense concentration at work and are looking for somewhere to sit down and rest for a little while, before going back to work.*" The scenario was meant to provide a standardized, plausible and relevant context for the rating task (cf. Herzog et al., 1997; Staats et al., 2003).

The presentation of the photos started with two practice photos of parks not included in the main sample. These and the 74 following photos were each shown for 15 s. During that time, each participant was to provide a rating on the single statement for the variable to be rated in that session. With three 2-min breaks included, the total time for presentation of the photos was 24.5 min. At the end of a session the participants answered the question, "*How often do you visit the type of small places shown in the photos*?"

Undergraduate and graduate students at the Swedish University of Agricultural Sciences were sent an email message inviting them to participate in the study. Those who volunteered ($N = 52$) were entered in a lottery for which the prizes were gift certificates from a local book shop. The mean age among the participants was 26 years; 75% were women and 92% were Swedish. Their study background varied. The largest groups were landscape architects (31%), agricultural science students (22%), and veterinarians (18%), with the rest a mix of students in natural sciences, the social sciences, and the humanities. In response to the question posed after the presentation of the photos, "How often do you visit the type of small places shown in the photos," 25% of the participants mentioned that they visited them often, 71% sometimes, and only 1.9% never.

Statistical analysis

Our analyses focused on estimating the strength of the relationships between the objective park components and the rated likelihood of restoration, as well as the extent to which perceptions of being away and fascination mediated those relationships. We applied the logic of mediation tests proposed by Baron and Kenny (1986). We entered the environmental components at the first step in a hierarchical regression analysis with likelihood of restoration as the dependent variable. As the second step we entered one of the mediators (being away or fascination). We then examined the significant coefficients for the relationships between the different environmental components and likelihood of restoration, to determine whether the inclusion of fascination or being away substantially reduced their magnitude. Such a reduction would be in line with mediation (Baron and Kenny, 1986). Mediation can be either full (i.e., β-values reduced to statistical non-significance) or partial. We conducted Sobel tests to determine the statistical significance of the degree of mediation. All statistical analyses were done using SPSS version 16, with the exception of the Sobel tests, for which we used a tool available on the internet (Preacher and Leonardelli, 2001). We tested separate regression models for prediction of being away and fascination by the environmental components. Separate models were assessed because, looking across the 74 parks, the mean ratings of those two variables were correlated to a degree ($r = 0.74$) that multicollinearity became a concern. For each of the regression analyses, we applied standard diagnostic techniques to judge compliance with statistical assumptions and identify eventual multivariate outliers (Tabachnick and Fidell, 1996).

Results

Descriptive statistics and bivariate associations

The values for judged likelihood of restoration varied substantially across the parks in our sample (range = 5.55 out of 11 scale points), with some parks receiving low values and others receiving moderately high values. See Figs. 2–4 for the park photos with the highest, lowest, and closest-to-average likelihood of restoration ratings.

The values for the other psychological variables varied similarly, although the distribution of values was shifted slightly higher for preference and a bit lower for both being away and fascination (see Table 1). The four psychological variables correlated strongly, with coefficients between $r = 0.74$ and $r = 0.88$. Among the environmental components, some predictors correlated strongly, in particular hardscape and grass ($r = -0.82$). To avoid multicollinearity, hardscape was not used in the regression models.

Tests of mediation

Being away as mediator

Entered at the first step in the hierarchical regression analysis, the environmental components accounted for 70.8% of explained variance in likelihood of restoration (see Table 2). All environmental components except for

Fig. 2. Park photo with the highest mean rating on restoration likelihood ($M = 7.73$, $SD = 1.01$).

Fig. 3. Park photo with the lowest mean rating on restoration likelihood ($M = 2.18$, $SD = 1.72$).

Fig. 4. Park photo with the closest-to-average rating on restoration likelihood ($M = 4.82$, $SD = 1.78$).

Table 1. Means (*M*), standard deviations (*SD*), and correlation matrix for the variables in the analyses.

Variable	M	*SD*	Min.	Max.	1	2	3	4	5	6	7	8	9	10	11
1. Hardscape	52.66	33.51	0	100	–										
2. Grass	29.18	30.13	0	100	−.82**	–									
3. Lower ground vegetation	5.57	13.11	0	68.38	−.16	−.17	–								
4. Flowering plants	2.40	4.56	0	21.26	−.18	−.02	.41**	–							
5. Bushes	6.75	9.63	0	46.94	−.23*	.07	.00	.18	–						
6. Trees	32.49	17.59	0	58.84	−.01	.22	−.19	−.36**	−.44**	–					
7. Water	0.19	0.39	0	1	.12	−.29*	.14	.07	−.02	−.12	–				
8. Size	1.68	0.58	1	3	−.14	.07	.26*	.46**	.10	−.08	.15	–			
9. Preference	5.12	1.53	2	8.62	−.40**	.34**	.29*	.25*	.03	.28*	.17	.67*	–		
10. Restoration likelihood	4.80	1.50	2.18	7.73	−.37**	.33**	.25*	.32**	.25*	.13	.20	.68**	.88**	–	
11. Being away	4.11	1.25	1.86	6.86	−.43**	.35**	.27*	.29*	.18	.21	.17	.65*	.85**	.85**	–
12. Fascination	3.95	1.55	1.43	7.36	−.20	.10	.32**	.35**	.16	.08	.36**	.67*	.80**	.85**	.74**

Note. We report Pearson correlations.
*$p \leq 0.05$ (2-tailed).
**$p \leq 0.01$ (2-tailed).

Table 2. Summary of final hierarchical regression analysis with being away treated as a mediator of the relationship between environmental components and the rated likelihood of restoration for 73 park photos.

Variable	Step 1			Step 2			Sobel test
	B	SE *B*	*β*	*z*	SE *B*	*β*	*z*
Grass	.017	.004	.338****	.008	.003	.168**	3.46****
Lower ground vegetation	.021	.008	.184**	.007	.007	.062	2.66**
Flowering plants	.016	.028	.049	.010	.023	.031	–
Bushes	.042	.012	.270****	.018	.011	.114	3.05***
Trees	.025	.007	.299****	.007	.006	.082	3.55****
Water	.876	.267	.235***	.469	.229	.126*	3.55****
Size	1.390	.199	.545****	.627	.210	.246***	2.40*
Being away				.662	.115	.564****	
ΔR^2	.708			.100			
R^2 (R^2adj)	.708	(.677)		.808	(.784)		

Note. Both changes in R^2 are statistically significant.
*$p<.05$.
**$p<.01$.
***$p<.005$.
****$p<.001$.

Table 3. Summary of final hierarchical regression analysis with fascination treated as a mediator of the relationship between environmental components and the rated likelihood of restoration for 74 park photos.

Variable	Step 1			Step 2			Sobel test
	B	SE *B*	*β*	*B*	SE *B*	*β*	*z*
Grass	.015	.004	.294****	.011	.003	.230****	1.23
Lower ground vegetation	.019	.009	.167**	.007	.007	.059	2.02*
Flowering plants	.015	.029	.045	−.002	.021	−.005	.81
Bushes	.048	.012	.310****	.027	.009	.173**	2.37*
Trees	.027	.007	.315****	.011	.006	.130	2.99***
Water	.802	.278	.211***	.050	.228	.013	3.50****
Size	1.444	.208	.555****	.577	.191	.222**	4.75****
Fascination				.604	.080	.624****	
ΔR^2	.688			.146			
R^2 (R^2adj)	.688	(.655)		.833	(.813)		

Note. Both changes in R^2 are statistically significant.
*$p<.05$.
**$p<.01$.
***$p<.005$.
****$p<.001$.

flowering plants were strongly associated with restoration likelihood. Those variables most predictive, as indicated by the β-values, were grass, bushes, trees, and size. When entering being away in the regression analysis, the β-values for all of the environmental components, except for flowering plants, became smaller. The Sobel tests indicate that the reductions were statistically significant. These results are in line with mediation (Baron and Kenny, 1986). The reductions in β-values indicate that grass, water, and size are partially mediated and lower ground vegetation, bushes, and trees are fully mediated. Being away explained an additional 10% of variance. On examining the residuals plotted against the predicted values, we found satisfactory conformance with the normality and linearity assumptions of the regression (Tabachnick and Fidell, 1996). Assessment of potential outliers revealed one potential problem case. When we excluded this case from the analysis, the explained variance increased by an additional roughly 2%, bringing the total to 80.8%. We report the details of the final model in Table 2.

Table 4. Summary of the regression analyses with environmental components as predictors of being away and fascination ($N = 74$).

Variable	Being away			Fascination		
	B	SE *B*	β	*B*	SE *B*	β
Grass	.013	.003	.304****	.005	.004	.104
Lower ground vegetation	.021	.007	.217**	.021	.010	.174*
Flowering plants	.009	.024	.032	.027	.033	.081
Bushes	.036	.010	.280****	.035	.014	.220*
Trees	.027	.006	.385****	.026	.008	.296***
Water	.615	.233	.194**	1.245	.315	.318****
Size	1.153	.174	.532****	1.436	.235	.535****
ΔR^2	.686			.625		
R^2 (R^2adj)	.686	(.653)		.625	(.586)	

Note. Both changes in R^2 are statistically significant.
*$p<.05$.
**$p<.01$.
***$p<.005$.
****$p<.001$.

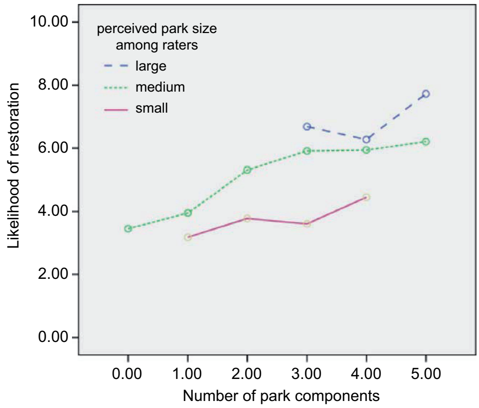

Fig. 5. The number of park components with above-median values as a function of park size. Note that the figure represents our sample of existing parks, which means that not all possible combinations of size and component numbers are represented.

Fascination as mediator

When repeating the regression analysis with fascination as the mediator, the β-values for lower ground vegetation, bushes, trees, water, and size were all reduced significantly, as indicated by the Sobel tests. This is in line with mediation (see Table 3). The amount of change in β-values indicates that the associations that bushes and size have with restoration likelihood are partially mediated, whereas the associations that lower ground vegetation, trees, and water have with restoration likelihood are fully mediated. When entering fascination, variance explained increases by almost 15% bringing the total to 83.3%. Diagnostic checks revealed satisfactory conformance with the normality and linearity assumptions, and no evidence of extreme multivariate outliers.

In line with the mediation logic of Baron and Kenny (1986), we tested additional regression models to determine whether the park components were predictive of being away and fascination. This was the case. With fascination as the outcome, 62.5% of the variance is explained, whereas with being away as the outcome, the environmental characteristics explain 68.6% of the variance (see Table 4). Fascination is strongly associated with water and size, whereas being away is strongly associated with grass, bushes, trees, and size.

Combination of components: an illustration

Fig. 5 shows that the range in values for the cumulative components measure varies as a function of park size. Not surprisingly, in larger parks more of the components have values above the median; however, some relatively small parks have greater amounts of more components than do some larger parks. This is in turn reflected in values for the likelihood of restoration. Some relatively small parks have restoration likelihood values similar to those of larger parks that have the same number of components with values above the median.

Discussion

The results of this study illustrate that the restorative quality of small urban parks does not depend only on size. The issue of size, usually synonymous with scale, is commonly discussed in landscape architecture and planning theory (see for example Dee, 2003; Forsyth et al., 2005; Cullen, 2006). It is a highly relevant issue when the trend in European city planning is toward densification (Beatley, 1999). Our results do support the claim that the bigger a park is, the more likely it is that a person will find a possibility for restoration there. However, within our sample of small parks ($<3000\,m^2$), some of the smallest ones had some of the highest restorative value ratings. This implies that densification need not be seen as eliminating opportunities for restoration (Ståhle, 2008). The possibility for restoration is also about design and the components used to create the park. Not the least, design might help people experience the park as larger in area than it actually is.

In this study we used objective measures such as the amount of hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water, and size to predict subjective measures of being away, fascination, restoration likelihood, and preference. As indicated by the β-values in the regression analyses, those variables most predictive of the likelihood of restoration were first and foremost size and then grass, bushes, and trees. The R^2-values tell us that environmental components accounted for a large amount of the variance in the rated likelihood of restoration. These findings are in line with the claim that the greener or more ‘‘natural’’ the outdoor environment, the better it is likely to be for restoration (e.g., Kaplan, 1995), and they add nuance to the body of empirical results in line with the call from Velarde et al. (2007).

Questions about the amounts and combinations of certain components do however remain. The sample was too small for estimating the interactive effects of the different components. The more interactions, and the more variables combined in any given interaction term, the greater the difficulties in making sense of results and the greater the requirements for sample size. As a partial solution to this problem we depicted the potential influence of combinations of components (Evans, 2003). We found that a small park containing only one counted component (i.e., counted because of the presence of a given feature, such as water, or because it had an above-median amount) had almost as high a value on restoration likelihood as a medium-size park with one counted component. Similarly, a medium-size park with four counted components had as high a restoration likelihood value as a large park with the same number of components. Such results emphasize the importance of design for societies struggling with densification problems.

