Eesti Maaülikool
Estonian University of Life Sciences

EXPLORING THE SALUTOGENIC PROPERTIES OF THE LANDSCAPE: FROM GARDEN TO FOREST

MAASTIKU TERVENDAVAD OMADUSED: UURIMUS TERVENDAVATEST AEDADEST METSAVAADETENI

KADRI MAIKOV

Väitekiri
Filosoofiadoktori kraadi taotlemiseks maastikuarhitektuuri erialal

A Thesis
For applying for the degree of Doctor of Philosophy
in Landscape Architecture

Tartu 2016

Eesti Maaülikooli doktoritööd

Doctoral Thesis of the
Estonian University of Life Sciences

Eesti Maaülikool
Estonian University of Life Sciences

EXPLORING THE SALUTOGENIC PROPERTIES OF THE LANDSCAPE: FROM GARDEN TO FOREST

MAASTIKU TERVENDAVAD OMADUSED: UURIMUS TERVENDAVATEST AEDADEST METSAVAADETENI

KADRI MAIKOV

Väitekiri
Filosoofiadoktori kraadi taotlemiseks maastikuarhitektuuri erialal

A Thesis
For applying for the degree of Doctor of Philosophy
in Landscape Architecture

Tartu 2016

Institute of Agricultural and Environmental Sciences
Estonian University of Life Sciences

According to the verdict No 6-14/15-8 of 5.09.2016, the Doctoral Committee for Environmental Sciences and Applied Biology of the Estonian University of Life Sciences has accepted the thesis for the defence of the degree of Doctor of Philosophy in Landscape Architecture.

Opponent:

Daiga Zigmunde, PhD
Latvia University of Agriculture
Dean of the Faculty of Environment and Civil Engineering

Supervisor:

Prof. Kalev Sepp
Department of Landscape Management and Nature Conservation
Institute of Agricultural and Environmental Sciences

Prof. Simon Bell
Department of Landscape Architecture
Institute of Agricultural and Environmental Sciences

Venue and time for defence of the thesis:
06.12.2016 at 14.15 Kreutzwaldi 5-2A1, Tartu.

The English text in the thesis has been revised by Elsevier and the Estonian by Marju Mertelsmann.

The thesis was pre-reviewed by Erja Rappe, dos. MMT/ DSc., /senior researcher/ Ikäinstituutti / The Age Institute.

Publication of this thesis is supported by the Estonian University of Life Sciences and by the Doctoral School of Earth Sciences and Ecology created under the auspices of the European Social Fund

ISSN 2382-7076
ISBN 978-9949-569-55-7 (trükis)
ISBN 978-9949-569-56-4 (pdf)

Euroopa Liidu struktuuritoetus

Eesti tuleviku heaks

CONTENTS

LIST OF ORIGINAL PUBLICATIONS

The papers are reproduced with kind permission from the publishers. This thesis is based on the work contained in the following papers (the contribution table shows the role of the author in each):

I. **Maikov, Kadri**; Bell, Simon and Sepp, Kalev (2008) A comparison of the evaluation of room characteristics of healing gardens. Design and Nature IV. Wessex Institute of Technology Press. 223-232.
II. **Maikov, Kadri** (2014) Landscape characteristics of Tartu city parks – user influences through design. In: Zubir S.S and Brebbia CA (Eds). Sustainable City VIII. Ashurst, UK: WIT Press. 353-364.
III. Rennit, Piret and **Maikov, Kadri** (2015) The perceived restoration scale used as an evaluation tool for parks and open green spaces, using Tartu city parks as an example. City, Territory and Architecture 2:6. The SpringerOpen Production. DOI 10.1186/s40410-014-0020-3.
IV. Hansson, Karl; Külvik, Mart; Bell, Simon and **Maikov, Kadri** (2012) A preliminary assessment of preferences for Estonian natural forests. Baltic Forestry 18(2):299-315.

Contribution table. The contributions from the authors to the papers are as follows:

	Paper			
	I	**II**	**III**	**IV**
Original idea	KM	KM	KM	KH
Study design	KM	KM	KM	KH, MK, KM
Data collection	KM	KM	PR	KH
Data analyse	KM	KM	All	KH
Manuscript preparation	All	KM	All	All

KM – Kadri Maikov, SB – Simon Bell, KS – Kalev Sepp,
PR – Piret Rennit, KH – Karl Hansson, MK – Mart Külvik

ABBREVIATIONS

ART	Attention Restoration Theory
CAD	Computer Aided Design - Digital maps about green spaces in Tartu
EBD	Evidence Based Design
EBLA	Evidence Based Landscape Architecture
EBP	Evidence Based Practice
EC	Environmental Characteristics
ECLM	Emotional Character Line Method
EPM	Environmental Preference Matrix
EPT	Environmental Psychology Theories
GIS	Geographic Information System
HST	Health Support Tools
LC	Landscape Characteristics
POE	Post-Occupation Evaluation
PRS	Perceived Restoration Scale
PSD	Perceived Sensory Dimension
QET	Quality Evaluation Tool
SET	Supportive Environment Theory
SPUGS	Small Public Urban Green Spaces
UGA	Urban Green Areas
UGS	Urban Green Spaces
WHO	World Health Organization
XO, AC, CL etc.	marking the green space location on Tartu map

TERMINOLOGY

BEING AWAY – involves putting a psychological and possibly physical distance between one's usual context, including the work one ordinarily does and the pursuit of particular goals and purposes (Kaplan and Kaplan, 1989).

COHERENCE – one component of Kaplan's "legibility" dimension, an important factor in predicting preference (Kaplan and Kaplan, 1989).

COMPATIBILITY – the degree of match between personal inclinations and purposes, environmental supports for intended activities and environmental constraints on action (Kaplan and Kaplan, 1989).

COMPLEXITY – the amount of variety present in a scene able to keep one occupied or interested; complexity is defined through different visual elements in a scene (Ulrich, 1983).

CULTURE – the way of life, especially the general customs and beliefs, of a particular group of people at a particular time.

ENVIRONMENT – the aggregate of surrounding things, conditions, or influences; surroundings; milieu.

ENVIRONMENTAL PREFERENCE MATRIX – the (Kaplan and Kaplan, 1989) developed a preference matrix comprising four informational factors which affect preferences of landscape. These factors are coherence, complexity, legibility and mystery.

EXTENT – refers to the possibility for immersion in a coherent physical or conceptual environment that is of sufficient scope or scale to sustain exploration and interpretation.

FASCINATION – effortless attention (Kaplan and Kaplan, 1989).

FESTIVE – landscape characteristic - A meeting place for festive activity and pleasure.

GREEN AREAS – a place where plants are grown.

GREEN ROOM – is used to convey a sense that a specific place such as a garden consists of a set of distinct spaces that are separated from each other spatially and by intervening landscape elements which may enclose the spaces and which are experienced by visitors as part of a sequence. Rooms can be generally described using a specific name to which a set of characteristics is attached.

HEALING GARDEN – a garden in comprising a layout and constituent parts specifically designed to make people feel better (Eckerling, 1996). Lei et al. (2011) have divided these into two categories: gardens in healthcare facilities that improve the recovery process of patients e.g. suffering from mental illnesses or recovering from an operation and public parks playing a role in alleviating stress or "life-style depression". It is umbrella term for all kind of gardens designed to have a health function.

HEALING LANDSCAPE – healing landscape as a "green space in healthcare facilities" (Jiang, 2009). Wang and Li (2012) also refer to landscapes that have therapeutic effects on physical and mental health. Also known as a salutogenic landscape.

HEALING GARDEN – a garden in a healing setting designed to make people feel better" (Eckerling, 1996).

HEALTH – is a state of complete physical, social and mental well-being and not merely the absence of disease or infirmity. Health is a resource for everyday life, not the object of living. It is a positive concept emphasizing social and personal resources as well as physical capabilities (WHO, 2006).

HUMAN SCALE – is the set of physical qualities, and quantities of information, characterized and judged in relation to the size of the human body.

LANDSCAPE – "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000, p 114).

LANDSCAPE CHARACTERISTICS – in this context referring to the eight specific landscape attributes defined for healing gardens by Berggren-Bärring and Patrik Grahn (1995), these being: Serene, Wild, Rich in Species, Space, the Common, The Pleasure Garden, Festive and Culture.

LANDSCAPE READING – landscape has all the features of language. Designers and planners of landscape must try to read a place through their client's eyes, as well as their own, to read and response to the ongoing dialogues (Spirn, 1998).

LEGIBILITY – the promise of being able to extract meaningful visual information from the environment as one moves through it (Kaplan and Kaplan, 1989, p 115).

MYSTERY – something hidden in a scene, giving the impression that one could acquire new information if one were to wander deeper into the landscape. Mystery is often associated with the notion of surprise (Ulrich, 1983).

PERCEIVED RESTORATIVE SCALE – to represent factors set out in attention restoration theory (Hartig *et al.,* 1997a).

PREFERENCE – preferences could be conceived of as an individual's attitude towards a set of objects, such as the degree to which they like one landscape as compared to another, typically reflected in an explicit decision-making process (Lichtenstein and Slovic, 2006).

PERCEPTION – perception is described as the process of attaining an awareness and understanding of sensory information (Bell, 2012).

PROSPECT – a landscape characteristic of a green, open place with vistas and an invitation to stay there.

PUBLIC HEALTH – public health incorporates the interdisciplinary approaches of epidemiology, biostatistics and health services. Environmental health, community health, behavioural health, health economics, public policy, insurance medicine and occupational health (respectively occupational medicine) are other important subfields of public health.

REFUGE – a landscape characteristic comprising an enclosed, safe and secluded place, where you can relax and be yourself and also experiment and play.

RICH IN SPECIES – a landscape characteristic comprising a room offering a variety of species or animals and plants.

SALUTOGENIC LANDSCAPE – a landscape with health promoting properties, be it for physical or mental health and well-being.

SERENE – a landscape characteristic providing peace, silence and care. Sounds of wind, water, birds and insects. No rubbish, no weeds, no disturbing people.

SPACE – a landscape characteristic offering a restful feeling of "entering another world", a coherent whole, like a beech forest.