Of interest in this study was also whether the environmental components would predict being away and fascination (Kaplan, 1995; Kaplan et al., 1998). As shown in the regression analyses, fascination is influenced strongly by water and size, whereas being away is strongly influenced by grass, bushes, trees, and size. Fascination refers to the way in which attention becomes captured by environmental elements and the process of exploration. In line with theory and as supported by other studies, water can be seen as a fascinating element (see for example Kaplan et al., 1998; Purcell et al., 2001; Laumann et al., 2003; Regan and Horn, 2005). Being away refers to psychological distance from the demands and routines to which a person directs attention. A park containing bushes and trees is likely to offer some enclosure (Dee, 2003) because the vegetation create walls around the park ‘‘room’’. Enclosure might physically as well as psychologically create the opportunity to get away from demands on the directed attention capacity. The amount of enclosure, in terms of both size and the density of the green walls, may affect the restorative experience, a possibility that we are following up in ongoing studies.

When testing whether being away mediated the relationship between the park components and likelihood of restoration, we found that the influences of grass, water, and size were partially mediated and those of lower ground vegetation, bushes, and trees were fully mediated. Moreover, the influences of bushes and size were partially mediated by fascination and those of lower ground vegetation, trees, and water were fully mediated. The contribution that being away and fascination made to the regression models were also confirmed when examining the R^2-values. When being away and fascination were added to their respective regression analysis, explained variance increased by 10% and 15%, respectively. Conceivably, fascination and being away do not only mediate the associations between the individual environmental components and restoration likelihood, but also mediate their combined influence.

Given the strong correlation across the parks between the mean being away and fascination scores, we decided to treat them in separate models. One could reasonably ask what that strong correlation means with regard to the empirical separability of the two constructs and for ART. The present results indicate their distinctiveness in that, as described above, each construct has a somewhat different set of predictors, and each construct mediates relations between environmental predictors and restoration likelihood in a somewhat different way.

In line with other studies (Purcell et al., 2001; Staats et al., 2003; Tenngart Ivarsson and Hagerhall, 2008), preference and restoration likelihood correlated strongly. This correlation, calculated over a substantial number of parks with mean ratings from independent groups of observers, indicates that, for small urban parks, expressions of preference may serve well as markers of restorative quality.

Our method for quantifying the physical park components (i.e., through analysis of images) can be considered economical and yet not without possible limitations. A relevant issue with this approach to quantification is that it analyses a three-dimensional space using a two-dimensional photo. We addressed this issue by testing three different quanitification approaches for variables having to do with a ground surface (i.e., hardscape, grass, lower ground vegetation). We found large correlations between the values yielded by the different approaches.

Using photos to represent environments entails questions about validity. One criticism is that it is difficult to judge if a place is restorative if one cannot see the surrounding environment. Photo montages or a virtual reality technique, with a fixed background and varying park content, might have made for more reliable ratings of the psychological variables. However, these methods have other disadvantages. For example, they require substantial investment of time and programming to achieve a sufficiently realistic representation of vegetation. In any event, it bears mentioning that some previous studies have found no statistically reliable differences between ratings of restorative quality obtained on site versus with video (Hartig et al., 1997).

The likelihood of restoration as judged from photos is of course not the same thing as actual restoration, as reflected for example in changes in blood pressure or performance on tests of directed attention. Anyone who has tried to measure actual restoration in field settings would however know that doing so is a demanding task even with only two settings (cf. Hartig et al., 2003). As indicated in the introduction, such studies have not provided specific guidance for the design of small urban green spaces, as the challenges of measuring actual restoration imposed constraints on their environmental sampling. Such guidance can be obtained by studying a relatively large sample of green areas, as used in the present study.

Critics might fault this study for the small number of observers used to obtain values for the parks on the psychological variables. From our perspective, it is an empirical question as to whether the relative values for the parks would change appreciably with a larger sample. It bears mentioning that in a separate study (Nordh et al., 2009) another sample of students rated 38 of the parks from the current study on the likelihood of restoration. A comparison of the means for the set of parks as assigned by the two sets of observers shows that they do not differ significantly; $M = 4.8$ ($SD = 1.50$) in the ratings for the present study versus $M = 4.37$ ($SD = 1.67$) in the ratings from the other study. Moreover, the correlation for the values assigned to the parks by the two sets of observers is very strong, $r = 0.96$, $p = 0.01$. These results suggest that the present set of values is reliable. As for the use of students as observers, it bears mentioning that one meta-analysis found generally strong correspondence ($r = 0.83$) between environmental evaluations from student and non-student groups (Stamps, 1999). This said, it is of course of interest whether the pattern of findings we have reported will be found with other groups.

Although there are some limitations with this study, it helps move the field from broad environmental categories toward a focus on the specific physical components of environments that are important for restoration. The main message is that even within the category of small urban parks, restorative quality can vary widely and up to a high level. This should not be taken to mean that large parks are unnecessary. Rather, it opens up the possibility for increasing the number and distribution of parks even as cities becomes more densified. Finally, the possibility for restoration is not only a matter of the size of an available park, but also a matter of its design and the components used to create it.

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- Paper II

Identifying Restorative Components of Small Urban Parks using Eye Tracking

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Abstract

Earlier evidence suggests that natural scenes are in general more restorative than built scenes but we know very little about which specific components or structures in nature promote restoration. By using eye tracking this study investigates which components such as flowers, trees and bushes, people actually look at when evaluating if the space is restorative or not. Eye tracking is a rather new method in landscape architecture and environmental psychology and this study takes an important first step in the development of a new quantitative method. A sample of 38 photos of small urban green spaces (pocket parks) was selected for low and high rated restoration likelihood as established in previous research. Students (N=33) with varying study background were asked to imagine themselves being mentally tired and in need of restoration. Photos were presented for 10 seconds, on screen, and eye movements were registered for each photo and person. To identify which components (area of interest) attracted most attention, total fixation time (dwell time) in each area of interest was registered. Results show that the components where the subjects looked the most were trees, followed by benches and bushes. Relations between what the subjects look at and what ratings they make on the likelihood of restoration scale were explored and are discussed. Mean number of fixations per photo was calculated and correlated with the restoration likelihood ratings, results diverge showing both negative and positive correlations.

Keywords: environment, nature, vegetation, restoration, vision, landscape architecture

1. Introduction

Most studies on restorative environments (Kaplan, 1995; Kaplan et al., 1989) have neglected the details in the environmental stimuli. Comparison of scene types involve broad categories, most often built versus natural settings (see for example Berto et al., 2008; Herzog et al., 1997; Herzog et al., 2003; Peron et al., 2002; Staats et al., 2003; Tennessen et al., 1995). This has resulted in a lack of knowledge about which specific components or structures in nature promote restoration (Velarde et al., 2007).

However, a few examples of studies exploring restorative qualities, within the same scene type, can be found. For example Tenngart Ivarsson and Hagerhall (2008) assessed the restorative qualities of two different Swedish gardens using the perceived restorative scale by Hartig (1997). Han (2003) evaluated the restorative quality of different nature biomes and finally Nordh et al. (2009) explored restorative components of small urban green spaces. In Nordh et al. (2009) the park components such as for example bushes, trees and grass had a significant positive association with the rated likelihood of restoration. The photo stimuli used, were quantified in terms of how much area of the photo the different components covered, a method earlier applied by Shafer (1969). By regressing the psychological variables related to restoration given by groups of raters, on the quantification data, Nordh and colleagues (2009) could analyse which components that predict likelihood of restoration.

The method used in Nordh et al. (2009) raised some questions which we address in this paper. Which of the park components in Nordh et al. (2009) draw the most attention? What links are there between what people look at and the ratings they make on the restoration likelihood scale? Finally, is there a direct link between the size/amount of the component and how long time people look at it? To explore these questions we applied eye tracking technique.

Eye tracking is a method where the researcher can register what a subject gazes at when presented with a stimuli. In most cases the stimuli are photos or videos but they can also be real places using a head mounted (transportable) eye tracker. The eye tracker apparatus registers *fixations* (the gaze position held still for a longer period) and *saccades* (the gaze moving from one fixation to another) (Henderson et al., 2004). Data can be examined either visually, through for example *heat maps* (two-dimensional colour maps representing which parts of the image having most fixations) and *scan paths* (films of the eye movements, presenting order and lengths of fixations and saccades). Or it can be presented numerically through for example *number of fixations* in the total image and *dwell time* (total fixation time in an *area of interest* which is an area manually marked with polygon shapes). In this paper we focus on the numerical analysis and specifically on dwell time in areas of interests, relating our results to quantified components in Nordh et al. (2009).

Eye tracking methodology is commonly used in cognitive linguistics and psychology, but it is a rather new measurement approach in landscape architecture and environmental psychology. The articles found using landscape scenes all adapted free viewing (Berto, et al., 2008; De Lucio et al., 1996; Gratzer et al., 1971; Keul et al., 2005; Wiley et al., 1969), which is a method where the subjects explore the photos without being given a task or a question to answer. Gaze data is very sensitive to subject task (Duchowski, 2007; Yarbus, 1967). Not giving the subject a task could lead to a stimulus-driven gaze behaviour, which means that things in the stimulus such as dominant elements (i.e. garbage bins, sculptures) and contrasts can easily affect the gaze behaviour (Henderson, 2003). It can also mean a risk that subjects invent their own tasks, that drive the gaze behaviour, giving an undesired variance in data. In the present study we have a task related set up. We gave the subjects the same scenario as in Nordh et al. (2009) asked them to imagine themselves being tired and in need of restoration, where after they rated each photo, on an 11-point scale, in terms of how good a space it would be to rest and recover in. With this set up we presume that people would look at components in the park photos that were of importance for making a judgement of restoration likelihood. We hypothesized that a high value on the restoration likelihood scale means that the park components the subjects have spent time looking at were restorative, while a low value on restoration likelihood means that the components the subjects have spent time looking at were less restorative.

In Berto et al. (2008) attention was measured using eye tracking technique on photos rated low and high on fascination. Results showed that photos low on fascination had a greater number of fixations than photos high on fascination. Fascination is hypothesized to be a key aspect of a restorative experience (Kaplan, 1995; Kaplan, et al., 1989) and is hence highly correlated with rated restoration likelihood (Nordh, et al., 2009). We therefore explored if photos with low ratings on restoration likelihood would have greater number of fixations than photos with high ratings on restoration likelihood.

2. Method

2.1 Equipment setup

The lab was equipped with two computers connected to the eye tracker SensoMotorics Instruments iViewX Hispeed 1250Hz. The experiment was built up and shown in E-prime, and presented on a 19” screen, 670mm in front of the subject. Before each experiment session started a calibration of the apparatus was made. The subjects took place in the apparatus and leaned the head on a chin rest, see Figure 1. A fixation cross mark turned up in different corners of the screen, while the subjects systematically looked at the cross, the x and y coordinates of the eye position were registered. After calibration, photos with a resolution of 1024x768 pixels and colour mode of 24 bit, was presented for 10 seconds each. To centre the starting gaze of all subjects at one position, a blank slide with a fixation cross was inserted between each photo. Eye movements were registered for each photo, using fixations of the left eye. The fixation registrations were done by a saccade-based algorithm, measuring the saccade speed instead of the fixation length. All eye tracking data were analysed in Begaze 2.1.

------------------------Insert Figure 1.--------------------------

2.2 Subjects

Thirty-three students from the University of Lund volunteered to participate, mean age 23, 73% female, all but one Swedish. Most students were within humanistic sciences and only two had been working with, or studying, nature related topics before. To control for individual differences in terms of need for restoration, the students were, before the experiment started, asked to rate the extent to which they agreed with the statements *“I feel tired and worn out”* and *“I have difficulties* *in concentrating."* For evaluation, an 11- point scale was used (0 = not at all; 10 = completely). Results from the tiredness and concentration statements showed dominance on the lower end of the scale. For tiredness 63.6 % reported values below or equal to five (M = 4.27, SD = 2.05) and for concentration difficulties 81.8 % reported values below or equal five (M = 3.42, SD = 1.89). Due to the low number of tired and inattentive people, we decided to treat the group as a homogenous one.

2.3 Stimulus/Photos

Photos representing Scandinavian small urban spaces were selected from Nordh et al. (2009). By small urban spaces, we mean a range of public spaces, from square-like, with hard ground cover, to green ones, park like, with a lot of vegetation. As Nordh et al. (2009) we adapt the term pocket park for the type of spaces in focus. All parks presented were open to the public and located centrally, between dwellings, shops or offices. They were no bigger than an ordinary city block, see Figures 2 and 3 for example of park photos.

------------------------Insert Figure 2.---------------------------

-----------------------Insert Figure 3.----------------------------

From a total of 74 park photos in Nordh et al. (2009) we choose one third with high restorative ratings on the 11-point scale and one third with a low restorative ratings. To make sure that the participants from southern Sweden would not be familiar with the parks presented in the photos we excluded the photos from Malmö and Lund. Park photos from Copenhagen were considered not being familiar to this group of people. Based on the above mentioned criteria we ended up with 19 restorative (M >5.55) and 19 non restorative (M <3.82) park photos. For further description of the sample of park photos see Nordh et al. (2009).

2.4 Procedure

The data collection was made individually with new random order for each session. Arriving to the laboratory the subject filled in the socio demographic and background data. A short briefing followed, introducing the procedure and the eye track equipment. The subject was presented the same scenario as in Nordh et al. (2009)*”Imagine that it is midday and you are walking alone in a large town like Stockholm. You are mentally tired from intense concentration at work and are looking for somewhere to sit down and rest for a little while, before going back to work.”*

Following the briefing part, the subject took place in the eye tracking apparatus, and the experiment started with calibration, followed by park photo slides and a rating task. The rating task was as follows: ”*I would be able to rest and recover my ability to focus in this environment*.” By using the mouse of the computer the subject could mark, on a scale (0 = not at all; 10 = completely), whether they agreed with the statement or not. For an overview of the procedure see Figure 4.

To check for respondent suitability with regard to prior experience with urban parks as settings for restoration we added a final question on how often he or she visits the type of small parks shown in the photos. 97% mentioned that they visit them sometimes or often, hence most were frequent park users. Total time for the whole experiment including calibration time was 10-15 minutes.

-----------------Insert Figure 4.------------------------------

2.5 Park components marked by areas of interest

To prepare the photo material for analysis areas of interest we marked in each photo. The areas of interest represented the same park components that were quantified in Nordh et al. (2009), see Figure 5 for an example of area of interests classification. The areas of interest, from Nordh et al. (2009) were *hardscape*, *grass*, *lower ground vegetation*, *flowering plants*, *bushes*, *trees* and *water*.

Presuming that specific objects such as sculptures, garbage bins and people draw the subject's attention (Henderson, et al., 2004) we decided to add the new variables; *dominant elements* within the parks and *other people*. Even though Nordh et al. (2009) did not include the people variable in their analysis, due to lack of significant association with restoration likelihood, we thought it was of interest to see how much time the subjects in our study spent looking at other people. To relate to the scenario and rating task and to see if the subjects had understood the task we also included the variable *benches*. In those photos when there were people sitting on the bench people and bench, were marked as separate areas.

----------------------Insert Figure 5.------------------------

2.6 Statistical analysis

Ratings on restoration likelihood were computed across subjects to a mean value for each park. Standard descriptive statistics was used to analyse the restoration likelihood variable.

The dwell time variables were calculated for each area of interest, in every park, in a step wise model. First, we summarized dwell time for all subjects in each separate area of interest. In some of the images the same component appeared in different locations of the image (i.e. grass1, grass2, grass3…), we summarized these components into one dwell time variable (i.e. grass). Second, we divided the dwell time for each separate area of interest with the sum of dwell time for all areas of interest in the image. The procedure gave us a factor describing how much time all subjects looked in the given area of interest relative to the sum of dwell time in all the other areas of interest marked in the image. This factor is a variable we from now on call dwell time.

To explore which areas of interest that draw most attention we summarized the dwell time variables across all parks, assuming that the experiences of for example trees were the same in park one as in park two. To explore relations between what people gaze at and what ratings they make on the restoration likelihood scale the dwell time variables were correlated with the restoration likelihood ratings. We were also interested in assessing if the photos having a large picture area of a certain park component automatically also had a higher dwell time in that area. To explore this we imported quantification data on the amount of each park component from Nordh et al. (2009) leaving out the three new variables, dominant elements, people and bench as well as water, on which Nordh et al. (2009) did not have quantification data. We repeated the correlation analysis as a partial correlation between restoration likelihood and dwell time in each area of interest, controlling for the amount of each park component.

As a last step in the analysis we assessed relations between number of fixations and restoration likelihood ratings, presuming that photos low on restoration likelihood would have a higher number of fixations (Berto et al. 2008). Mean values on the restoration likelihood ratings were correlated with mean number of fixations for each park, across all subjects. To control for individual differences in scan pattern, correlations were also performed on an individual level. Following Berto et al. (2008) we also created a dichotomous variable by splitting our restoration likelihood variable into two categories. A split was made at a mean of 4.5 with 50% of the photos on each side of the split. This gave us the categories low restorative park photos versus high restorative park photos. Similar to Berto et al. (2008) we analysed mean number of fixations for each category using an average across participants and photos.

3. Result

The judged likelihood of restoration variable had a mean of 4.37 (SD = 1.67, range 2.30 - 7.39, N=33). This is consistent with results in Nordh et al. (2009). The correlation for the values assigned to the parks, by the two sets of subjects, is very strong, $r = 0.96$, $p = 0.01$.

The areas of interest drawing most attention by having highest dwell time for all subjects across all photos were trees, followed by benches and bushes. Results are presented in Figure 6.

------------------------Insert Figure 6.-------------------------

Looking for association between ratings on restoration likelihood and dwell time across all persons and parks, we found that the more time our subjects spent looking at grass the more likely they gave a high value on restoration likelihood Pearsons $r = 0.43$, $p = 0.05$. Except for water, a negative association, however not significant, occurred between all the other variables and likelihood of restoration, see Table 1. To analyse links between the size/amount of the component and how long time the subjects look at it we imported quantification data from Nordh et al. (2009) and correlated it with dwell time for each area of interest. As shown in Table 1 there is a significant strong correlation between dwell time in each area of interest and the amount of the park component. Repeating the analysis as a partial correlation analysis, controlling for amount of each component, the results changed slightly compared to the bivariate analysis. However, trees and lower ground vegetation became significantly negatively correlated with restoration likelihood, which means that subjects who spent time looking at these two variables were likely to give a low rating on restoration likelihood, independent of the amount of the component.

--------------------Insert Table 1.-----------------------

Our last step in the analysis was to explore correlation between mean number of fixations and mean restoration likelihood, across all subjects and all parks. Analysis gave a Pearsons r of -0.27 (ns). Calculating a mean value of all participants' fixations does not account for individual differences in scan patterns. People have different scan patterns, some have an active way of analysing an image with many and short fixations, whereas some have a more passive scan pattern with fewer and longer fixations. These differences can influence the mean value. To control for individual differences in scan patterns we analysed the fixation data on individual level, with number of fixations per individual in correlation with individual ratings on restoration likelihood. The result showed that 7 out of 33 subjects had a significant correlation, Pearsons $r > 0.30$ (out of those were four negative correlations). The rest of the subjects had non significant correlations with r values below 0.30, from which about 50% were negative.

Following Berto et al. (2008) we looked at number of fixations in two separate categories, in our case, low restorative park photos versus high restorative park photos. Using average across participants and photos we did not find any significant differences. Mean number of fixations for the low restorative group was 34, whereas mean value for the high restorative group was 33. With these results we did not conduct a t-test.

4. Discussions and Conclusions

In the present study we analyse what park components people look at when making judgements on restoration likelihood. Stimuli to the study were sampled from Nordh et al. (2009) and represent small urban spaces, so called pocket parks. Photos were presented on screen and eye movements were registered where after subjects gave their rating on restoration likelihood. Ratings on restoration likelihood in the present study were highly correlated with results from Nordh et al. (2009) where the same photos were presented and ratings on restoration likelihood were recorded. The high consistency between the subjects in the two studies strengthens the possibility to generalise the results. An interesting methodological result is also that even though this study did not adapt to the common procedure comparing built versus natural scene types, instead used the scene type small urban parks, varying in amount of vegetation, people seem to be able to perceive differences in the environment. They adapt to, and use, the full 11-point scale when evaluating the potential for restoration within the park presented in the photo.

The components where people looked the most (dwell time) were trees, followed by benches and bushes. Focusing on the benches is highly relevant in relation to the scenario and rating task, where subjects were asked to rate all photos in terms of how good the park, presented in the photo, would be to sit down and rest and recover. The focus on benches confirms that the subjects have understood the rating task. In Nordh et al. (2009) bushes and trees were found to be important for restoration likelihood a result in line with theory (Kaplan, 1995; Kaplan, et al., 1989). One of the key components mentioned in many studies of urban nature are trees (Harrison et al., 1987; Jim et al., 2006; Schroeder, 1982; Ulrich, 1993). In our sample of pocket park photos, the centre of the photos consists of tree canopies or bushes in more than half of the photos. The high dwell time in these areas might therefore be affected by the tendency that people automatically focus on the central part of the image when viewing scenes presented on screen

(Tatler, 2007). This central bias effect has been found in other type of scene types, hence it may not be relevant for our photos where the park room itself is the middle of the image.When looking at the associations between what park components the subjects spend time looking at and the ratings they give on the restoration likelihood scale we found that grass is significantly positively correlated with restoration likelihood, a result which is consistent with Nordh et al. (2009). This means that when viewing grass for longer time the subjects are likely to give a higher score on the restoration likelihood scale. Nevertheless, all other variables, except water, were negatively associated with restoration likelihood, though not significant. Spending much time looking at other people and dominant elements is likely associated with negative feelings for restoration likelihood, and one could expect a lower value on the rating scale. But, spending time looking at trees, bushes and lower ground vegetation would according to theory lead to a higher value on restoration likelihood (Kaplan, 1995; Kaplan, et al., 1989). Our hypothesis saying that a high value on the restoration likelihood scale means that the park components people have spent time looking at are restorative, is hence partially supported by our results.

The above dwell time analysis does not say anything about the amount of a certain park component and its correlation with restoration likelihood, but it says something about the relation between what people look at and what ratings they make on the restoration likelihood scale. As seen in the results there is a strong association between the size of the area (amount) of the variable and how long the subjects gaze at it. A complimentary explanation to the dwell time variable can be that a large area has bigger chance of fixations ending up there, hence high dwell time. A partial correlation analysis between the dwell time for the area of interest and likelihood of restoration, controlling for the amount of the park component, showed that even independent on the amount of the variable there is still a negative association between dwell time in most of the areas of interest in relation to restoration likelihood. Trees and lower ground vegetation even got a significant negative value.

In other studies one have found that a high dwell time can mean that the area is difficult to interpret, the variable demands more cognitive effort to be able to perceive (Henderson, 2003). This can for example occur when an object is put into the wrong setting, or in a peculiar place in the scene (Henderson, et al., 2004). This explanation is less likely in our study where all objects in the image can be found in a regular park. Because there is a lack of studies on how people analyse landscape images and, more specifically, how eye tracking can be linked to cognitive decisions about restoration likelihood, parts of the eye tracking data is at this stage exploratory (Keul, et al., 2005) and more studies are needed.

When creating the dwell time variable we summarized components from different photos. Being aware of limitations related to differences in colour and texture within the same variable across parks, we wanted to try the technique on a larger sample of photos.

The areas of interest were based on quantifications from Nordh et al. (2009). Other areas of interest could also have been created representing combinations of different variables for example seating area. In the dwell time analysis we found that benches, bushes and trees were the components with highest dwell time. These components commonly existed near each other in the photos. It can therefore be a matter of one component being more important than the other.

Because we chose to mark the same components as quantified in Nordh et al. (2009) most of the park room was covered by different areas of interest and the areas border to each other. This means that there is a small risk that some fixations in the border area could have been registered in the wrong area of interest. One example of this is benches and people. In those cases people were sitting on a bench we marked bench and other people as separate areas. It means that some fixations could have been registered in the wrong area, however, the calibration were made carefully with a high precision apparatus. To reduce the risk of fixations being registered in the wrong area, it could have been possible to either overlay the areas or separate them with a buffer zone. Both these approaches would however likely have affected the data to a greater extent, either by fixations being counted as belonging to two areas of interest or loss of relevant fixations ending up in the buffer zone and not being counted at all.

When looking for associations between number of fixations and the restoration likelihood ratings results diverge. On an individual level correlations show both negative and positive results with 7 out of 33 being significant. On a group level (mean restoration correlated with mean number of fixations, across subjects) no significant results were found. This was in contrast with Berto et al. (2008) who found that low fascination photos had higher number of fixations. There is of course a difference between fascination and restoration likelihood. However, according to other studies these variables are strongly correlated (Herzog, et al., 2003; Nordh, et al., 2009). With values on fascination from a separate subject group of raters in Nordh et al. (2009) we repeated the above analysis but with fascination instead of restoration likelihood. However, results showed a non significant correlation between mean fascination ratings and mean number of fixations per pocket park photo, Pearsons $r = -0.23$. This result is likely due to the high correlation between mean fascination and mean restoration likelihood Pearsons $r = 0.90$, p=0.01. Furthermore, the context in Berto et al. (2008), comparing built versus natural scene types, differ from the set up in our study using one scene type. It might be that physiological measures such as number of fixations are not as sensitive as cognitive measures on restoration likelihood, when comparing images within the same scene type.

Number of fixations can be related to need for restoration, and one could expect people being tired and in need of restoration would have fewer fixations (Berto, et al., 2008). In our study most participants had low to moderate need of restoration which means one could expect a more homogenous fixation pattern. However, the literature is inconclusive, and the issue is highly relevant to explore in future research.