WILD – a landscape characteristic offering fascination with wild nature. Plants seem to be self-sown. Lichen- and moss grown rocks, old paths.

PREFACE

My scientific journey started when I defended my Master's thesis on the theme of Rehabilitation Opportunities in Hospital Green Areas based on the case studies of Maarjamõisa (Tartu) and Pärnu hospitals. This interest in healing gardens developed and during the time I participated in the Cost Action E39 "Trees, forests and human health and well-being" I was privileged to meet and cooperate with many of the European experts in nature and health. This spurred me to start a PhD about healing gardens as it was at that time a new concept with environmental psychology tools in landscape architecture in Estonia.

During the first years of my PhD studies, I explored healing gardens in England and the New England region of the USA for to discover what is the different in normal and healing garden, how green liveable material used there, to find out the garden characters. Until my work, there have been published only few healing garden description how garden works and how garden therapy are used and measured. In these places I visited all the healing gardens listed in the database of the Therapeutic Landscapes Network (special gardens created for healing purposes). These gardens were specially designed for their users. I obtained great inspiration from these as well as a wealth of data. After the study visits in 2011, I wrote the book "Healing Gardens" (in Estonian), in which I introduced scientific theories about therapeutic landscapes and healing gardens in order to fill a gap in Estonian awareness (garden can be a healing tool) and knowledge. I started to have lectures about the topic, I was invited to be quest in companies and wrote articles about healing gardens. In Estonia, there are currently three healing gardens today: Metsamõisa sensory garden, therapeutic garden at Pärnu hospital and the garden section of the Tallinn Botanical Garden.

The next step was to broaden the scope of the work and to ask the question "What are the elements in landscape at both the small and larger scale that promote well-being?" I would like to develop tools that are useful for landscape architects who want to identify salutogenic landscapes or to create therapeutic landscapes in the Estonian context. This is my motivation and I hope that through this PhD thesis I will be able to provide a tool for use in different hospital gardens for different treatments and which speed the process of recovery.

1. INTRODUCTION

1.1. Health and green space

Around the world there is increasing interest in understanding the impact of the physical environment (both indoors and outdoors) on people's health and wellbeing. The realization that good design not only generates functional efficiency but also strengthens and improves health processes has given rise to a new branch of architecture, known as Design and Health (Dilani, 2001). More recently there has been an upsurge in interest in understanding the role of the landscape in promoting and supporting health and well-being (Stigsdotter, 2011). This includes a wide range of landscape types, from forests and wild areas through to gardens and cultivated spaces. Parks form an integral part of what is now referred to as urban "green infrastructure" (Benedict and McMahon, 2006) and provide many so-called "ecosystem services" (Wence 2016) of which recreation and health promotion are two within the social ecosystem services category (environmental health). In countries as diverse as the USA, UK, Australia, the Netherlands, Denmark, Finland, Sweden and Japan, major research activities have been taking place as well as efforts to "mainstream" the results of the research into health promoting and health improving policies and processes together with public health bodies and general practitioners (Hancock, 1993). In Estonia there is a long history of therapeutic facilities for various conditions set in forests or parks, especially in Soviet times, where the fresh air, quietness and proximity to nature were considered important aspects of health. However, there is now a resurgence of interest, not least from the tourism sector. The time is now ripe to apply some of the existing evidence and to carry out Estonian-specific research in this field, testing and adapting theories and models in the local context.

Health supportive environments are defined by the WHO as follows: "Our societies are complex and interrelated. Health cannot be separated from other goals. The inextricable links between people and their environment constitutes the basis for a socio-ecological approach to health. The overall guiding principle for the world, nations, regions and communities alike, is the need to encourage reciprocal maintenance - to take care of each other, our communities and our natural environment. The conservation of natural resources throughout the world should be emphasized as a global responsibility." (WHO, 1986).

1.2. Salutogenic landscapes

Salutogenic landscapes are places with certain combinations of characteristics which support our general physical and mental health and wellbeing and can include a range of natural and man-made places. Different frameworks can be used in evaluating health supportive environments. Antonovsky (1979) advanced the concept of salutogenesis as a complement to the concept of pathogenesis – in outdoor environments intended to support health, there is need to consider both risk and salutary factors. Green areas such as gardens, parks, forests and nature, as already noted, can fulfil such functions (Bengtsson and Grahn, 2014).

As well as using existing or planning new landscapes such as forests and parks for health-promoting possibilities, there are also specially designed types of spaces. Healing gardens are designed to offer a specific health-supporting function. The healing garden concept became popular in both research and practice following the 1995 publication "Gardens in Healthcare Facilities", by Clare Cooper Marcus and Marni Barnes. The term "healing garden" often refers to places where people obtain generally passive experiences of (cultivated) nature (Cooper Marcus and Barnes, 1999; Stigsdotter and Grahn, 2002). According to Kaplan, healing gardens can have an impact on two levels: (1) the environment may directly affect the recovery process (e.g. from a disease or operation) and (2) the environment may have an indirect effect on enhancing the quality of care and helping patients feel restored (Kaplan, 1995). Several studies have focused on the role of healing gardens in the recovery process from stress and from chronic depression (eg Adevi and Lieberg, 2011; Adevi and Martensson, 2013; Stigsdotter *et al.,* 2010). Well known examples of such gardens include that located at the campus of the Swedish Agricultural University in Alnarp (Adevi and Martensson, 2013).

In some ways the idea of salutogenic landscapes is not new – a large number of spas, sanatoria and hospitals have historically been located in quiet and picturesque natural settings near water or in the forest (Ottosson, 2007) and modern "wellness tourism" capitalizes on this to offer retreats from the stresses of city life (GSS, 2010). A number of studies have demonstrated that simply looking at everyday nature can be more effective in promoting restoration from stress than views of the artificial urban environment (Cooper Marcus and Barnes, 1999). Outdoor places which offer recreation (or re-creation) possibilities are increasingly popular

and the notion that escaping from urban life to visit nature was recognised as far back as 1901 when the famous conservationist John Muir (one of the fathers of landscape conservation and the National Park movement in the USA) stated: "Thousands of tired, nerve-shaken, over-civilised people are beginning to find that going to the mountains is going home; that wilderness is a necessity; and that mountain parks and reserves are useful not only as fountains of timber and invigorating rivers but as fountains of life." (Muir, 1901). While we may nowadays use more technical terms for "nerve-shaken" this quotation still strikes a chord today.

1.3. Earlier research

Healing gardens have been reviewed before as follows: Views of nature alleviate stress –significant feature in hospital environments (Sherman *et al.,* 2005; Pasha and Shepley, 2013); Evidence based theories which are used in design of healthcare settings (Bengtsson and Grahn, 2014); How nature is used in health care (Hartig and Cooper Marcus 2006). Ulrich found, for example, in an oft-quoted but landmark study, that after gall bladder surgery, patients with a view of nature spent less time in the hospital and needed less pain medicine than people without a nature view (Ulrich, 1984). Office workers with a more natural view assess their own health more positively than people with less natural views (Kaplan, 1993). Danish cancer patients valued outdoor views because they were "a way of connecting with personal life stories" (Timmermann *et al.,* 2013). Nature restores mental functioning in the same way that food and water restore bodies.

What man-made environments take away from us, nature gives back. Forests, streams, rivers, lakes, and oceans demand very little from us, though they are still engaging, ever changing, and attention-grabbing. The Japanese version of natural therapy is shinrin-yoku, or forest bathing, which requires that patients walk for extended periods through forested areas while inhaling woody scents that complement the sylvan atmosphere (Tsunetsugu *et al.,* 2010). Natural environments promote calmness and well-being in part because they expose people to low levels of stress. Studies by Ulrich (1984), Kim (2010), and Cervinka *et al.* (2012) show that time in nature or scenes of nature are associated with a positive mood, and psychological wellbeing, meaningfulness, and vitality. A Cost Action, E39: Forests, Trees and Human Health and Well-being, which ran from

2004-2008 was the first attempt to bring together researchers and their work from all around Europe.

A healthy environment and a good standard of living are the most basic demands of modern societies (Simonic, 2006). Research has demonstrated that people are psychologically, emotionally and spiritually related to the natural environment (Wilson, 1984; Frumkin, 2001). In many city environments around the world there are few parks or green areas and access to nature can be very limited, especially so for people in lower socio-economic classes living in deprived areas (RWJF, 2008). Well-endowed cities contain green infrastructure including urban forests, parks and gardens in many sizes, shapes and qualities to facilitate contact with nature. Wilson's biophilia hypothesis (1984) is central to evaluating the existence of parks as a positive health resource. According to the biophilia hypothesis, human health and wellbeing are based on contact with nature. In his book "Last Child in the Woods", Richard Louv deplored the way the modern children are not allowed out to play freely in nature and he coined the now widely used term "Nature deficit disorder" to draw serious attention to this (Louv, 2008).

Cordell et *et al.* (1998) found that approximately 45% of adult respondents in a US study rated wilderness as "very important" or "extremely important" for spiritual inspiration, and a further 56% stated that just knowing it exists were "very important" or "extremely important." Further evidence for positive effects on health and wellbeing from contact with city nature are found in therapy-based treatments, for example, ecopsychology, wilderness therapy and horticultural therapy.

1.4. Landscape quality

Landscape quality arises from the relationship between the characteristics of the landscape and the effects of these characteristics on individuals (Daniel, 2001). Van den Berg *et al.* (1998) note that earlier studies focused on environmental management, planning, design and the definition of general beauty to shape policies. Examining and describing the visual characteristics of any area in the context of tourism and recreation leads to the view that the most important factor regarding natural environments is visual and/or landscape quality (Clay and Daniel, 2000). This aspect, and the positive feelings for aesthetically attractive landscapes should

not be underestimated. The pleasure gained on experiencing a beautiful garden or the emotional release of a sublime experience of nature can be powerful and contribute to our emotional restoration in times of stress (Bell, 2012). Preferences for different landscapes have been widely studied and deserve continuing attention.

The possibilities and the accumulation of evidence summarised above lead to the need to ensure that Estonia is not left behind and that the benefits now accruing in other countries can also be obtained here. It is, however, not as simple as merely copying what others have done. Many differences exist between Estonia and other countries – climatic, environmental and cultural, for example – and must be taken into account. The rural and urban landscapes differ as a result of many factors but especially the legacy of the Soviet era and the policies and practices of urban planning, housing, green space development and management. The urban landscape is not as well developed in some aspects as in western European cities – housing areas are often sterile and poorly managed. Conversely, cities may be very green in other ways, with many parks and wooded areas – much more so than their western European counterparts, although their management may not be as sophisticated. The amount of nature and wilder landscape and especially forest is the envy of many other countries and the Estonian people are very happy to use them for recreation as well as for berry and mushroom picking.

Traditions die hard and some practices in health care and landscape management could be considered to be outdated and old-fashioned. The experience of visiting healing gardens at hospitals in the UK and the USA raises questions about the Estonian health perspective in relation to the acceptability of nature-based solutions. Now that the Tartu City Government is creating a new research-based working group focused on green space, the health perspective may be one which has reached the right moment to be taken more seriously. When looking at the future of parks in Tartu (or in Tallinn or elsewhere) it will be important to assess them not only in terms of general recreation potential, biodiversity values and suitable maintenance regimes but also as salutogenic landscapes. What characterizes the structure of city parks where people go to relax, to recover from stress or to become energised? What characterizes Estonian preferences for park and forest landscapes as places to visit? These are the main focal points for the research presented in this thesis.

While, up to now, Estonia hospitals have shown little interest in healing gardens, this is starting to change. Sillamäe rehabilitation centre for drug addicts (autumn 2015) and East Tallinn Central Hospital (early 2016) have requested help in establishing healing gardens. Tartu parks are located around the new hospitals and these parks are part of the city green structure and used by many local people. There are many opportunities to enhance their value by connecting them more directly with the hospital administrations and their therapeutic policies and practices but we need to be able to maximise the benefits gained through planning, design and management of the spaces so readily available. For this we need more research and this is provided here.

2. THEORETICAL FRAMEWORK AND REVIEW OF THE LITERATURE

2.1. History of healing gardens

The first description of a healing garden dates back 5000 years ago to The Epic of Gilgamesh from Mesopotamia, but healing gardens have also existed in western culture for thousands of years. Gardens for hospital patients in Europe date back to the 12th century in hospitals and monasteries that ministered to the sick and the insane (Cooper Marcus and Barnes, 1995). Here, in "physic gardens" herbs were grown for medicinal purposes. In the 14th and 15th centuries, cloister gardens began to decline because of periodic plagues, and because of urban growth.

According to Warner (1995), restorative gardens were rediscovered in the 18th century when hygiene became a factor added to the garden design concept. In the 18−19th centuries pavilion style hospitals set in extensive parks were built, where hygiene and fresh air were important qualities thought to help recovery from illnesses (Cooper Marcus and Barnes, 1999). The Romantic movement of the 19th century provided the therapeutic connection between medicine and use of outdoor garden spaces.

The original concept of the healing environment was developed by Florence Nightingale whose theory called for nurses to manipulate the environment to be therapeutic (Nightingale, 1859). Nightingale outlined in detail the requirements of the "sick room" to minimize suffering and optimize the capacity of a patient to recover, including quiet, warmth, clean air, light and good diet. At the time, hospitals were located on the periphery of towns with views of green areas, away from pollution and noise. In psychiatric hospitals for mentally disabled and mentally ill patients, horticulture therapy programmes were started (Nightingale, 1859).

In the 20th century, gardens disappeared, balconies and roofs were abandoned, and hospital grounds became dominated by entrance ways, tennis courts and car parks (Cooper Marcus and Barnes, 1995). However, in recent years, gardens have been rediscovered and healing gardens have started to appear, especially in the UK and the USA, as a result of work by pioneers such as Cooper Marcus.

2.2. City parks

Throughout western history, the notion that green areas may help promote the health of city-dwellers has existed. During industrialization in the 18th and 19th centuries, city planners tried to improve health by offering better sanitation and housing and by incorporating more sunlight and fresh air. In part this was a result of the prevailing theories that diseases were spread by bad air and "miasmas", until the germ theory of medicine was established (The History…, 1888).

The first city parks were in fact former hunting forests or parks (the term park originated as an enclosed territory for deer) originally owned by the crown or aristocrats and opened to the public. The first purpose designed park was Sefton Park in Liverpool designed by Joseph Paxton, expressly for the purpose of providing a place with an attractive landscape and paths for exercise, fresh air and other amenities (Pollard *et al.,* 2006). Other famous parks followed, such as Central Park in New York and the Boston park system, also designed for health-promoting behaviour and many others, designed by Frederick Law Olmsted. Thus, the prevailing theories of the time, which have evolved since then, focused on parks as places for recreation, exercise and fresh air, as salutogenic landscapes.

2.3. Nature and health

Recent interest in the links between nature and health has already been summarised in the introduction, as have some of the earlier trends. The relationship between aspects of the built environment and health in part emerged back in the 1970s with research indicating that the newly built high-rise housing, following the influential ideas of the architect Le Corbusier, who advocated tower blocks set in extensive natural parks - as complete self-contained "machines for living" and "unité d'habitation" (Knox, 2011) - was associated with behavioural problems (Gillis, 1974; Richman, 1977) and many negative social conditions which were not foreseen by the architects and planners.

A substantial body of scientific research has now demonstrated that environmental factors, especially those in the living environment, can affect our emotional wellbeing, psychological system and health status (Ulrich, 1999). The calming effect of nature and the ease of interpretation of the natural environment were advanced by Knopf (1987). He proposed

the theory that in nature people use natural behaviour, resources and problem solving everyday solutions; that a natural environment is neutral, free from stimuli that require constant concentration and does not give positive feedback (in the sense of reinforcing stress); that a natural environment allows a person to express themselves freely and increases personal control.

Coley *et al.* (1997) found that the presence of trees and vegetation in outdoor public spaces was associated with greater use of these spaces by both young and adult residents and concluded that naturalistic landscape design promotes opportunities for social interaction. Bringing vegetation into the city environment can have a positive influence on the psychological reactions of people (Honeyman, 1990; Vroom, 1994; Stigsdotter and Grahn 2011).

More recently, as well as the psychological benefits of nature on health and the self-reported evidence from surveys, there is evidence that physiological mechanisms are also at play. For example, recent research from the UK has demonstrated that salivary cortisol (a stress hormone) tends to decline after a person spends time in eg. a forest but increases when the same person spends time in an urban area (Thompson *et al.,* 2012). Other research from Japan suggests complex mechanisms are involved in causing immunosuppression as a result of stress which exposure to natural environments helps to counter (Li, 2008).

2.4. Landscape preferences and links to health and well-being

The link between landscape and health includes aspects of perception and preference for different kinds of views and particular aesthetic qualities. A valuable overview of the various theories which try to explain our environmental preferences has been presented by Hartig *et al.* (2010) and include Fromm's biophilia hypothesis, Orian's savannah theory, Appleton's prospect and refuge theory and Gibson's (1977) ecological theory of environmental perception along with his theory of affordances. Owing to the human reliance on sight as the primary sensory system (Bell, 2012) visual preference for landscape and scenery as part of the informational system has dominated the discourse, although more recently attention has been given to the other senses.

Many studies have been conducted on landscape preferences, typically

using techniques such as Likert scales to rate photographs of different scenes, landscape elements, forest types and so on, for example using the tried and tested Scenic Beauty Estimation Method (Daniel and Boster, 1976). Although the results of these surveys are not conclusive, there has been a trend for natural scenes to be rated generally more highly and consistently across populations and cultures, whereas urban or more man-made scenes are typically much less statistically predictable. Complex views are generally preferred over simple ones (Ludlow, 1976) and natural scenes sustain attention and interest much more effectively than urban views (Ulrich, 1986). Thus, in line with some of the theories mentioned above, a person may have an evolutionary and aesthetic preference for the natural environment (Kjellgren and Buhrkall, 2010). Natural and open settings seem to be preferred for passive activities and natural/enclosed ones for active activities, suggesting that behaviour preferences are linked to setting preferences (Barnhart *et al.,* 1998).

Information processing models offer another way of understanding preference. The Environmental Preference Matrix (EPM) composed of the four interacting dimensions of Coherence, Complexity, Legibility and Mystery has been proposed by Kaplan and Kaplan (1982; 1989) is an example of an approach based on information processing – by seeking and responding to the information contained in a scene or landscape. Naturalness has been regarded as a particularly powerful factor in preference (Kaplan *et al.,* 1972; Purcell and Lamb, 1984; Lamb and Purcell, 1990).The key link between environmental (or landscape) preference and health and well-being arises from the logical reasoning that, if our ancestors used information from the environment to increase their chances of survival in a hostile world, there are sufficient of these tendencies to guide us towards places which offer restoration opportunities (Hartig *et al.,* 2010).

According to Hartig *et al.* (2010) we each diminish a range of resources when we are meeting the demands of daily life and the processes of rebuilding or recovering these is termed "restoration". These resources can be physiological, psychological or social. A possible need for restoration may occur frequently or regularly and after restoration new demands will tend to deplete our resources once more. Natural environments, as places where we can escape the factors which deplete our resources (owing in part to the avoidance of stressful over-stimulation) are postulated as places where restoration can occur efficiently and effectively. However, if we cannot reach natural areas the next best thing might be well-designed

parks and enclosed gardens where some of the negative stimuli, especially visual and potentially auditory can be screened or blocked out. So, the daily environment could be restorative (Hauru *et al.,* 2012) under some circumstances.

Stephen and Rachel Kaplan's attention restoration theory (Kaplan and Kaplan 1989; Kaplan 1995) is also about restoration, this time from attentional fatigue. It is based on the idea that in order to focus on something uninteresting, an individual must suppress other stimuli that are more interesting and compete with the need to focus on the boring. This requires effort and, if prolonged or intensive, the ability to suppress competing stimuli will cause fatigue. There are different types of attention: directed attention, effortless attention and restored attention.