One limiting factor with eye tracking is that the composition or contrasts in the photo can impact the different analysis (Gratzer, et al., 1971; Henderson, 2003). We know from earlier studies with free viewing that people are extra interested in objects such as houses, people and animals (De Lucio, et al., 1996; Henderson, et al., 2004), which is why we added the dominant elements, benches and other people variables. However, as can be seen in the dwell time analysis the subjects did not spend long time looking at these variables. When using a sample based on real parks these features will occur and vary between images. Similarly in a sample from real parks the number of components and their combinations are related to external factors such as design trends and economic factors. Which means that all components were not represented in all parks. These restrictions could have an influence on the result due to a lower N in the correlation analysis.

Despite the limitation discussed above, this study shows that eye tracking methodology can contribute with valuable information complementing more ordinary methods such as photo ratings and regression analysis commonly applied in environmental psychology. Eye tracking gives the researcher a possibility to analyse what the subjects gaze at when answering a research question. It is therefore an objective, direct link between the stimuli and the subject. Even with a low number of subjects, task driven eye tracking can provide very objective results and detailed information about what people look at in the stimuli. Future research is though needed to understand how to interpret all results, in specific dwell time.

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List of Tables

		Dominant elements	Flowering plants	Benches	Grass	Trees	Bushes	Lower ground v.	Hardscape	Water	People
Restoration likelihood mean	Pearson *r*	-.206	-.360	-.246	.431*	-.296	-.141	-.349	-.287	.428	-.315
	N	31	17	35	24	34	26	14	37	4	20
Amount of each component	Pearson *r*		.842**		.747**	.464**	.375	.543*	.568**		
	N		17		24	34	26	14	37		
Restoration likelihood mean controlled for quantified amount of the variable	Patrial correlation		-.308		.341	-.495***	-.291	-.608*	-.061		
	df		14		21	31	23	11	34		

* p<0.05, **p<0.01,***p<0.005

Table1.

List of Figures

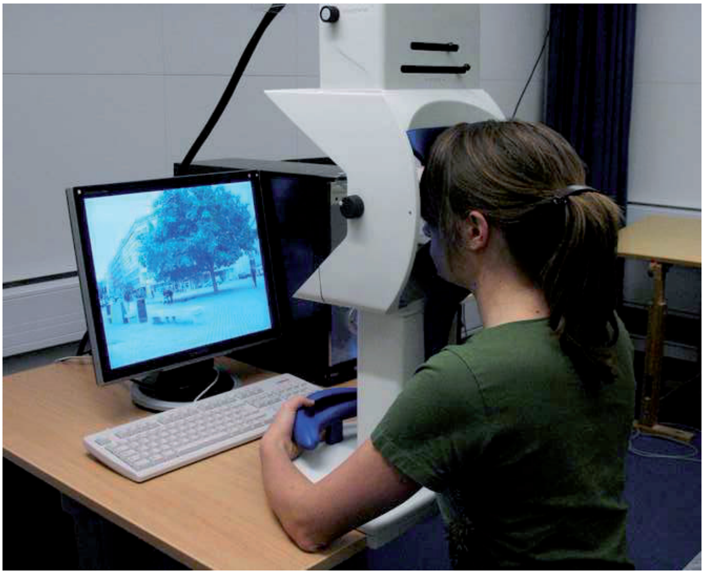


Figure 1

Figure 2

Figure 3

1. Collecting socio demographic and background data.
2. Introducing the procedure and the equipment.
3. Presenting the scenairo.

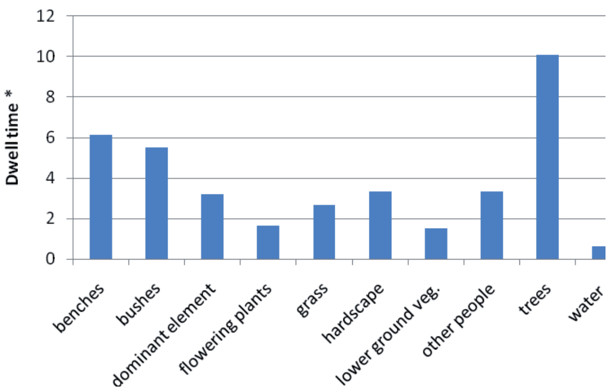
Outside the lab

1. The subject takes place in the eye tracking apparatus for calibration.
2. Park photos are presented followed by the rating task, for all 38 parks.
3. Final question, the subject respond to how often he or she visit the type of small parks shown in the photos?

Experiment in the lab

Figure 4

Figure 5



* Dwell time: the sum of all subjects dwell time (ms)/park component, divided by the sum of dwell time for all other park components (ms)/park. Dwell time was then summarized across parks. The sum of dwell time in all components is 38.

Figure 6

Acknowledgements

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- Paper III

EXPLORING VIEW PATTERN AND ANALYSING PUPIL SIZE AS A MEASURE OF RESTORATIVE QUALITIES IN PARK PHOTOS

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Keywords: Eye tracking, restoration likelihood, pocket parks

Abstract

Earlier evidence suggests that natural scenes are in general more restorative than built scenes but we know very little about which specific components or structures in nature promote restoration. Using eye tracking this study investigates which components e.g. flowers, benches and water, people focus on when evaluating if the space is restorative. A sample of 38 photos of small urban green spaces (pocket parks) was preselected for low and high restoration likelihood. Photos were presented on a screen and eye movements were registered for each photo, followed by a rating task about restoration likelihood. Visual analysis such as heat maps and scan paths were done as well as analysis of correlation between restoration likelihood ratings and pupil size. Results show that although the view pattern among individuals was variable, people tended to focus on similar components. The components drawing most attention were benches and other people. Regarding the pupil size we found a negative correlation with restoration likelihood, the smaller the pupil size the higher value on restoration likelihood. We interpret the result that restoration is the opposite to emotional arousal. Arousal is in other studies found to cause pupil dilation. Photos on parks promoting restoration and causing relaxation, would hence result in constriction of the pupil.

INTRODUCTION

In light of an increasing number of people suffering from stress-related illnesses there is a growing interest in restorative environments, places where one can rest and recover cognitive functions (Kaplan, 1995). According to most studies, natural compared to urban (built) environments are better at supporting restoration (van den Berg et al., 2007). However, little is know about which components in nature promote restoration. The present study focuses on restorative components in small urban green spaces. As the trend in European cities is densification, these small green spaces are likely to become important settings for restoration (Thwaites et al., 2005).

Vision is the most dominant sense. Through looking at stimuli people are able to take rapid decisions about preference for the environment (Gratzer and McDowell, 1971). By using eye tracking technique this study explores which park components people look at when judging if a park, presented in a photo, has restorative qualities. The eye tracker apparatus registers *fixations* (the gaze position held still for a longer period) and *saccades* (the gaze moving from one fixation to another). In this paper we focus on visual analyses, such as *heat maps* and *scan paths*.

Heat maps are two-dimensional colour maps representing which parts of the image draw most attention. The heat maps are based on a summation of attention time across subjects, this means that high attention activity is a measure of both number and duration of fixations. Red colour (hot spots) in the heat map indicates high attention (>300ms), while blue is less attention. A Gaussian curve is placed at each fixation point creating a topographic height map presenting the attention caused by fixation activity (Henderson, 2003).

Scan paths are films of the eye movements, presenting order and lengths of fixations and saccades. According to Henderson (2003) scan patterns are relatively understudied and more research is needed to explore consistency across scenes.

As a compliment to the visual analysis we assess the relation between the pupil size and the ratings people gave on the restoration likelihood scale. The diameter of the pupil is by some researchers proposed to be related to how pleasant the subjects perceive the stimuli to be (Hess and Polt, 1960). Others relates dilation to emotionally arousing photos (Wiley et al., 1969; Bradley et al., 2008). Arousal is the opposite to restoration, we therefore hypothesized that photos with low values on restoration likelihood would cause constriction of the pupil.

METHOD

Park photos

A sample of 38 photos representing Scandinavian small urban green spaces (pocket parks) was preselected for low and high restoration likelihood. All photos were taken during summer season and the amount of vegetation in each park varied from very "grey" parks with hard ground cover and a few trees, to very "green" parks with trees, bushes, plants etc. Seating, people and nearby vehicles were present in most photos. In the photos with less vegetation the facades around the park were more present. The heights of the facades were at least three floors. For further description of the sample see (Nordh et al, (2009); Nordh et al., (submitted)).

Subjects

Thirty-three university students, all within humanities, participated (mean age 23, 73% female, all but one Swedish). The need for restoration was checked by asking the subjects to rate how tired or unconcentrated they felt at the moment. No extreme values were found and the group was considered as a homogenous one with low to moderate needs for restoration.

Procedure

The data collection was done individually. Before the experiment started the subject was briefed about the procedure and the rating task in which the subject should indicate on a scale from 0-10 if they would be able to rest and recover their ability to focus in this environment presented in the photo. All subjects were given this context/scenario: *"Imagine that it is midday and you are walking alone in a large town like Stockholm. You are mentally tired from intense concentration at work and are looking for somewhere to sit* *down and rest for a little while, before going back to work."* (Nordh et al, (2009); Nordh et al., (submitted)).

The subject took their place in the eye tracker, the apparatus was calibrated and photos were presented for 10 seconds, on a 19" screen, 670mm in front of the participant. Each photo was followed by the rating task on restoration likelihood. Eye movements were registered for each photo, using fixations of the left eye. The heat maps and scan paths were created in Begaze 2.1. For a comprehensive description of the procedure and equipment see (Nordh et al., (submitted)).

Data analysis

Individual data was summarized into one heat map, for each park photo. This was done to explore patterns in the group as a whole. All hot spots, in each heat map were counted and frequencies for different components were calculated. In those cases where the hot spot was covering a bench with people sitting, the spot was counted as people.

All scan path films were analysed on individual basis. The three photos having highest value on restoration likelihood ratings and the three photos with the lowest ratings were deeper analysed.

Relations between pupil size and judgements on restoration likelihood were explored. A mean value of the pupil size, for each person's fixations for every photo was calculated. The mean pupil size per photo was then correlated with each individual rating on restoration likelihood for each park photo. Statistical analyses were done using SPSS version 17.

RESULTS

Analyses of heat maps for each park across all subjects show that the components getting highest attention were people and benches, see Figure 1. The heat maps also showed that most attention had been concentrated within the park room, which is an area marked by ceiling, represented by tree canopies; walls, represented by bushes or trees; and floor, represented by grass, plants or other hard materials (Dee, 2003; Robinson, 2004). Little attention is paid to the areas outside the park. In more open parks, or parks having lower vegetation, the facades around the park served as the walls of the park room, in these park photos the facades got more attention. An example of a heat map is presented in Figure 2.

When exploring the individual view pattern in each photo we found that people analyse the images horizontally. They focus on the central part of the image, moving from the left in the image to the right, or vice versa, going from one interesting object to another. An example of a scan path is presented in Figure 3.

The area the subjects explored are rather similar, however, the number of fixations and the order of fixations diverge between individuals. When exploring the view patterns in the three parks with the highest score on restoration likelihood (M=7.39 (SD=1.68), M=6.97 (SD= 1.83), M=6.82 (SD=1.51) versus patterns in the three park photos with the lowest restoration likelihood scores (M=2.30 (SD=1.55), M= 2.30 (SD= 1.69), M= 2.33 (SD= 1.27) we found no specific differences. Differences in view pattern seem to be related to the openness of the park room. An open park room has a more widely spread scan pattern (this is in our sample generally the "grey" parks with low ratings on restoration likelihood), where as an enclosed, narrower, park room (which is in our sample usually more “green” parks with higher values on restoration likelihood) has a more restricted view pattern.

When analysing associations between pupil size and restoration likelihood ratings, 31 out of the 33 correlation analysis showed negative results, however, only 9 were significant. This means that the higher value on the restoration likelihood rating the smaller the pupil size.

DISCUSSION

The findings show that the components that draw most attention are people and benches. When making judgements about if the park is a place to sit down and rest and recover from mental fatigue it is likely that people focus on the location of the benches. This result also confirms that the subjects have read and understood the rating task. It is also likely that other people in the park can influence the potential for restoration, hence a lot of attention is used to analyse other people. Objects such as houses and people were also found to draw attention in a study by De Lucio et al (1996). Analysis of the heat maps also shows that people focus on the park room, paying little attention to the surrounding environment. The park room covers most of the image area and contains most information, hence draws more attention (Henderson and Ferreria, 2004). People may perceive the surrounding through the peripheral sight, a topic discussed in Henderson and Ferreria (2004). However, knowing that the park room, rather than the environment surrounding it, is attracting most attention when making judgement on restoration likelihood of park photos, is highly valuable information. It strengthens the validity of this study and contributes with important information to other studies using similar methods in which people are presented scenarios and shown photos of environments, and being asked for judgements on preference or restoration likelihood.

The heat map is, as mentioned, based on the total time that people have spent looking at one specific area. An area with a lot of attention (hot spot) is therefore a result of both number and length of fixations. In an earlier paper (Nordh et al., (submitted)) we propose and discuss different explanations for what causes long fixation time. It may be that people perceive the component as pleasant and restorative and it is why they spend time looking at it, or it might mean that the area is difficult to interpret and demands more cognitive effort to perceive and make judgements on restoration likelihood (Henderson, 2003). It is also possible that a high level of stress in individuals result in longer fixations. To control for individual differences related to stress, we had two background questions about concentration difficulties and tiredness. Because most responses were on the lower end of the scales we decided to analyse our group as homogenous one and could most likely exclude the last explanation. Repeating the study with mentally fatigued subjects would however be interested for future research.

Scan paths, order and lengths of fixations, were found to be rather different between individuals which confirms results in other studies (Rayner and Pollatsek, 1992; Henderson, 2003). According to Hendersson (2003) scan paths can be inconsistent even within the same individual performing repetitive analyses of the same photo. However, the areas of the photo that draw most attention were similar between individuals, a result in line with earlier theory (Henderson, 2003). As in Berto et al (2008) most photos were analysed horizontally, from left to right or vice versa.

Finally, when analysing the correlation between pupil size and ratings on restoration likelihood we found negative correlations which is in line with our hypothesis. We assumed that when people watch photos with high restoration likelihood scores, the pupil would constrict. We base our assumption on the idea that restoration is the opposite to arousal and we know from earlier studies that arousal is associated with pupil dilation (Bradley et al., 2008). Our results confirm that when people look at restorative images they become relaxed which result in a restriction of the pupils. The result is also in line with earlier studies using landscape images (Hess and Polt, 1960; Wiley et al., 1969). However, only 9 of 33 possible negative correlations of pupil size to restoration likelihood proved to be statistically signification, suggesting that pupil size might not be as sensitive as cognitive measures on restoration likelihood when comparing images within the same scene type. More studies are needed to explore the relationship between restoration and pupil restriction.

The use of eye tracking as a tool for assessing qualities in different environments is under development. Eye tracking adds information about how people analyse a photo and what components of the photo draw most attention. It is a valuable complement to studies presenting photos for groups of raters, providing a direct link between the subject, the rating task, and the photo.

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Figures

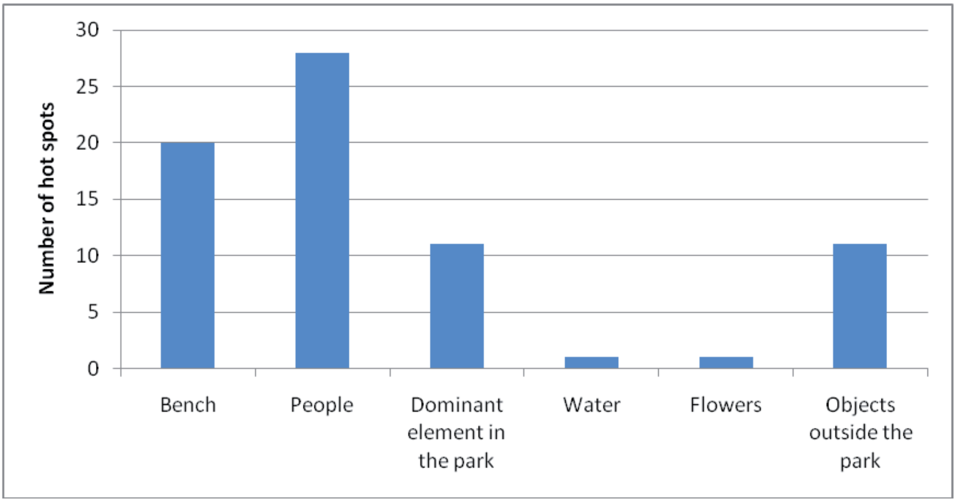

Figure 1. Frequencies of attention areas marked as hot spots in the heat maps.

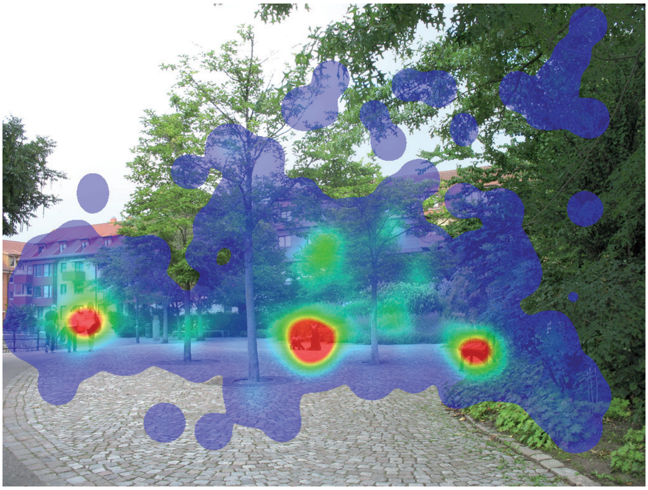

Figure 2. An example of a heat map. Red colour indicates most attention, while blue is less attention. All fixations have been inside the park room, and highlighted (red) areas are other people, dominant elements and bench.

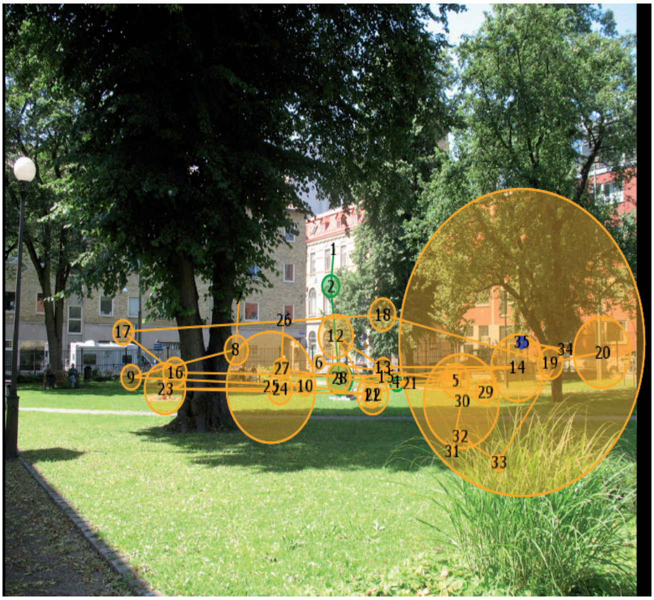

Figure 3. An example of a scan path. Fixations are numbered and marked with circles, the size of the circle is related to the fixation length calculated in milliseconds.

- Paper IV

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Abstract: Many studies have supported the proposition that natural environments contribute positively to psychological restoration. Less attention has been given to the relative importance of the physical environmental components that contribute to the restorative potential of such environments. The aim of the current study was to investigate the relative importance of environmental components in small urban parks for people looking for somewhere to sit down and rest. To address this aim, we used choice-based conjoint analysis, coupled with hierarchical Bayes estimation, to assess the utilities assigned to grass, bushes, trees, flower beds, water, and the number of other people in the park. Via a web-based questionnaire, adult residents of Oslo, Norway (N = 154) were presented with text describing successive pairs of park alternatives. Each alternative was comprised of a set of environmental components at different levels. The respondents were to choose the preferred alternative in each pair, given that they were fatigued and looking for a space to rest for a little while. The amounts of grass, trees and other people had the most influence on their choices among park alternatives. Responses across groups defined by age, gender and earlier experience with parks and nature were relatively homogenous. From a planning perspective, the findings indicate the importance of focusing on structural components such as grass and trees rather than decorative components such as flowers and water features.

Assessing Restorative Components of Small Urban Parks using Conjoint Methodology

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1. Introduction

Scientific knowledge about nature as a setting for restorative experiences has developed mainly during the last 50 years (for reviews, see Knopf, 1987; Hartig, 2007). Many of the empirical studies have compared natural settings with outdoor public urban spaces that are predominantly built (see for example Hartig et al., 1996; Laumann et al., 2001; Herzog et al., 2003; Hartig and Staats, 2006). Such research has supported general policy and planning measures, such as the preservation of natural areas (e.g. County of Stockholm, 2003). However, the studies provide relatively little guidance for specific environmental design measures (Velarde et al., 2007). The need for such guidance is growing (James et al., 2009). In Europe and elsewhere, the trend in city planning is towards densification (Beatley, 1999). Given that densification commonly entails the loss of access to some natural areas and open spaces within cities, it is of pressing importance to identify ways to create opportunities for restoration with the outdoor spaces that remain accessible to the public within cities (Thwaites et al., 2005; van den Berg et al., 2007).

In this study we focus on small parks and open spaces as settings for psychological restoration. This focus encompasses a range of outdoor public spaces, from grey ones, square-like, with hard ground cover and little vegetation, to green ones with much vegetation. The type of park is referred to as a pocket park (Nordh et al., 2009). All pocket parks of interest here are open to the public and located near a city centre, among dwellings, businesses, and other buildings. They are no bigger than an ordinary city block. These spaces presumably will become increasingly important as settings for restoration as the demand for densification of cities increases. They provide opportunities for restoration near the workplaces and homes of urban residents. They function as spaces where people can get away from daily demands mentally and physically and become pleasantly engaged by the greenery and other features (Kaplan, 1995; Kaplan et al., 1998; Nordh et al., 2009).

Small parks may function well as settings for restoration. The possibility for restoration afforded by a pocket park is not only a matter of its size, but also a matter of its design and the components used to create it (Nordh et al., 2009). By exploring the relative importance of specific components in the environment, rather than comparing broad categories of natural versus built as in much research on restorative environments, this study helps to fill a gap in the empirical literature concerning restorative environments (see for example Velarde et al., 2007). It also provides potentially valuable information to professionals working with landscape architecture and planning who must make decisions about the design of our future cities (James et al., 2009). The components of interest in this study are grass, bushes, trees, flower beds, water, and the number of other people in the park. The choice of components is based on research by Nordh and colleagues (2009; 2010a; 2010b). In a recent study concerned with the restorative quality of small urban parks and open spaces in Scandinavia, Nordh et al. (2009) found that the environmental components most predictive of the judged likelihood of restoration were the percentage of ground surface covered by grass and the amount of trees and bushes visible from the given viewing point. The more vegetated the image was, the higher the aggregate rating of restoration likelihood it received.

The study by Nordh et al. (2009) focused on visual aspects of pocket parks, using photographs as the media for presentation of the parks to research participants. In the present study we use a web-based approach, presenting lay people with brief texts that describe different combinations of physical components in a pocket park. By presenting the environments with words instead of photos, the approach relies on the respondents' ability to imagine the different alternatives by referring to their own experiences. The components all commonly exist in pocket parks; even people without any professional knowledge should be able to imagine them.

Although we assume that most if not all people can imagine the different park components on the basis of past experience, we do not assume that all people will assess the different components similarly. For example, previous research indicates that demographic factors can influence environmental preferences (Stamps, 1999). Information on such differences may also be of interest to practitioners in the planning process of new pocket parks. We decided to compare evaluations of the park alternatives on the basis of our respondents' age, gender, frequency of park visits, and earlier professional experience with parks/nature. This set of variables overlaps with the set of variables examined by Aspinall (2007), who performed a cluster analysis to identify subgroups within a sample of visitors to woodlands.

Our use of text in presenting the different parks is in line with our use of choice-based conjoint analysis, a method that enables examination of preferences for various attributes and levels of attributes that define alternatives. In this study the attributes are the different park components. There are three primary systems of conjoint analysis: conjoint value analysis, adaptive conjoint analysis and choice-based conjoint analysis (CBC) (Orme, 2009). We adopted choice-based conjoint (CBC) with a full profile set up as recommended when the alternatives have six or fewer attributes (Orme and King, 1998; Orme, 2009). With a full profile set up, each park component of interest is presented at some level in a given park alternative. The levels used are realistic descriptions of the possible variation in the attribute (e.g. many trees, a few trees or no trees).

Conjoint analysis has mainly been used in marketing research in the development of new products (Orme, 2009). In our case, the park is the "product," elaborated in terms of different park components. Respondents are presented with pairs of park alternatives which differ in the levels of different components. Given a pair of alternatives, each with six components at different levels, the respondent's task is to choose the alternative that is best for him or her. In the present study, the matter of what is best is framed in terms of the possibility for needed restoration. The method provides a setup that reminds of real world choices; it creates a realistic choice situation to which people can relate and in which they can make trade-offs.

Utilities represent the degree of worth or preference assigned by an individual to the different levels of the park components. These utility values cannot themselves be compared across components, but they can be used to calculate the relative importance of different components. Relative importances represent the 'weight' or the maximum influence park components may have on the choice of parks bearing in mind the levels of that components. The significance of such a measure lies in the fact that it is ratio-scaled and sums to zero i.e. a component with importance of 20% is as twice important as a component with importance of 10% with regards to how respondents made their choices given the components set under study. This has practical implementations as it suggests that meaningful comparisons can be performed in terms of the potential influence among park components within a study. Such a comparison could inform practitioners' decisions on where to focus attention in order to increase the potential resporative experience of a park or to attract different segments of people e.g. particular age group.

In sum, the aim of the present study was to assess the relative importance of specific components in Scandinavian pocket parks using conjoint methodology. Via a web-based questionnaire, residents of Oslo were presented with brief texts that described different combinations of physical components in a pocket park. The components under study are grass, bushes, trees, flower beds, water, and the number of other people in the park.

2. Method

A web-based questionnaire was constructed using Sawtooth Software SSI Web version 6.4.4. With the web-based set up, respondents could log on to the survey from any computer with a web connection.