Directed attention means that people must concentrate on the task, avoiding distractions and the task also requires other knowledge and skills. People begin to suffer "directed attention fatigue", after some time being in directed attention. Then they become less effective in tasks, become distracted and irritable. Relaxation can begin once there is a connection to the environment. Attention restoration theory components are Compatibility, Coherence, Being Away, and Fascination. For providing a restorative effect there should be Extent (in order to feel immersed in the environment), Being away (providing an escape from daily activities), Soft fascination (environmental aspects that capture attention effortlessly) and Compatibility in the landscape, where soft fascination plays the key role. To reinforce this, we can also refer to the Supporting Environment Theory (Grahn *et al.,* 2010). According to this, humans have developed in a social, cultural and physical environment, and that physical environment, for most of human history has been nature. The theory states that people need supportive environments for developing physically and psychologically. Such an environment has to be comprehensible, accessible and secure and offers possibilities to restore the function of the individual, parallel to that of healing. The more mentally weak an individual is, the more they need to support from the environment.

Searles conception of nature as a link between the conscious and the subconscious has a special relevance in connection with unconscious scanning and soft fascination: contact with nature can contribute substantially to peoples' recovery from critical situations of various kinds. Signals from nature spark creative processes that are important in the rehabilitation

process. This, and being able to master these relationships, says Searles (1960), helps to reduce anxiety and pain, restore our sense of self, improve our perceptions of reality and promote tolerance and understanding. Our relations to other people are the most complex, while the simplest ones occur with inanimate objects, e.g., stones, while plants and animals remain somewhere in between. Signals from nature spark creative processes that can be important in rehabilitation processes, for example of people recovering from stress or depression. According to this theory there is a need for human beings to revert to simple relations in the rehabilitation process, because complicated relations are too difficult to handle (Searles, 1960).

Tyson (1998) studied the main aspects of landscapes at the garden scale. She claims that there are four aspects of landscape that influence users the most: trees/plants – 69% (trees, flowers, colors, seasonality), the psychological aspect – 50% (peace/openness), senses – 26% (animals, wind, fresh air) and visual values – 17% (design, views, elements).

To sum up the theoretical basis so far, there is a link between the human state and the environment or landscape, which may have evolutionary roots. We seem to prefer landscapes which offer certain qualities and these are often natural types. Living in the modern urban world requires concentrated attention which is exhausting and can lead to stress. Stress can in turn lead to other health problems. By creating conditions for engaging with nature or nature-like places we can offer opportunities for people to recover from attention-fatigue, stress and other psychological problems. The big question then is: what kind of landscapes are best suited to providing these benefits and how can we plan and design them to be most effective?

As we have seen, salutogenic landscapes include natural areas (where the lack of design is a feature, although there is a wide diversity of types of natural landscape), designed parks and gardens and more specific healing gardens. These latter are designed with particular therapeutic purposes in mind which go beyond the reduction of "everyday" stress. In the next section the research evidence for the necessary landscape characteristics of salutogenic parks and healing gardens is reviewed.

2.5. Characteristics of salutogenic landscapes

One of the key links which gives a landscape its salutogenic properties is its character and quality. This is true for landscapes in general but becomes particularly crucial for healing gardens which are designed with specific therapeutic functions (Berggren-Bärring and Grahn, 1995; Stigsdotter and Grahn, 2002). The definition and specification of landscape characteristics came into focus in the late 20th century and have been developed for over 30 years by different people trying a variety of concepts. Table 1 summarises these, starting with Tinsley and Johnson (1984), Grahn and Sorte (1985) and lastly Tyrväinen *et al.* (2007). Previously, landscape characteristics were referred to as environmental characteristics (EC). Tinsley and Johnson (1984) made a significant attempt to classify (these) environmental characteristics (Table 2) and some of their terms survive into the more recent classifications (see below).

Table 1. Development of concepts for classifying landscape characteristics over time

Theory developers from EC to LC	**Classifications of characteristics of nature**	**Comments**
Tinsley and Johnson (1984)	Peoples action and landscape character description.	See table 2
Grahn and Sorte (1985)	Dense green-space networks. Years later, they mapped different types of parks according to their quality, characteristics and possible activities.	Park quality and their green room characteristic connections.
Beggren-Bärring and Grahn in 1995	Different green areas and used GIS. Different statistical analysis for inference. The work centered on organizations, schools, kindergartens.	For current work LC, the third generation of LC went to PSD and it does not deal with evaluation the landscape.
Tyrväinen *et al.* (2007)	Beautiful landscape, valuable nature site, forest feeling, space and freedom, attractive park, peace and tranquillity, opportunities for activities, history and culture, unpleasantness, scariness, noisiness.	Because a lot of other data on the urban green space was available in the same GIS format, it became possible to compare and relate the results of this study with the actual landscape, vegetation and forest characteristics recorded, as well as with management classes for the various areas used by the Helsinki Green Area Division.

Table 2. Description of environmental characteristics (based on Tinsley and Johnson, 1984).

Character	Activity	Landscape description
Wilderness	Scouting, hiking, nature excursion	National nature character
Rich variety of species	Nature and species studies, collecting objects	National nature character, meadow, pasture, grove
Forest	Physical culture and cross country running, exercise walking	Nature sports park, city woodland, activities with animals, play equipment, national nature character
Play inspiring	Apparatus play, activities with animals, building, growing	Activities with animals, national village tradition, art and culture, park with ponds, water and amusement
Sports orientated	Arena sports, games for fun	Nature sports park, municipal sports park, with flowers, cafeteria, art and culture, play equipment
Peaceful	Garden studies, movement play, games for fun	Art and culture, activities with animals
Festive	Socializing, for pleasure and togetherness	Park with ponds, water and amusement, modern park for youth, activities with animals
Square	Architecture studies, cultural studies, garden studies	Modern park for youth, art and culture

Grahn and Sorte (1985) created a schema based on a distinction between robust parks with two sub-types: nature and activity parks, and fine parks, also with two sub-types: peaceful and intensive. Figure 1 shows the structure of their scheme. The characteristics of nature parks are wilderness, rich variety of species and forests. Activity parks have two main types – play inspiring and sport orientated. Intensive parks are divided to festive parks and squares, while peaceful parks have no subdivisions.

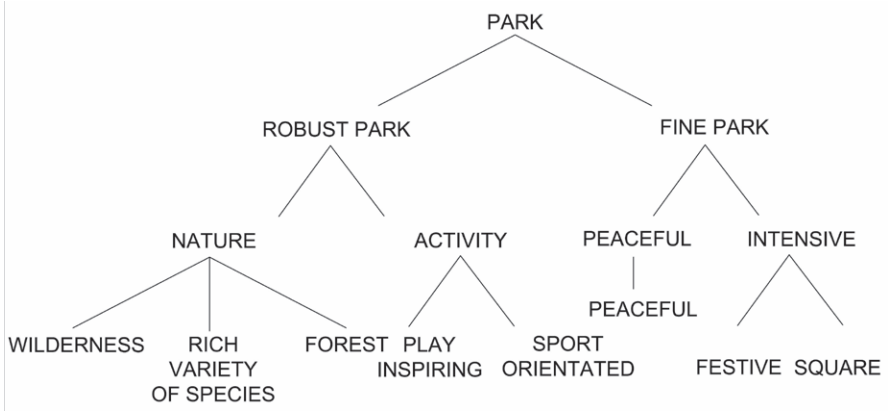


Figure 1. Schema classifying environmental characteristics of green areas (according to Grahn and Sorte 1985, source: the author)

Grahn and Sorte (1985) claimed the importance of assessment and evaluation of green spaces before further designing or redesigning spaces or developing the rural landscape. They found that nature-style parks were generally the most popular in general and that in urban areas there was a need for denser green space networks to avoid long distances between residential areas and parks, to ensure easy access by users. They also mapped different types of parks according to the quality, characteristics they defined and the possible activities which could take place there and from this they were able to claim that people were attracted to places with different characteristics depending on their well-being and state of mind (Grahn and Sorte, 1985).

The second generation development of landscape characteristic was presented by Beggren-Bärring and Grahn in 1995 (Table 3). This was refined as a result of research where they asked survey respondents to evaluate different green areas. They used a Geographic Information System (GIS) and different statistical tools to look at the relationships between the survey responses in terms of well-being and the landscape characteristics they preferred. This work centred on different organizations, e.g., schools and kindergartens, and their outdoor areas.

Table 3. Second generation descriptions of landscape characteristics (Berggren-Bärring and Grahn, 1995)

Old name	New name	Description
1. Serene	Serene	Peace, silence and care. Sounds of wind, water, birds and insects. No rubbish, no weeds, no disturbing people.
2. Wild	Wild	Fascination with wild nature. Plants seem to be self-sown. Lichen- and moss grown rocks, old paths.
3. Rich in Species	Rich in Species	A room offering a variety of species or animals and plants.
4. Space	Space	A room offering a restful feeling of "entering another world", a coherent whole, like a beech forest.
5. The Common	Prospect	A green, open place admitting of vistas and stay.
6. The pleasure garden	Refuge	An enclosed, safe and secluded place, where you can relax and be yourself and also experiment and play.
7. Festive	Festive	A meeting place for festivity and pleasure.
8. Culture	Social	A historical place offering fascination with the course of time.

Grahn and Stigsdotter (2010) subsequently developed the third generation by adopting the Perceived Sensory Dimension (PSD). Landscape characteristics and the PSD are both similar, being tools to evaluate the content and structure of green areas for planning and design (Skärbäck, 2007).

There are smaller physical and often enclosed spaces within parks and gardens that are able to be experienced on more human scale and in which people can spend time. These are termed "rooms". According to Grahn and Stigsdotter's work each room should be designed to contain a single landscape characteristic and a number of them can be arranged to be experienced in a specific sequence. However, spaces in general, for example, within a park, can be treated conceptually as rooms in similar fashion to the more specifically designed ones in healing gardens.

To complement the work on landscape characteristics Grahn developed the activity triangle, which refers to the interaction of people in green areas – from inward-directed to outward directed engagement. According to Grahn (1991), followed by Bengtson and Grahn (2014), the engagement levels are also related to a gradient of low wellbeing to high wellbeing (Figure 2) based on the landscape characteristics.

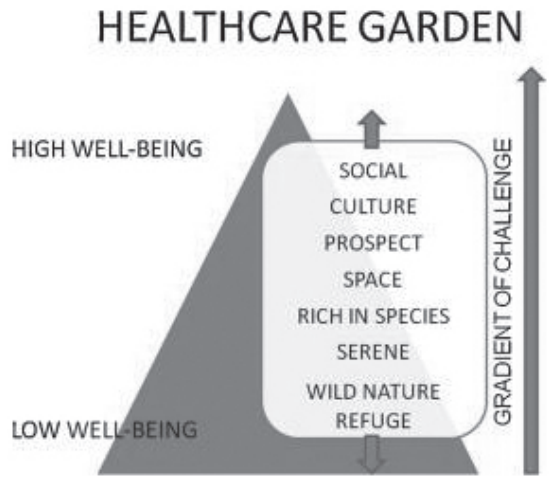


Figure 2. Relationship between wellbeing and Perceived Sensory Dimension (aka landscape characteristics) (taken from Grahn *et al.,* 2010).

In the current field of study, these landscape characteristics have become established as the main tool for designing healing gardens.

2.6. Perceived Restorativeness Scale

Perceived restorative scale is a measuring tool for ART components. In Kaplan theory the four components of environmental preferences and attention to the factors conducive to recovery (being away, fascinating, extent and compatibility) are the components what are used in creating the PRS. The current tool have been a measurable tool in many specialities and have been operationalized in many ways. I think the tool is also good for environmental measurements. The classifications of tool questions are very specific, but as a greenery evaluation tool it is useful in any scale. The Perceived Restorativeness Scale was derived from Attention Restoration Theory (Kaplan, 1995). It was initially made up of 26 items aimed to measure an individual's perception of four restorative factors. Restoration can proceed when all factors, Being away, Extent, Fascination and Compatibility characterize the person–environment interaction by influencing the relationship in a positive way (Kaplan and Kaplan, 1989).

Being away, involves getting psychological and possibly geographical distance from one's usual context, including the work one ordinarily does and the pursuit of particular goals and purposes. Attention is engaged

effortlessly by an interesting environmental context. It provides a basis of functioning that does not require inhibitory effort. The seaside, the mountains, lakes and streams, forests and meadows are idyllic places for getting away.

Fascination (effortless attention) can be engaged by attributes of the environment, such as water, or by the process of exploring and making sense of an environment. Fascination, according to William James (1890), entails effortless attention toward a space given by a person. Nature is certainly well endowed with objects of Fascination and offers many processes that people find engrossing. Thus, restorative experiences can draw on a great variety of circumstances, as long as there is sufficient space to keep one absorbed.

Extent refers to the possibility for immersion in a coherent physical or conceptual environment that is of sufficient scope to sustain exploration and interpretation. Extent is attributed to Coherence in experience of environment.

Compatibility refers to a match between personal inclinations and purposes, environmental support for intended activities and environmental constraints on action (Kaplan, 1983). It is a motivational context regarding the correspondence between what people want to do, must do and can do in the environment. Compatibility is the notion of a good fit between demands and purposes (Kaplan, 1995; Laumann *et al.,* 2001); it is a special resonance between the natural setting and human inclinations. People often approach natural areas with the purposes that these areas fulfil already goals in mind, thus increasing Compatibility.

Many studies have used the PRS (eg. Hartig *et al.,* 1996; Hartig, 2001; Korpela *et al.,* 2001; Laumann *et al.,* 2001; Berto, 2005; Tenngart *et al.,* 2008; Nordh *et al.,* 2009a). Although recovery can occur when only one component is present, ART suggests that recovery is greatly enhanced in environments that include all four (Bagot, 2004).

2.7. Bringing together the theoretical models

If we take all the main theories as summarised so far in this Chapter it is possible to see that they can be connected to form a super-model. This connection starts from the point of seeking the differences in experience and characteristics of natural areas, parks and gardens from a salutogenic and therapeutic point of view. For example, has a forest the same properties and can it be read in the same way as a park? Can a park be read like a garden? Can a "normal" garden be read like a healing garden (or vice versa)? When we look at the various properties and landscape characteristics we can see many similarities and it is this structure which forms the basis for the research presented in this thesis (see Figure 3)

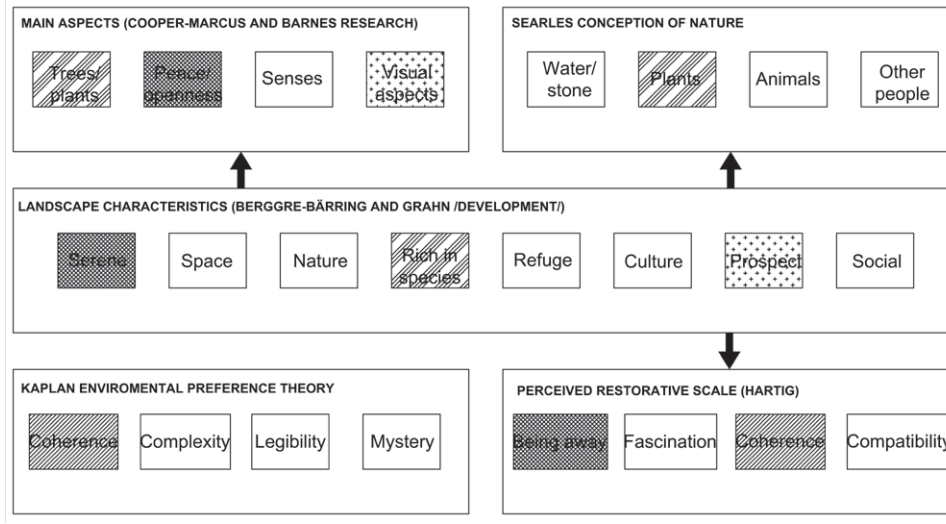


Figure 3. Structure of the connections between the main theories related to salutogenic landscapes.

3. AIMS AND OBJECTIVES

The aim of this thesis is to examine the salutogenic properties of landscapes at different scalar levels – constituent elements, in any kind of green rooms, the spatial and compositional aspects of urban parks as a whole up to the wider natural environment such as forests. It would seem, from the literature review above, that it should be possible to connect the theories and their associated rating scales used to test different landscapes in terms of their salutogenic and/or therapeutic potential, and to be able to maximise the health-promoting properties of the landscape in the future. In a country like Estonia, with a wide range of landscapes and close physical distances between different types there is good potential to test this as well as to explore the possibilities to enhance the role of healing gardens and landscapes. Figure 4 shows the ways in which we can make these connections.

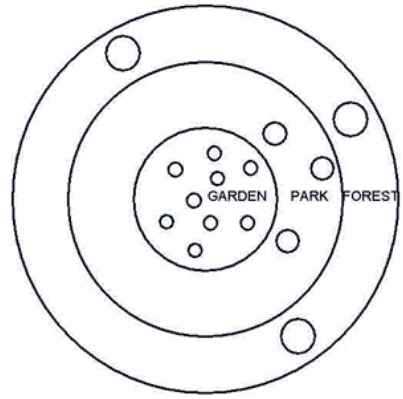


Figure 4. Landscape scales related to the potentials for connecting salutogenic and therapeutic landscapes.

It is possible to be in the environment in a "personal" or "impersonal" way and landscape characteristics will influence a person's self-perceived health status as they move from green room to green room in a garden or when walking through a park or forest. Personal or non-personal experience is considered here to mean active or non-active use of an area. For example, hearing, seeing and smelling are non-personal experiences. Personal experiences mean those gained by physical connections such as touching and tasting. It is a strong statement to say that experiencing a pleasurable view is not personal: this is the case on seeing a more distant

vista from a viewpoint but in the case of Estonia it is much more likely that the person is within the landscape – the garden, park or, especially, the forest and has to engage with it to get the experience (see Berleant, 1992 for discussions on the "aesthetics of engagement"). The degree of intimacy and the scale of the space also have an effect, so that gardens influence people more than parks because of the size of the human scale and most people prefer views in forests that look like "romantic, well organized park views" (Hansson *et al.,* 2012).

The overall goal of the research is to develop a tool for landscape architects to use in order to maximise the salutogenic and health promoting properties of any landscape based on the analysis of its landscape/environmental characteristics. Is it possible to find the landscape characteristics described in the literature review in Estonian parks? Are there therapeutic views in the landscape? Does the Estonian landscape offer different possibilities from others? In the future, if garden therapy is promoted and prescribed by doctors, could there be a market for a less-expensive version in Estonia where nature is so abundant? Do park environments have sufficient qualities to provide therapeutic benefits? If not, how can we improve this through planning, design and management? These are big questions but for any to be answered we need to know that there are robust, reliable and repeatable tools available. The ones which so far fit the bill are those reviewed above.

The more focused goal of the work is therefore to test theories and tools for use by landscape architects which predict the degree to which green areas can positively influence people's well-being and to use them later, if successful, as landscape architecture tools at different scales.

The main hypotheses of the study are:

- The appearance of the landscape characteristics of Serene, Rich in species, Festive, Space, Culture, Pleasure garden, Wild and the Common (Berggren-Bärring and Grahn, 1995) can be used to describe the healing potential of any kind of "green room" whether found in healing gardens, urban parks or forests.

- The visual preferences of people have an impact on the use of and the salutogenic properties of natural landscapes such as forests.

The thesis, since it is constructed from several articles, has a number of discrete objectives which are summarised as:

To analyse a sample of healing gardens (from the UK and USA) on the basis of eight characteristics that, according to the literature, should be present in a garden for it to be classified as a healing garden and that may also be considered some of the fundamental building blocks of parks and gardens in general (Article 1).

To test how parks are influenced by landscape elements, using the case study of Tartu (Article 2).

To assess the perceived restorativeness of city parks and urban green spaces, using the case study of Tartu (Article 3).

To test the Kaplan model (Kaplan and Kaplan, 1989) for landscape preferences under Estonian conditions in Estonian forests (Article 4).