2.1. The park components

Choices regarding components and levels of components are of great importance in conjoint studies. Small differences between levels can affect the calculation of utilities and in turn the determination of the relative importances assign to the different components. As mentioned previously, our choice of components for the alternatives (grass, bushes, trees, flower beds, water, and the number of other people in the park) was based on the findings from Nordh et al. (2009; 2010a; 2010b). The levels of each component, except for water and flowers, were none, a few, and many (e.g., no trees, a few trees, many trees). These three levels give clear and separable distinctions between the park alternatives. The levels for water were no water, mirror pond and small fountain. Flowers had only two levels, flowers and no flowers (see Figure 1).

---------------------Insert Figure 1. -------------------

All of the components except for other people can be used by a landscape architect when designing small urban parks. They also commonly appear in Scandinavian parks. The variable "other people" was in Nordh el al. (2009) found to have a weak bivariate association with restoration likelihood. However, in subsequent work with eye-tracking methodology, Nordh et al. (2010a) found that the presence of people in a park image attracted visual attention. This result and the assumption that the presence of other people can influence the possibility for restoration (Ulrich et al., 1991) led us to include this component in our study.

2.2. Framing the choice tasks

After some initial background questions, respondents proceeded to the series of choice tasks that comprised the greater part of the questionnaire. To set the stage for the choice tasks, the respondents were presented with a scenario similar to the one used by Nordh et al (2009; 2010a; 2010b):*"Imagine that it is summer and midday and you are walking alone in a large town like Oslo. You are mentally tired from intense concentration at work and are looking for somewhere to sit down and rest for a little while."* Following the scenario, the respondents were given a pair of alternatives, and their task was to choose the one that was best for them. In the present study, the matter of what would be "best" was framed in terms of the possibility for restoration under the conditions presented in the scenario. The respondents were to take into account all six park components when choosing between the two alternatives with regard to their suitability for restoration. The respondents were told to assume that all other features except for the ones presented were the same across the two alternatives. Each park component was positioned at the same place in the list of components, starting with trees and ending with people. This was done to maintain consistency across successive choice tasks, thereby making it easier to complete the task (see the example in Figure 2). It was a forced choice task; the respondents had to choose one of the two alternatives. This set up is in line with the assumption that in an everyday situation a person who is tired and looking for a park to sit down in will not walk on in search of the best alternative.

--------------------Insert Figure 2. ----------------------

2.3. Check of questionnaire design

Three test design procedures were used in creating the choice questionnaire: frequencies, ordinary least squares (OLS) efficiency and logit report of simulated data. The frequencies procedure counts the number of times each level of a component is presented, looking across all of the alternatives used in the choice tasks in the study. The aim here was to balance the number of times each level within each component occurred. For example, we wanted “No trees”, “Few trees” and “Many trees” to appear the same number of times across the choice tasks. In our study design we used 20 versions of the questionnaires. The versions differed in terms of the orders in which the different choice tasks were presented. Each of the 15 choice tasks included two park alternatives, and each park alternative had six components. We set up the choice task so that levels within each attribute appeared an equal number of times across the study. This was the case for both three-level attributes and two-level attribute i.e. Flowers. Hence, our design was optimally balanced. This is particularly important to ensure that more frequent choice of a level is not simply a matter of the frequency with which it is presented.

The OLS efficiency procedure estimates the relative standard error of main effects in each level using ordinal least square method based on the number of choices made (in the present case 15 per person) and compares it to what the standard error would be if the design were optimal (i.e., a hypothetical orthogonal design). As a rule of thumb, the closer the median of the OLS efficiency across all levels to 1.0, the better the design (1.0 is the maximum hypothetical value that OLS efficiency can get) (Orme, 2007a).

With our study set up, the efficiency in all levels, in all attributes, exceeded 0.99. Frequencies and OLS efficiency tests are based on the number of questionnaire versions, number of choice tasks and number of components. In contrast, the logit report of simulated data takes into account the number of respondents. Simulated answers are produced for a specified number of respondents and the standard error in utility estimation is calculated and reported for each level. According to Orme (2007b), a sample size that achieves standard errors lower than 0.05 is acceptable.

To check that the respondents were paying attention to the choice task, one hold-out profile was included. A hold-out profile (also called a fixed-choice or brain dead choice task) is a choice task with one alternative that is definitely more likely to be chosen over the other. The design of the hold-out profile built on the knowledge about the importance of the different components gained from the previous research (Nordh et al., 2009) (see Figure 3). The hold-out profile was presented halfway through the set of 15 choice tasks. Respondents marking the “wrong” alternative in the hold-out profile were excluded from the study.

---------------Insert Figure 3. ----------------------

2.4. Choice-based conjoint analysis (CBC)

We analysed the choice data using a multinomial logit analysis method that provides estimates of ‘utility’ for each level of each component. To measure how many times each level of each component was selected, relative to the number of times it appeared across all choice tasks, we performed count analysis using SMRT software version 4.18 (Orme, 2009).

To determine which *levels* of components were most important to people, average utility values were calculated from the individual utility data gained from hierarchical Bayes (HB) estimation performed by Sawtooth's CHC/HB software. Utilities represent the degree of worth or preference assigned to a particular level of a park component.

To determine which *components* were most important, it is also necessary to use individual utility data. However, utility values cannot be compared across components because they have different metrics; each component has a unique scale determined through the hierarchical Bayes estimation procedure on the basis of the obtained choice data. However, the difference in individual utility between the most and least preferred levels of a component can be used to represent the importance of each component for each respondent (Orme, 2009). These individual importances can in turn be used to determine the individual relative importance of each component, which is based on the difference between the highest and lowest utility for the given component divided by the sum of differences across all components for that respondent. This quotient is multiplied by 100 so that the individual relative importances can be expressed as a percentage of the overall importance assigned to the different components across the choice tasks. Going further, to determine which components were most important, the individual relative importances are used to calculate the average relative importance of each component. The average importances were calculated with SMRT software.

We also analyzed the preferences of different groups of respondents. A segmentation analysis was conducted with respect to age, gender, earlier involvement through studies or work with parks or natural environments and frequency of park visits. Nonparametric independent samples tests were used to check group differences.

2.5. Background questions

Following a brief introduction to the questionnaire, but before the choice tasks, respondents were asked about their age and gender. Three additional background questions were used to check on respondent characteristics relevant to the interpretation of results. These questions concerned prior experience with urban parks as settings for restoration: "How often during the warm months of the year do you visit small urban parks?" (1 = *never*, 2 = *a few times during the season*, 3 = *at least once a month*, 4 = *at least once every week*, 5 = *many times a week*); "How important is it to you to relax, clear your mind and reduce stress when you visit a small urban park?" (1 = *not at all;* 11 = *very much*); "In your own experience, how well does spending time in a small urban park actually help you to relax, clear your mind and reduce stress?" (1 = *not at all*; 11 = *very much*).

At the end of the questionnaire, respondents were asked to rate how easy they had found it to imagine the scenario and how easy they found it to imagine the different parks on the basis of the presented features (1 = *very easy;* 11 = *very difficult*). We also opened up for comments on the procedure as a whole.

2.6. Respondents and procedure

We recruited respondents with an advertisement in a magazine distributed by Oslo Bolig- og Sparelag (OBOS), one of the largest property organisations in Oslo. The magazine is sent out to 220 000 households, all members of OBOS, of which approximately 95% are located in Oslo.

We also advertised in OBOS' external and internal web pages. Residents in OBOS' Oslo housing experience the urban environment on a daily basis. We assumed that they would be able to imagine the scenario used to frame the choice task (i.e., being on a walk in a large town like Oslo, looking for somewhere to sit down and rest for a little while), and that they would be familiar with the type of small urban parks and open spaces in focus. A total of 206 respondents entered the web-survey, but only 164 completed it. Nine indicated that they did not reside in Oslo and were excluded from the study. One respondent chose the wrong alternative on the hold-out question and was also excluded from the analysis. Altogether, then, we had 154 useable surveys. Recall that the efficiency procedure used to develop the questionnaire has a criterion of a standard error in levels' utility estimation of < 0.05 and that this is dependent on number of respondents. With the present sample size we had a maximum standard error of 0.034.

It took respondents on average ca. 11 minutes (median 8.5 minutes) to complete the questionnaire, including background questions and choice tasks. This is not excessive with regard to the cognitive demands typically imposed by the choice tasks (Johnson and Orme, 1996).

About 90 % of the respondent had lived in Oslo more than 5 years. Their mean age was 43 years (SD = 12.9, range 19-75). More than two-thirds (67.5 %) were women. Almost all (98 %) reported being Norwegian. About 22 % of the respondents reported having some kind of earlier experience through work or studies with parks, gardens or other kinds of natural environments.

For the segmentation analysis the sample was broken into categories as follows: for age, less than 29 years (n = 18), 30-59 (n = 115), 60 or more (n = 21); for gender, man (n = 50), woman (n = 104); for earlier work or studies concerning parks and nature, yes (n = 34), no (n =

120); and for park visits, never, a few times every season, at least once a month (n = 60), at least once a week (n = 47), and many times a week (n = 47).

3. Results

3.1. Checks on the respondents' use of parks and imaginability of the scenario

The respondents were frequent park visitors. Some 61% reported visiting parks more than once a week, and only two respondents reported that they never visit parks. The respondents generally considered it very important to them to relax, clear the mind and reduce stress when visiting a small urban park (M = 8.5, SD = 2.4). The respondents also reported that park visits actually helped them to restore (M = 8.4, SD = 2.2). The responses to the checks on the scenario tell us that our respondents found it relatively easy to imagine being tired and in need of restoration (M = 4.2, SD 2.7). They also found it relatively easy to imagine the different parks on the basis of the presented components (M = 5.9, SD = 2.4). However, in the response to the open-ended question on the procedure as a whole, four respondents mentioned that they found it difficult to imagine the parks on the basis of the components. Three respondents mentioned that they found the choice tasks to be fatiguing.

3.2. Importance of the component levels

We performed a count analysis to determine the number of times each level of each component was selected, relative to the number of times it appeared across all of the choice tasks. For each component we found that the different levels were selected with distinctly different frequencies (all ps < 0.01). This indicates that the component levels that we used did capture meaningful distinctions for our respondents.

Analysis of the average utility values showed that many trees, many bushes, all grass cover, flower beds, a small fountain, and a few other people were prefer over the other levels for their respective component (see Figure 4).

-----------Insert Figure 4.------------

3.3 Relative importance of the components

The average importance of the components, based on individual utility calculations, shows that grass was the most important component in making choices among the park alternatives, accounting for more than 20% of the overall importances. Grass was closely followed by trees and other people (see Figure 5).

The omnibus Friedman non-parametric test, equivalent to repeted measures analysis of variance, showed that the relative importances differed across components, χ^2 (df = 5, N = 154) = 93.13, $p < 0.001$. Wilcoxon matched-pairs tests showed that people were assigned higher average relative importance value than the water features ($p = 0.03$). Water features in turn were assigned slightly higher values than flowers, but the difference was not significant at the conventional criterion ($p = 0.06$). The difference between bushes and flowers, was not significant ($p = 0.14$).

-------------Insert Figure 5.------------

3.4 Segmentation analysis

Non-parametric tests were used to determined whether importances differed among respondents grouped according to age, gender, earlier involvement in parks or nature through work or studies and frequency of park visits. We found that people who visit parks frequently had similar importance values to those who visit parks in frequently (all ps > 0.1).

Regarding people with earlier involvement in parks or nature, we found that those with professional experience preferred trees ($p = 0.02$) (earlier experience mean rank = 93.0; no earlier experience mean rank = 73.1) , water ($p = 0.032$) (earlier experience mean rank = 92.0; no earlier experience mean rank = 73.4) and other people ($p = 0.002$) (earlier experience mean rank = 83.4; no earlier experience mean rank = 56.5) more than those without experience (see Figure 6).

We found significant differences between age groups in terms of their preference to flowers ($p < 0.05$) and water ($p < 0.05$). The data suggests that the older the respondent is, the greater the importance of flowers (> 60 mean rank = 99.2; 30-59 mean rank = 75.6; < 29 mean rank=64.6) (see Figure 7). The same trend was found for water (> 60 mean rank = 98.5; 30-59 mean rank = 76.4; < 29 mean rank = 60.1). However, note that the levels for water (no water, water fountain, mirror pond) differ from those for other components.

When looking at preferences segmented by gender, we found that flowers were significantly more important to women ($p < 0.05$) than to men (women mean rank = 82.5; men mean rank = 67.2) (see Figure 8).

-----------------Insert Figures 6, 7, 8. -------------------

4. Discussion

Results from the choice-based conjoint analysis tell us that grass, trees and other people are the components most influential to the choice of park alternative when looking for somewhere to rest. This is a result in line with earlier findings (Nordh et al., 2009). It is also a result that calls attention to the importance of vegetation in city planning, for which densification is the dominant trend. When analyzing the average utility values, we found that many trees, many bushes, all grass cover, a small fountain, and flower beds had the highest utility values within their respective components. The linear relationships (e.g., the more trees, the higher the importance) were also found in the study by Nordh et al. (2009), in which the amount of trees, bushes, grass and flowers correlated positively with the likelihood of restoration rated for a sample of small urban parks in a sample of Scandinavian cities. The findings support the idea that structural components such as grass and trees are more important than decorative components such as flowers and water features. This result is potentially valuable from a planning perspective. Structural components take more time to establish than decorative components and so demand more planning.