4. MATERIAL AND METHODS

4.1. Concept of research

Following on from the synthesis of the theories presented in the summary section of the literature review and in order to meet the research objectives and answer the research questions within each of the contributory articles, an overarching conceptual model has been developed. Figure 5 shows how the synthetic model has been applied at each scale and in which article while Figure 6 shows which tool is tested in which article. These diagrams show the connections among and between the different articles constituting the thesis.

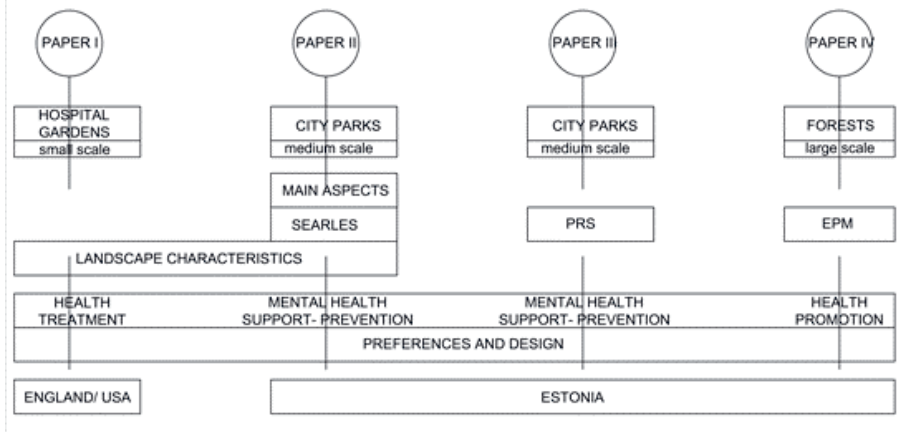


Figure 5. Relationship of the scalar levels, theoretical models, evaluation tools and research focus for all the papers forming the thesis.

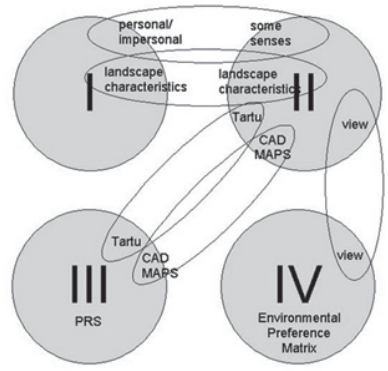


Figure 6. The relationship of the different methods used in each contributing study.

4.2. Study locations

The research took place in three main locations as follows:

Healing gardens. A sample of healing gardens in hospitals in England (UK) and New England (USA) were visited and assessed at the garden scale as reported in Article 1. These were all of the healing gardens listed in the database of the Therapeutic Landscapes Network

Tartu parks. All the parks of Tartu formed the sample for the assessments carried out for Articles 2 and 3.

Estonian forest views. A sample of photographs taken in a range of Estonian forests was assembled for the research presented in Article 4

4.3. Data collection

In each case, for each element of the research, the main assessments (with the exception of the preferences in Article 4) were carried out by experts. The experts were landscape architects who have been in an environmental psychology course, where the method was practiced many times. The prepared tables about evaluated theories were read out loud, and all answers about landscapes were agreed upon by the assessment evaluators. Each situation was particular because there were too many aspects to measure at any given scale. In Article 4 the initial assessment of the characteristics was carried out by experts, after which the preferences were assessed by members of the public.

Healing gardens. A total of 40 healing gardens were visited to analyse representativeness of landscape characteristics, 20 (17 hospitals) in England (summer 2005; see Appendix 1) and 20 (18 hospitals) from the New England area in the USA (summer 2006). In the USA, sampling sites were chosen out of 126 healing gardens, the highest concentration of which was in New England. Garden types (e.g., specifically for Alzheimer patients, rehabilitation or child treatment) were not differentiated because sample sizes were too small for separate statistical analysis.

The study of healing gardens required the gardens to be divided into physical "rooms". Each room was evaluated with respect to the degree of presence of the thematic landscape characteristics defined by Berggren-

Bärring and Grahn (1995): "Serene", "Wild", "Rich in Species", "Space", "The Common", "The Pleasure Garden", "Festive" and "Culture" using a four-point scale (0 – not present, 1- weak presence, 2 – medium presence, 3 – strong presence), for exploring how to read healing landscapes through landscape characteristics. Landscape reading (Spirn, 1998) was based on the collection of information about landscapes by experts.

Tartu city parks. 92 green spaces were evaluated in the following locations: 24 urban green spaces (UGS) in the city centre, 11 in Tähtvere, 8 in Ihaste and Annelinn, 7 in Raadi-Kruusamäe, Karlova and Ülejõe, 6 in the Maarjamõisa neighbourhood, 4 in Tammelinn, 3 in Jaamamõisa, 2 in Ropka and the Ropka Industrial District and 1 in Veeriku, Vaksali and Supilinn.

The parks were assessed using a landscape characteristic evaluation tool with a 4-point scale (0-3) and the PRS by three experts walking through each area. The group of three visited all parks together over a four days period, spending approximately 15 minutes (deemed enough time for small parks) in each park or UGS. The evaluation was based on the overall impression of the whole park/UGS. The group measured the four PRS characteristics of each UGS on a four-point scale, where 0 means 'no, does not exist'; 1 'weak existence', 2 'medium existence', 3 'strong existence'. The main aspects of landscape elements were recorded as rough percentages. Searle's elements like stone/water, plants, animals and other people were recorded in affirmative/negative answers (in prepared tables).

Forest views. Based on the Kaplan matrix of psychological environmental preference (EPM), pictures of 27 Estonian natural forest views were compiled out of an archive of approximately 2000 nature photographs belonging to an environmental expert with an ecological background. The photos were selected by an expert group to represent the "green" season, i.e., late spring to early autumn, to focus on the main recreational season in Estonia and to contain a range of different typical stand structures of Estonian forests. The test group comprised 97 18–28-year-old students. Forest view preferences were assessed using a questionnaire with typical questions derived from previous studies, to enable comparison. Answers were requested on a 5-point Likert scale ranging from 1 (not at all) to 5 (very much).

4.4. Descriptive and map analyses

Healing gardens. Landscape characteristic descriptions were based on those of by Berggre-Bärring and Grahn 1995. Small garden maps were drawn to identify the green rooms with specific characteristics (Serene, Wild, Rich in species, Space, the Common, The Pleasure garden, Festive and Culture).

Tartu city parks. The version of PRS used in this study was based on Hartig *et al.* (1997a), which uses the following four subscales: five items in the subscale Being Away; eight items in Fascination; four items in Extent; and nine items in Compatibility

The map of each park was coloured with positive results using a 1-3 scale after the visit. Topic maps were created using layers for each topic. The assessment scale was transformed to a three tones (0 – was not used), light – low presence (1); medium – medium presence (2); dark – strong presence (3). Green space codes were marked in capital letters on the map.

Forest views. Based on the Kaplan preference matrix several experts assessed each photograph on a scale for coherence, complexity, legibility and mystery. Respondents were asked to rate them according to preference, degree of naturalness, coherence, complexity, mystery, familiarity, the most liked objects and least liked objects.

4.5. Statistical methods

The main statistical tools used for analysis each of the studies are shown in table 4.

Healing gardens. Statistical methods used in all studies are shown in table 4. Porcent analyse, T-tests and Pearson correlations were used to seek for relationships among the variables tested. The 0-3 scale was originally used by Stigsdotter and tested using students.

Park study used descriptive statistics such as frequency analyses and Pearson correlations were used (SPSS 2.0.) as above. Information about green areas was coded in tables and in the same manner on a digital map (e.g., A, AV and CD.) (Appendix 4). Codes under columns follow the assessment scale (0-3) for questions answered as affirmative, 1 – yes, or

negative, 0 – no, or positive. Descriptive table analyses, e.g., ratio analysis and Pearson's linear correlation were used.

Forest study. The predictive ability of coherence, complexity and mystery on preference was tested using linear regression, and their combined effectiveness was indicated using R^2. A Z-test was used to evaluate the similarity between test and expert group responses with respect to the variables. This enabled comparing the value for each variable in each view between the test and expert group assessments. The data analysis was performed in SPSS 16.0 and MS Excel.

Table 4. Main statistical methods of the case studies.

nr	Name of article	Aims of the study	%-analysis	correlations (Pierson)	Regression analyse	student t-test	Relability measure (Cronbach alpha)	R2	Z - test
1	An evaluation of the design of room characteristics of a sample of healing gardens	To analyse representativeness of landscape characteristics according to Grahnand Ottoson (1995) in healing gardens in UK and New England, USA (paper I). To explore a new method how to read the healing gardens through landscape characteristics (LC).	YES	YES	-	YES	-	-	-
2	Landscape characteristics in Tartu City Parks - User Influences through Design	To determine the recreational and healing potential of Tartu parks (paper II). To study emotionally important room connections through PRS elements and Searle's communicative park elements in Tartu city parks (paper II and III).	YES	YES	-	-	-	-	-
3	Perceived restoration scale method turned into (used as the) evaluation tool for parks and open greenspaces, using Tartu city parks as an example.	Aim is to assess the PRS of Tartu City Parks and UGS in order to answer to following questions: 1.To find statistically high quality correlation descriptions about Tartu city parks with example of parks and find the areas in CAD MAP 2. To find few example high score restoration features in Tartu and descriptions through evaluation items.	-	YES	-	-	-	-	-
4	A preliminary assessment of preferences for Estonian natural forest	To test preferences for Estonian natural forest landscapes and describes them through predictive model of Kaplan Environment Preference Matrix (paper IV). The main question is "Does the Kaplan model enable landscape preferences to be predicted in relation to the specific foreststs and structures and their combinations found in natural Estonian forests"	-	-	YES	-	YES	YES	YES
5	Comments			p<0.01; p<0.05	linear	-	-	-	-

5. RESULTS

5.1. Landscape characteristics in healing gardens

In this section a sample of the results obtained (and described in greater detail in each contributing paper) are presented. As this is a summary, the reader is directed to look at each paper for the full set of results.

Objective 1: To analyse a sample of healing gardens on the basis of eight characteristics that, according to the literature, should be present in a garden for it to be classified as a healing garden and that may also be considered some of the fundamental building blocks of parks and gardens in general.

This study revealed that the Berggre-Bärring and Grahn (1995) landscape characteristic dimensions can be successfully used in describing healing gardens. Hospital gardens fell mostly under the Rich in species and The Common categories. Pleasure gardens were hard to find among the sample. However, incomplete or overall descriptions influence these results. A personal or impersonal characteristic (Figure 7) gives insight into the emotions of the garden user. Personal landscape characters influence user more than others, because they use touch and taste. Here the landscape characteristics are applied as in the original theory. There were some gardens where all landscape characteristics could be found and some with only a few. Serene was strongly represented in most of the gardens.

PERSONAL	IMPERSONAL
Wild	Serene
Rich in species	Space
Pleasure garden	Common
	Festive
	Culture

Figure 7. Personal and impersonal landscape characteristics found in healing gardens.

In England, the healing gardens sampled are designed with strong constructed views, a sense of cohesion and use of natural voices, with non-disturbing factors used to include calm. Healing gardens in England were

represented by Serene, Rich in Species and Wild, and Space and Common were inter-correlated ($r=0.8$, $p<0.05$). On the basis of the evaluation results, the strongest scores were: "Serene" – 55%, "Rich in Species" – 30% and "Wild" – 25%. There is a tendency for country gardens to be nature oriented in their design and to have more opportunities for personal contact. The "Pleasure Garden" and "Wild" were only found in 25% of the cases. Other characteristics are found to a lower degree. The two themes "Space" and "The Common" were strongly correlated ($r=0.8$, $p<0.05$), indicating that they are frequently found together in gardens. This could be accounted for by the use of the typical approaches to English garden design.

In the USA, the same characteristics tended to have lower scores than in England. High scores tended to be associated with impersonal characteristics like "Serene" – 55% and "the Common" – 25%. While other characteristics were almost equally represented at a low level in England, by contrast the gardens of the American sample show a low and middle level of presence (average of 40%). Cohesive characteristics are associated strongly with "Festivity" and "the Pleasure garden" – in both cases the correlation was ($r=0.9$, $p<0.05$). there are fewer personal characteristics to be found in the landscape than impersonal ones.

5.2. Landscape characteristics and landscape elements in parks

Objective 2: To test how parks are influenced by landscape elements.

Tartu city parks were found to be predominantly Rich in species (plant species and animals), more that 50%. It was found that the following landscape characteristic – Wild (perimeter vegetation), Rich in species (half of the vegetation, in south-west vegetation) and Space (perimeter vegetation), and their combinations resembles forests (Table 5) and have certain views. Serene, Prospect, Festive and Culture were also found, special square shaped places in mid-town. There were two areas within the Tartu park context in which Rich in Species was linked to flowerbeds or scented bushes. Special places characterized by Refuge gave users an opportunity to let their children play and be themselves. Festive was very rare and resembled an outdoor ball-room. Culture was usually close to ruins, old monuments or museums and resembled a tenuous tree view. Altogether, 736 characters were evaluated in Tartu (which could be present simultaneously in a room), and there were 0 (none existence) – 267

rooms, 1 (low presence) – 312, 2 (middle existence)– 128 and 3 (high presence)– 29 rooms.

Table 5. Division of landscape characteristics for Tartu City Parks.

Landscape characteristics/ evaluation scale	**0 – no presence**	**1 – low presence**	**2 – medium presence**	**3 – high presence**
Serene	26	49	17	-
Wild	22	46	14	10
Rich in Species	7	47	34	4
Space	16	52	21	3
The Common	17	49	23	4
The Pleasure Garden	48	33	10	1
Festive	66	18	3	4
Culture	62	20	7	3

In terms of communicative elements of parks, the connection between person and water/stone was represented in 55% of the cases (especially Ülejõe and Vaksali). Plants were growing in 99% of the cases. Animals were found 64% (Veeriku, Vaksali, Supilinn).

It emerged that design was correlated to senses ($r=0.501$, $p<0.01$).

Senses/peace and openness were correlated ($r=0.412$, $p<0.01$). The main aspects provide a variety of senses and different types of visual experiences – mostly various constructed views in the case of Tartu.

Objective 3: To assess the perceived restorativeness of Tartu City Parks and urban green spaces.

The PRS tool describes the environment through distance, attention, environmental context and through the activities people engage in. All, or at least three, of the PRS subscales were strongly represented, i.e., there were high scores in PRS assessments and examples of strong correlations.

One green room description emerged from question to question in correlation results between Fascination 'My attention is drawn to many interesting things' correlated with Being away 'Being here is like an escape' ($r=0.689$, $p<0.05$). Where we can find it in parks is marked on maps,

coded as follows: BS, AÜ, AK, CL, CP, CO, O, CN, AR, BÕ (Appendix 4).

The park on Toome Hill (quality area) comprised large areas that are, for the sake of perception and comprehension, represented separately on the map (Appendix 4) to decrease the impact of negative features of one area on other areas. The assessments for CP and CO (park codes) were highly correlated. Natural relief is the main attraction and tall massive buildings intensify the singular and grandiose feeling of this park. The large variety of playgrounds, monuments, bridges, historic and state buildings also gave additional value to the park. At the first, it was difficult to perceive the extent of the area, but after some time its coherence and harmony could be appreciated (Extent). Different zones (e.g., a playground at the foot of the hill) made it possible to use the Toome Hill according to one's preferences and not only attractive to historians. Therefore, this area called for an extended stay and absorption, even if within one's thoughts (Being away), which explains why it was necessary to divide it in two.

5.3. Landscape preferences of people

Objective 4: to test the Kaplan model (Kaplan and Kaplan, 1989) for landscape preferences under Estonian conditions in Estonian forests.

Regression analysis showed that Mystery was the best predictor of preference. The views were described as follows: high occurrence of large trees, low variability of relief, low visibility of the sky, medium occurrence of leaning trees and medium visual penetrability. The most attractive elements where the following: crooked forked great pine-tree (45 respondents), large and thick pine-trees (24), low soft underbrush (12), tree-root (6), small white blossoms (5). The most unattractive elements were as follows: dry branches (16), fallen branch (10), broadleaved trees in the distance (9), small fir-trees (9). View 8 was the next in terms of preference (see Figure 9)

Figure 8 was described as follows: coherent, not complex, rather mysterious, very familiar and perceived as natural. For this view, the regression analysis showed that mystery and coherence were the best predictors of preference. Assessment of the variables of the view was as follows: medium occurrence of large trees; medium visibility of the sky; low occurrence of leaning trees; high visual penetrability. The attractive ele-

ments were tall straight pines (34); underbrush and moss (33); neatness and order (11); coherence, spaciousness and view (6); and wholeness (5). The unattractive elements were branches on the ground (21), a straight stem in the foreground (12) and the excessive order of trees (8). The most pleasant objects were straight, vital pines and soft, low underbrush. Preferred landscapes were described as having medium Complexity high Coherence and high Mystery (Figure 8 in the image to the left) and low Complexity, high coherence and medium Mystery in the image to the right (Hansson *et al.,* 2012; p 312).

The reliability measure (Cronbach's alpha) across the entire used questionnaire about forest views was 0.78, which is generally considered a good result. The reliability of the assessments for each variable ranged from 0.83 to 0.91 (average 0.88). According to the Z-test, about half of the assessments were similar. We equalized the view in article to each environment. Students preferred view 18 (see Figure 9, to the right below), it was Coherent and Mysterious, moderately Complex and familiar and perceived as Natural.

Figure 8. Most preferred natural landscape views in Estonia

Figure 9. Second-most preferred landscape views in Estonia

5.4. Development of a new tool for landscape architects - the Emotional Character Line Method

Following on the previous results a new method for assessing the characteristics of a space in terms of its salutogenic potential has been developed. This has the possibility to become a new tool for use by landscape architects. The new method was inspired by the visits to and analysis of the hospital gardens. The question emerged: would it work also in parks in general? The method was pilot tested on Tallinn Bastion park, where it appeared that there were some gaps (no characterized areas) between the characterized green areas but that the method seemed to work. It was then applied to the Tartu City parks which were the subject of the research presented in Articles 2 and 3.

The Emotional Character Line Method (ECLM), shown in Figure 10 and Table 6, is based on data from healing gardens in England, the USA and other countries (Sweden, Finland). As the landscape characteristic is measured at the human scale of the green room and the movement within the garden is by walking along paths, awareness of how the garden user really experiences the garden can be obtained as a sequence of spaces. Thus the garden can be sketched on paper, the walking path marked and the green rooms through which the walking path passes, can be assessed in sequence and thus the relationships can be understood and evaluated. In a single garden there could be several walking paths

for different journeys offering a range of possibilities for the user. The landscape characteristics can be transformed into numbers and marked along the journey as a line of numbers. This is a new way of describing the garden as a journey of therapy.

Using this method, it is possible to give an accurate description of the garden. In the future it could be further developed, based on specific requirements for a particular illness or the hospital speciality, such as varying the length/time of the garden walk, the senses used in a specific order or the strength of the landscape characteristic in a room. The method of recording is to use a set of columns. Each column represents a garden and each square within the column a green room. The colour of each square is determined by the predominant landscape characteristic, and each landscape characteristic is represented by a different colour (see below). The method maps the landscape characteristics room after room following the walking path through the garden. Each landscape characteristic influences the user in a different way.

Table 6. Description of the Emotional Character Line Method (ECLM) based on the new method.

Location	1. The method is applied while following the path from green room to green room and passed (journeyed) room character is mapped as following rooms. 2. The method is used at the garden and park scale.
Assessment	3. The main landscape characteristic is designated on a numerical scale (0-3), could also include "followed by" the next predominant landscape characteristic. 4. Can be compared to standard descriptions of culture rooms. 5. Accuracy is designated by green room description. 6. The method requires choosing a degree from 0-3, where 0 is non existence, 1-low, 2-middle and 3-high representation . 7. Only pen and paper are needed. 8. Assessing the landscape is required in garden and park level.
Statistical methods	9. Pearson correlation and other descriptive methods. 10. Scientific interpretation is based on qualitative and quantitative methods.
Good for	11. Intended for landscape architects. 12. Gives more information while also reading other descriptive information about the green room.