A variable that did not follow the same pattern as the rest of the components was the presence of people. This variable had a u-shaped relationship with preference, where the middle alternative, a few people, was preferred above no people or many people. This may be due to the type of setting under study, in which the presence of a few other people can increase feelings of safety (Staats and Hartig, 2004; Kirkebøen, 2010) but more than a few may in the small space cause feelings of crowding.

Regarding the water component, we did not find any significant difference in terms of preference for mirror pond or small fountain. However, the park alternatives with water were more preferred than the ones without. Water is a component that usually gives high scores on both preference and restorative quality (see for example Schroeder, 1982; Ulrich et al., 1991; Korpela et al., 2001; Purcell et al., 2001; Laumann et al., 2003; Berto, 2005; Regan and Horn, 2005). However, water is more often represented by natural water, such as lakes, the sea, and rivers, and relatively little is known about urban water such as ponds and fountains (cf. White et al., In Press).

The components used represent rather broad categories and so allowed the respondents to think of their own trees, bushes, flowers and so forth. However, with our scenario we directed the participants to imagine being on a walk in Oslo looking for a place to sit down, so one could expect that our respondents thought of vegetation that commonly appears in Scandinavia. All of the people in our study were living in Oslo, and 98% reported being Norwegian, hence they were most likely to have similar frames of reference for the different components (e.g., what a tree looks like). The components were moreover very common, easily understandable, and easy to imagine.

The choice of components is of great importance in conjoint analysis. An interview or focus group discussion is commonly done prior to the experiment to find relevant components and levels of components (e.g. Alalouch, 2009). Instead of going through such a procedure, we based our choice of components on the results of previous studies in the area (2009; 2010a; 2010b). All of the components used, with the exception of the presence of people, are environmental components that a landscape architect can design with when creating small urban park. They are also commonly existing components in Scandinavian small urban parks.

A component that we did not include in our study was the presence of benches. Using eye-tracking methods, Nordh el al. (2010a; 2010b) found that benches draw a lot of attention. Their subjects spent much time looking at the benches shown in the parks they studied. In the present study the respondents were given a scenario in which they were tired and looking for somewhere to sit down, so the presence of benches was implied. However, in the open-ended question six of the respondents commented on the importance of enough benches in small urban parks.

By using text instead of photos, we relied on the respondents' capacity to imagine the parks on the basis of the presented components. The respondents reported that they had no difficulty in imagining the different components; however, some mentioned that they experienced the choice tasks as rather fatiguing. The time for completion of the whole questionnaire including back ground and follow up questions was however relatively short.

Conjoint methodology is a new and promising method which can contribute valuable information applicable in practice. For example, the average importances for the different components suggest that it is better to put limited funds into grass before spending much money on flowers. The within-components differences in utility suggest that people would prefer increasing the amount of grass from none to some grass cover as compared to increasing the amount of bushes. However, one must be careful when making such claims. The results from conjoint depend of course on the number of components in the study and the presented combinations of components. There may be other components and levels that are important. Also, design is site specific, and encouraging the creation of parks that all look the same is not our intent here. The results simply give some valuable guidance on what residents of Oslo think is important in a small urban park. This information can be utilised differently by landscape designers to inform design decisions that take into account users' preferences, and subsequently increase the likelihood of a park design with high restorative quality.

Of interest in this study was also whether preferences for park components were related to age, gender, earlier experience in studying or working with nature and parks, and frequency of park visits. However, we found relatively few differences between groups. This is in line with the results of Stamps (1999), who performed a meta-analysis on environmental aesthetics. A concern raced by Sevenant and Antrop (2010) is that most studies within this field are based on responses from students. The present study is strong in that sense that is uses lay people living in an urban setting. However, results from the present study are in line with results from the study by Nordh et al. (2009), in which the subjects were students. The results are also in line with Stamps' (1999) meta-analytic finding that students' environmental preferences correlated strongly with the preferences of lay people.

The use of a web-based questionnaire involves a variety of issues that may not be familiar for some researchers. One issue involves open versus closed access to the questionnaire. Closed access requires the assignment of passwords. Every respondent would thus have had to send an email, asking for a password to be able to open the survey. This extra step could possibly have reduced the number of respondents, so we decided not to use passwords. There are however some limitations imposed when not using passwords. First, the participants cannot stop the questionnaire and continue from the same location later. We had 44 incomplete answers. This number might have been lower if potential respondents were able to save their responses and continue the survey later. Second, when using web surveys there is always a risk that people outside of the target group log on to the study. With open access it is impossible to determine how well the relevant target group has been reached. However, web surveys have been found to be as reliable as other surveys (Gosling et al., 2004) . In an effort to address this issue and determine that our respondents were living in Oslo, we added a question about the number of years the respondent had lived in Oslo. Answers to this question were used to exclude nine respondents who were not residents of Oslo.

Even though conjoint is based on the combination of components, where the subject is evaluating the whole park rather than separate parts (Aspinall, 2007), questions about interactions among components as raised by Nordh et al. (2009) still remain. Which combinations of components promote the optimal park? Studies with larger number of respondents would allow for analysis of interaction effects and so would be interesting for future research.

The present application of conjoint methodology breaks new ground for quantitative research in landscape architecture and environmental psychology. However, during the last years the use of conjoint analysis has extended to a wide range of issues, such as in understanding architects' priorities in hospital design (Alalouch, 2009), housing preferences (Leishman et al., 2004), safety perception (Zamora et al., 2008) and landscape architectural education (Zuin, 2002). This study is unique in that it applies this relatively new quantitative approach to identifying the specific components in the environment that are of potential importance for restoration. It contributes to an increasing body of knowledge dealing with the psychological benefits of vegetation in cities. And it strengthens the arguments for designing small urban parks in which green components such as grass and trees are important supports for psychological restoration.

Acknowledgements

The authors wish to thank Oslo Bolig- og Sparelag (OBOS) for their generous help in recruiting participants for the study. We would also like to thank all of the respondents for taking the time to complete the questionnaire. Finally we would like to thank the members of the Open Space Research Centre, and particularly Peter Aspinall, for willingness to communicate their knowledge of conjoint analysis.

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List of Figures

Components	**Trees**	**Bushes**	**Grass cover**	**Flowers**	**Water feature**	**Other people**
Levels	No trees	No bushes	No grass cover	No flowers	No water	No people
	A few trees	A few bushes	Some grass cover	Flower beds	Mirror pond	Few people
	Many trees	Many bushes	All grass cover		Small fountain	Many people

Figure 1. The six park components of interest in the study, with their respective levels as presented in the different park alternatives used in the choice tasks.

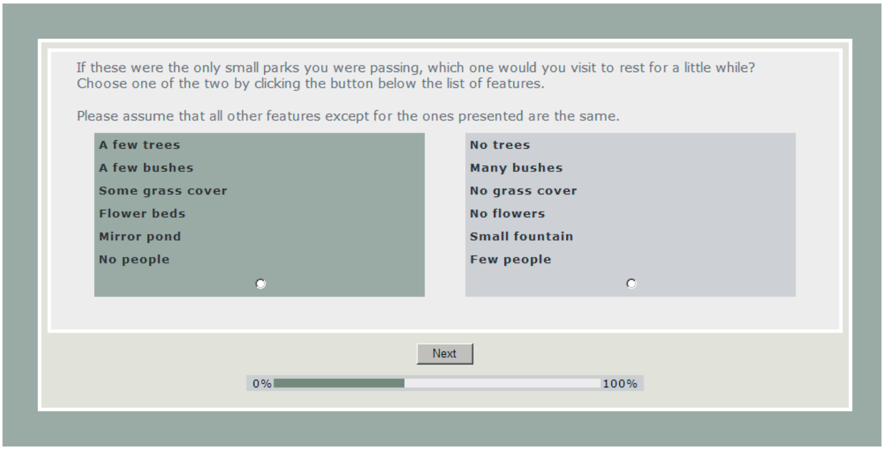


Figure 2. An example of a choice task (English translation from the Norwegian version used in the study).

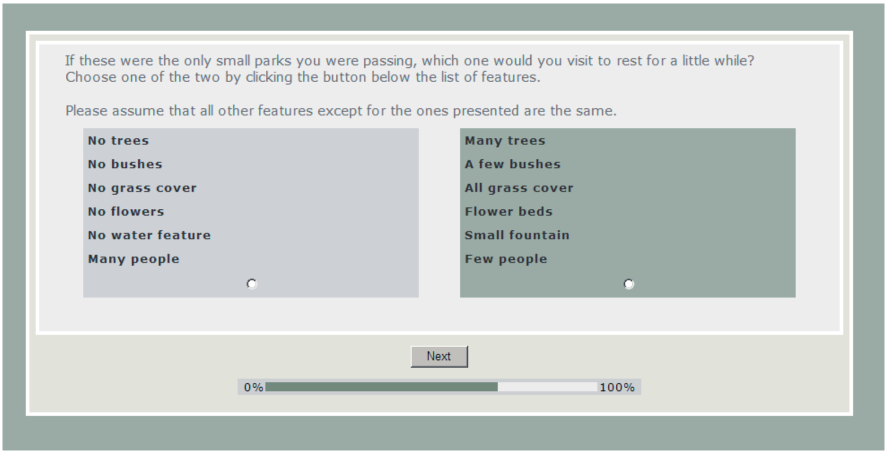


Figure 3. The hold-out profile. It was expected that the alternative on the right would be chosen over the alternative on the left.

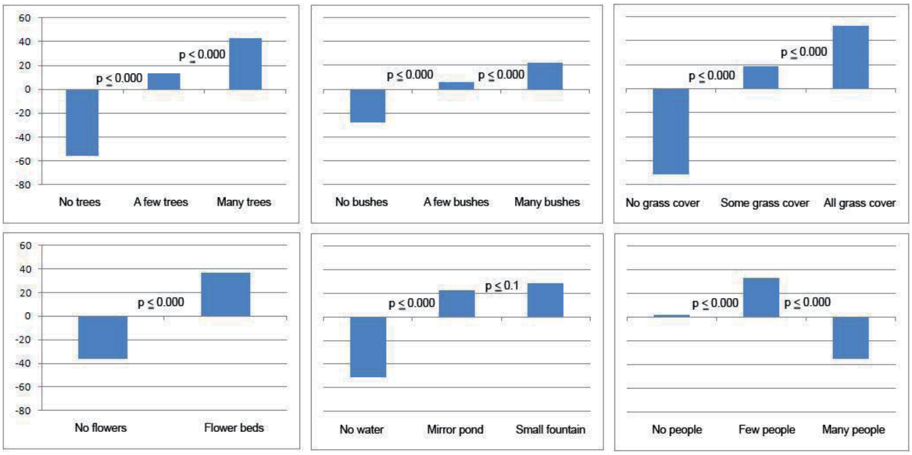


Figure 4. Average utility values for each level, calculated across respondents for each of the six components. The utility values are scaled to sum to zero. A negative value does not necessarily mean that the given level is disliked; however, in a choice situation in which all other components are equal, the alternative that includes the level with the highest positive utility will be preferred over the alternative with the lowest utility. The p-values refer to the differences between adjacent levels of the given component.

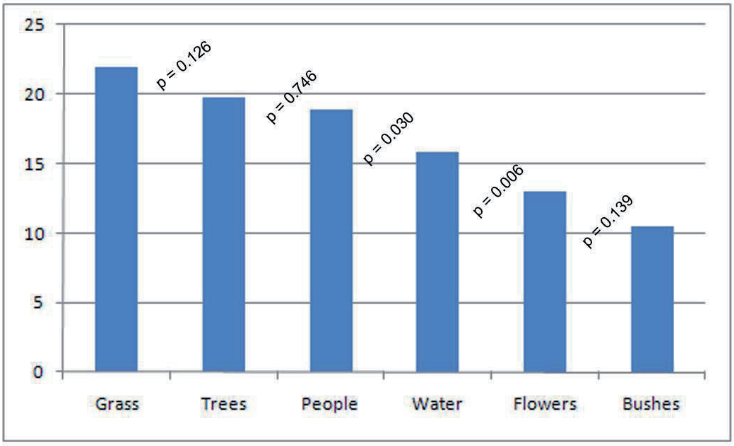
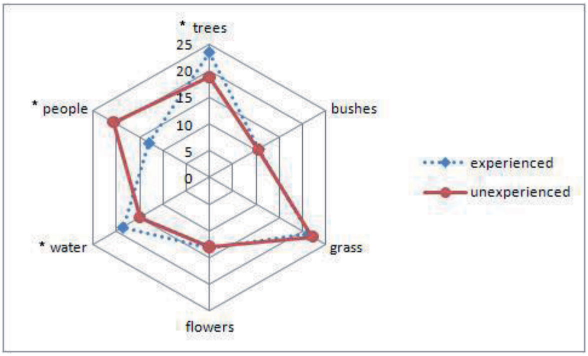
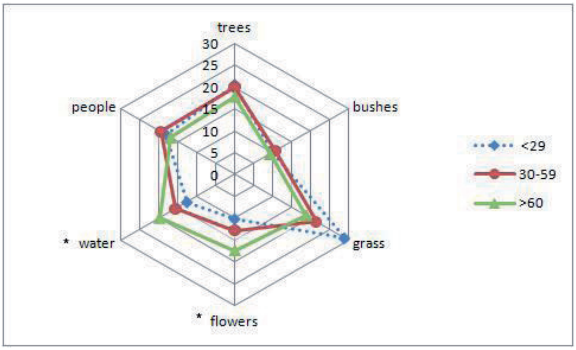


Figure 5. Average importances for the six park components. As presented in the figure, grass is the most important component, followed by trees and people. In the choice situation the respondents put the least emphasis on bushes. All components sum to 100%, which reflect the whole park alternative. The p-values refer to the differences in average importandes between adjacent components.



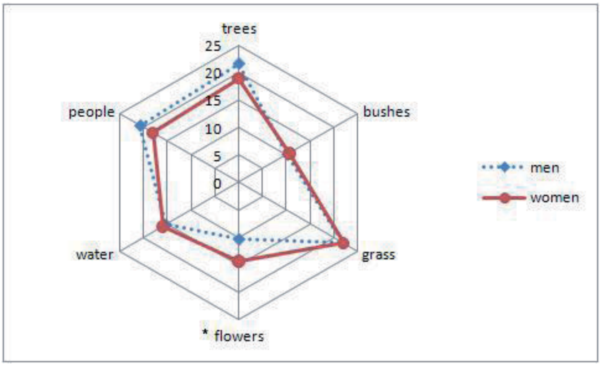
** $p \leq 0.05$*

Figure 6. Segmentation of average importance values according to earlier experience with parks/nature.



** $p \leq 0.05$*

Figure 7. Segmentation of average importance values by age group.



** $p \leq 0.05$*

Figure 8. Segmentation of average importance values by gender.

Park photos

The 74 park photos used in Study 1 (out of these 38 photos where used in Study 2). The photos are arranged from most restorative to least restorative. Mean value on restoration likelihood as well as standard deviation from Study 1 is presented below each photo.

M = 7.73; SD = 1.01

M = 7.73; SD = 1.42

M = 7.73; SD = 1.74

M = 7.45; SD = 1.92

M = 7.45; SD = 1.75

M = 7.09; SD = 1.30

M = 6.82; SD = 1.25

M = 6.73; SD = 1.19

M = 6.64; SD = 1.12

M = 6.64; SD = 1.75

M = 6.55; SD = 1.37

M = 6.45; SD = 1.13

M = 6.36; SD = 1.36

M = 6.36; SD = 1.75

M = 6.27; SD = 1.95

M = 6.27; SD = 1.95

M = 6.18; SD = 1.83

M = 5.91; SD = 1.30

M = 5.91; SD = 1.70

M = 5.73; SD = 1.42

M = 5.64; SD = 1.36

M = 5.55; SD = 1.86

M = 5.45; SD = 1.63

M = 5.45; SD = 1.69

M = 5.45; SD = 1.86

M = 5.45; SD = 1.75

M = 5.36; SD = 1.75

M = 5.27; SD = 1.85

M = 5.27; SD = 1.62

M = 5.18; SD = 1.99

M = 5.09; SD = 1.58

M = 5.09; SD = 1.87

M = 5.09; SD = 1.87

M = 5.00; SD = 1.26

M = 4.91; SD = 1.70

M = 4.82; SD = 1.78

M = 4.82; SD = 2.32

M = 4.55; SD = 1.44

M = 4.55; SD = 1.97

M = 4.55; SD = 2.02

M = 4.45; SD = 1.21

M = 4.45; SD = 1.75

M = 4.36; SD = 1.57

M = 4.36; SD = 2.01

M = 4.27; SD = 1.49

M = 4.09; SD = 2.30

M = 4.09; SD = 1.38

M = 4.09; SD = 1.97

M = 4.00; SD = 1.34

M = 3.91; SD = 1.70

M = 3.82; SD = 1.25

M = 3.82; SD = 2.09

M = 3.73; SD = 1.79

M = 3.73; SD = 1.56

M = 3.64; SD = 2.42

M = 3.45; SD = 1.37

M = 3.45; SD = 1.75

M = 3.36; SD = 1.43

M = 3.27 ; SD = 1.79

M = 3.27; SD = 2.33

M = 3.27; SD = 2.37

M = 3.18; SD = 1.25

M = 3.18; SD = 1.47

M = 3.18; SD = 1.78

M = 2.91; SD = 1.14

M = 2.91; SD = 1.58

M = 2.91; SD = 1.81

M = 2.73; SD = 1.74

M = 2.64; SD = 1.50

M = 2.64; SD = 1.75

M = 2.55; SD = 1.69

M = 2.36; SD = 1.96

M = 2.27; SD = 2.05

M = 2.18; SD = 1.72

The conjoint questionnaire

The coice tasks are in random order in each questionnaire.

Start

Kjære OBOS-medlem, Velkommen til Parkstudien.

Alle svar vil bli behandlet anonymt og konfidensielt!

For å fortsette til neste spørsmål, klikk på "Next"-knappen. Når du har klikket på "Next"-knappen vil studien begynne. Du vil ikke kunne gå tilbake til tidligere sider ved å trykke på tilbakepilen i nettleseren.

Next

info

Denne studien har to deler, én som handler om deg og én som handler om elementer i små byparker.

Med små byparker mener vi et spekter av offentlige rom, fra de plass-lignende med hardt grunndekke, til de "grønne" med mye vegetasjon. All parker i denne studien er åpne for allmennheten og sentralt beliggende, mellom boliger, butikker og kontorbygg. De er ikke større enn et vanlig kvartal i byen.

Next

0% 100%

Age

Din alder:

Next

0% 100%

Gender

Kjønn:

- Mann
- Kvinne

Next

0% 100%

nationality

Din nasjonalitet:

Next

0% 100%

Osloyear

Hvor lenge har du bodd i Oslo?

- Bor ikke i Oslo
- Inntil 2 år
- 2-5 år
- >5 år

Next

0% 100%

earlierexp

I ditt arbeid eller studier, er du på nåværende tidspunkt eller har du tidligere vært involvert i arbeid med parker, hager eller andre typer naturlige miljøer (for eksempel økologi, landskapsarkitektur, naturforvaltning, skogbruk, jordbruk)?

- Ja
- Nei

Next

0% 100%

Parkvis

Hvor ofte besøker du små byparker i løpet av sommerhalvåret?

- Aldri
- Noen få ganger i løpet av sesongen
- Minst en gang i måneden
- Minst en gang i uka
- Flere ganger i uka

Next

0% 100%

Resto1

Hvor viktig er det for deg å slappe av, klarne tankene og senke stressnivået når du besøker en liten bypark?

- 0. Ikke viktig
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10. Svært viktig

Resto2

Etter din erfaring, hvor godt hjelper et besøk i en liten bypark deg å slappe av, klarne tankene og senke stressnivået?

- 0. Ikke i det hele tatt
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10. Svært godt

Next

0% 100%

intro

Denne studien er om elementer i små byparker som kan hjelpe deg å slappe av, klarne tankene og senke stressnivået. Vi er interessert i dine preferanser for disse elementene.

Next

0% 100%

intro2

For at du skal ha en referanseramme for dine preferanser, vil vi at du skal forestille deg at du er i en viss situasjon.

Forestill deg at det er sommer og midt på dagen, og du går alene i en stor by som Oslo. Du er mentalt sliten etter intens konsentrasjon på jobben og leter etter et sted å sette deg ned og slappe av en liten stund.

Next

0% 100%

CBCRAN1

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Noen få trær	**Ingen trær**
Noen få busker	**Mange busker**
Noe gressplen	**Ikke noe gressplen**
Blomsterbed	**Ingen blomster**
Dam	**Liten fontene**
Ingen andre personer	**Få andre personer**

Next

0% 100%

CBCRAN2

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Noen få trær**
Ingen busker	**Mange busker**
Bare gressplen	**Noe gressplen**
Blomsterbed	**Ingen blomster**
Ikke noe vannelement	**Liten fontene**
Mange andre personer	**Ingen andre personer**
○	○

Next

0% 100%

CBCRAN3

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Ingen trær**
Noen få busker	**Ingen busker**
Ikke noe gressplen	**Bare gressplen**
Ingen blomster	**Blomsterbed**
Dam	**Ikke noe vannelement**
Mange andre personer	**Få andre personer**
○	○

Next

0% 100%

CBCRAN4

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Ingen trær**
Noen få busker	**Ingen busker**
Noe gressplen	**Bare gressplen**
Blomsterbed	**Ingen blomster**
Liten fontene	**Dam**
Få andre personer	**Ingen andre personer**
○	○

Next

0% 100%

CBCRAN5

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Noen få trær	**Mange trær**
Mange busker	**Ingen busker**
Ikke noe gressplen	**Noe gressplen**
Blomsterbed	**Ingen blomster**
Ikke noe vannelement	**Dam**
Mange andre personer	**Få andre personer**
○	○

Next

0% 100%

CBCRAN6

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Ingen trær	**Noen få trær**
Mange busker	**Noen få busker**
Ikke noe gressplen	**Bare gressplen**
Blomsterbed	**Ingen blomster**
Ikke noe vannelement	**Liten fontene**
Ingen andre personer	**Mange andre personer**
○	○

Next

0% 100%

CBCRAN7

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Ingen trær	**Mange trær**
Noen få busker	**Ingen busker**
Noe gressplen	**Ikke noe gressplen**
Ingen blomster	**Blomsterbed**
Ikke noe vannelement	**Liten fontene**
Mange andre personer	**Ingen andre personer**
○	○

Next

0% 100%

CBCRAN8

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Noen få trær**
Noen få busker	**Mange busker**
Ikke noe gressplen	**Bare gressplen**
Ingen blomster	**Blomsterbed**
Ikke noe vannelement	**Dam**
Ingen andre personer	**Få andre personer**

Next

0% 100%

CBCRAN9

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Noen få trær	**Ingen trær**
Mange busker	**Ingen busker**
Bare gressplen	**Noe gressplen**
Ingen blomster	**Blomsterbed**
Dam	**Liten fontene**
Få andre personer	**Mange andre personer**

Next

0% 100%

CBCFIX1

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Ingen trær	**Mange trær**
Ingen busker	**Noen få busker**
Ikke noe gressplen	**Bare gressplen**
Ingen blomster	**Blomsterbed**
Ikke noe vannelement	**Liten fontene**
Mange andre personer	**Få andre personer**

Next

0% 100%

CBCRAN10

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Noen få trær**
Mange busker	**Ingen busker**
Noe gressplen	**Ikke noe gressplen**
Blomsterbed	**Ingen blomster**
Dam	**Ikke noe vannelement**
Mange andre personer	**Få andre personer**

Next

0% 100%

CBCRAN11

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Ingen trær**
Mange busker	**Noen få busker**
Noe gressplen	**Bare gressplen**
Ingen blomster	**Blomsterbed**
Ikke noe vannelement	**Liten fontene**
Få andre personer	**Ingen andre personer**

Next

0% 100%

CBCRAN12

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Ingen trær	**Noen få trær**
Noen få busker	**Ingen busker**
Ikke noe gressplen	**Bare gressplen**
Blomsterbed	**Ingen blomster**
Dam	**Liten fontene**
Mange andre personer	**Ingen andre personer**

Next

0% 100%

CBCRAN13

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Noen få trær**
Mange busker	**Noen få busker**
Bare gressplen	**Noe gressplen**
Ingen blomster	**Blomsterbed**
Liten fontene	**Ikke noe vannelement**
Mange andre personer	**Få andre personer**
○	○

Next

0% 100%

CBCRAN14

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Mange trær	**Ingen trær**
Noen få busker	**Ingen busker**
Bare gressplen	**Ikke noe gressplen**
Blomsterbed	**Ingen blomster**
Liten fontene	**Dam**
Få andre personer	**Ingen andre personer**
○	○

Next

0% 100%

CBCRAN15

Hvis disse var de eneste byparkene du passerte, hvilen ville du besøke for å slappe av en stund? Velg en av de to ved å klikke på knappen under listen av elementer og egenskaper.

Vennligst ta utgangspunkt i at alle andre elementer og egenskaper ved parkene enn de som står på listen er like.

Ingen trær	**Noen få trær**
Mange busker	**Ingen busker**
Noe gressplen	**Ikke noe gressplen**
Ingen blomster	**Blomsterbed**
Ikke noe vannelement	**Dam**
Ingen andre personer	**Mange andre personer**
○	○

Next

0% 100%

feedback1

Hvor lett syntes du det var å forestile deg scenarioet – å være mentalt sliten etter jobben, gå i en stor by, og lete etter et sted å sitte og hvile seg en liten stund?

- ○ 0. Veldig lett
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10. Veldig vanskelig

feedback2

Hvor lett syntes du det var å forestille deg de ulike parkene på grunnlag av de ulike elementene du fikk presentert?

- ○ 0. Veldig lett
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10. Veldig vanskelig

Next

0% 100%

feedback

Hvis du har andre kommentarer kan du gjerne skrive dem her.

Next

0% 100%

last

Dine svar er registrert. Takk for at du deltok!

Resultatene vil bli publisert i min doktoravhandling ved Universitetet for miljø- og biovitenskap, samt i OBOS bladet i løpet av høsten 2010.

Vennlig hilsen, Helena Nordh

Du kan nå lukke nettleseren ved å klikke på "X" i øvre høyre hjørne.

0% 100%