Based on the gardens the author visited in England and the USA there were usually four or seven green rooms per garden. With respect to green rooms, 298 rooms were evaluated Wild (63) rooms, the Common (91 rooms), Space (66 rooms) and Festive (one room), character Culture is absent. There was one garden with one green room, two with two, two with three, five with four, two with five, three with six, ten with seven, three gardens with eight, and one with twenty-seven green rooms. Usually gardens and parks had a path that led through the garden's physical rooms. Future research should determine how this sequence contributes to the message in the journey and how it would affect therapeutic response.

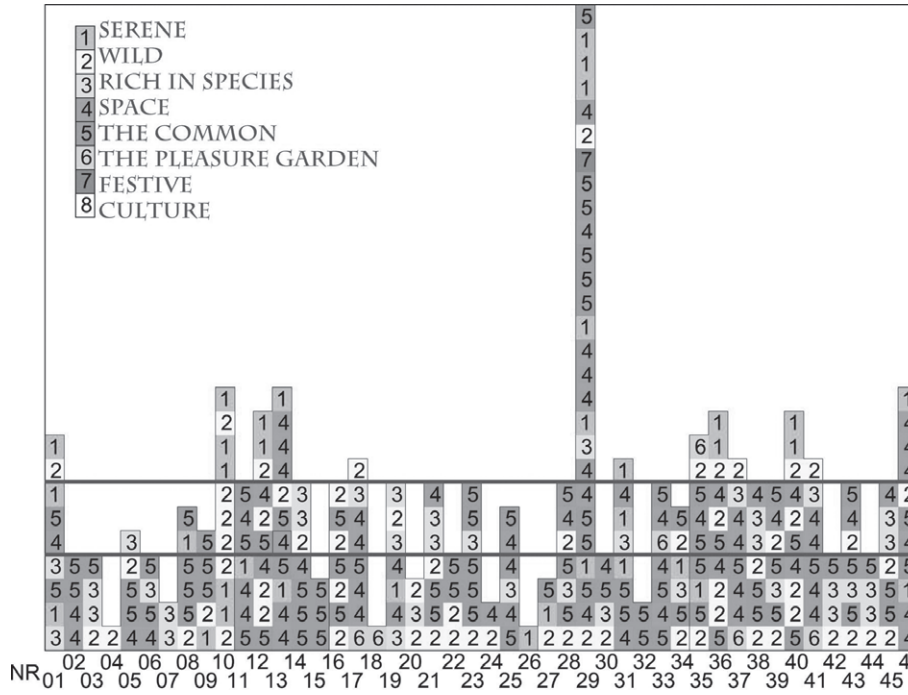


Figure 10. Example of the observations of the Emotional Character Line Method (ECLM) in the healing gardens in England, USA, Sweden and Finland.

The method produces a visually clear pattern by describing the gardens according to the height of the column and number of landscape characteristic and their order and repetition. As well as interpreting existing gardens or parks it can be used at the start of the design process, for creating different green rooms with different landscape characteristics. It can be used to create the type of garden needed for each illness, or for example, a sequence of four green rooms as a journey Wild-Serene-Rich in species-Space. These are able to adjust the user's environment, time,

activity and feelings in a quick, but effective way. Here are presented some illustrative examples based on the figure 10 as follows:

5.4.1 Trinity Hospice (Garden 29) started in 1891, where 90% of patients are in cancer treatment. This garden was designed by John Medhust and David Foreman and was built in 1983-1984. It is divided into three large areas within which are many different rooms that are visited by walking along the path. The garden journey starts from the backyard balcony where the forest corner does not open the garden journey yet. The user goes through the middle of a closed room of Wild character through Betony Bridge, which is accessible by wheelchair. An open room (Space) gives the first views of the path to one divided room. Serene continuously keeps the senses awake. A green lawn room (the Common) to another room (the Common), remind me of a park-like setting with stunning personal level views. It is incredible that it is also possible to walk around these rooms. The pathway goes through two Space LC rooms, where large conifer trees of different colours and textures make closed rooms. Moving back toward the building on the north side, the user is welcomed by a small Rich in species balcony garden. Under the balcony is a small sitting area, with a lawn and flowerbed that fills all corners (both sides). Small paths continue opening the Serene areas further. Three Space areas continue, almost in darkness, between the bushes. The transition to the next room is Serene. The following rooms are concentrated around the pond sitting areas and the Common character will nail you in place, looking at the timeless cloud-reflection pond. The journey back begins. Between the bushes, a wall starts the view of the Common corridor used to divide the sitting areas on the left with Rich in species areas and the remaining road the Common way. The Space is the same area that was behind the building after the Wild area with huge stunning lawns. Lawns with hills in between remind me of the Festive character, which then end with Wild areas at the corner of the path and Space thereafter with views that continue the space. The journey ends with Serene area between raised flower beds that continue for a long time until ending at the Common.

5.4.2. West Dorset Hospital (Garden 4) courtyards are well-known. One of these courtyards is covered from wall to wall with a high bush layer, making the room a very Wild one.

5.4.3. Royal Brompton National Heart and Lung Hospital (Garden 18) has an example of a Pleasure garden; it is laid out as one room which has a middle area like a heart looking onto a functioning fountain. The area was designed with many different corners where you can be yourself and play alone or with others. There are no distractions from inside or around.

5.4.4. Healing garden for children in the Rusk Institute (garden 33). The garden itself is the complete opposite of a street environment – the garden is so green and street so stony. As you enter the garden, the Common space with a long view will direct the user to a sitting place that is scaled for children. Space comes between large trees and from being on the bridge, where walls are a rose arch. The Common and Space are almost side by side, where trees frame the landscape and Space is given with long distance green views. The northern part of the garden is a child's paradise with the Pleasure garden, there is leisure in sunny and also shady areas. The Space and Common area are located in the back, where it is an animal care garden with a large central tree focal point, with air roots and long views to the entrance door.

6. DISCUSSION

6.1. Landscape characteristics in healing gardens and the Emotional Character Line Method

The research suggests that garden green rooms encompass various landscape characteristics. They are not physically connected, but in the future, it will be important to develop green room patterns for which the ECLM is useful. However, some characteristics are not highly represented. Landscape characteristics as a tool appears to be quite stable. Five of the eight characteristics appear to be most relevant and should be represented in all healing gardens, which has also been confirmed in previous studies. English gardens are more oriented to providing closeness to nature than the American gardens, which is supportive of social interaction. The characteristics of the green rooms studied possessed a variety of values, from very high to very low or absent. The sample of gardens in the USA contained most of the selected room characteristics and usually had mid-range scores, which is understandable because these gardens were not specifically designed based on landscape characteristics but were present more by accident or good general garden design. The real criteria used for assessment was explained in the first article (0- not present, 1-weak presence, 2 – medium presence and 3 – strong presence). Some authors consider that eight characteristics are too much and that there has been overlapping description (Skärbäck, 2007). It is possible to refer to POE for evaluation of healing garden criteria and to assess each situation in terms of personal and impersonal characteristics, realizing that personal characteristics should prevail.

Rich in Species was correlated with Festive and Culture. This connection suggests that a good combination in a design links impersonal action categories with personal contact possibilities through the richness of materials used to create a Coherent design; the characteristics have to be strongly differentiated to support the actions of users and ensure their safety. Serene and Festive are generally distinguished by a stronger presence, which means existence in the culture room together. Wild and Rich in Species are strongly present personal characteristics that spoke the most. The completion and extension of the characteristics of each theme type, described and related here to user activities and therapeutic values, should help designers adapt and develop spaces to increase the healing potential

of green rooms. This implies that following the descriptions requires understanding of the designer's language and point of view. I aimed to find the key room characteristics with a strong relationship to certain types of healing processes. Walking through the rooms helps users orientate themselves and also to find rhythm in the design (Emotional Character Line Method). A next step would be to test if the order of the rooms is important for enhancing the healing process and to understand how the message of the journey from room to room affects the healing process.

6.2. Landscape characteristics and landscape elements in parks

Several landscape characteristics were found in a single place. When reading the landscape, it is important to find eight non-overlapping landscape characteristics; however, theory indicated that there can be many layers in the same place (design themes or topics). It is easier to work with natural material in the city; because there are fewer changeable factors in a mature park environment. The user can experience many different aspects simultaneously. If this information is gathered directly from the landscape using precise descriptions, it is also easier to obtain clearer results, i.e., an average person (without any disabilities) can get the same results even after decades have passed (landscape characteristics are developed based on the park environment). I found that Prospect and Visuals are related, and because landscape characteristics function in one cultural room, it is possible to confirm that in Estonia the Wilderness characteristic is connected with trees and plants. According to Swedish studies, it is comparable to the ancient Wilderness found in the forest, and when compared with the healing gardens of England, Serenity is more prominent in Estonia (Maikov, 2014). The information is related to green spaces that are similar, although the results for Tartu parks are not highly correlated due to the method used (though when compared to studies on healing garden characteristics, there are stronger correlations). Serenity was connected to all visual dimensions as expected from the theory. To increase the landscape characteristics in a park, smaller gardens could be incorporated into larger ones.

The literature on landscape characteristics indicates that Serenity, Spaciousness and Culture appeal to many people, though vulnerable people often see commonness whereas stressed people see Festivity (Stigsdotter and Grahn, 1995). It was found that Wilderness and Serenity, Refuge and Space, and Culture and Festivity exist together in Tartu green spaces.

Peschardt and Stigdotter's (2013) show that, first and foremost, individuals expect to find silent and calm surroundings (Serene) and room for social interaction (Social), followed by Space with trees, sun and shade (Space), and safe areas with bushes and the opportunity for play (Refuge) in that order. Social contact is conserved between green space and health. Coherence had strongest predictable effects on Serene, followed by Culture, Social, Space, Rich in species and Refuge. Landscape characteristic like Serene, Space and Rich in species generally need large areas which is where parks have a lot to offer compared with small gardens (Berggren-Bärring and Grahn, 1995) which is confirmed by the current work. The WHO encourages local administrations to increase the provisioning of UGS (WHO 2006). Peschardt et al. (2012), in their work on SPUGS is similar to this study, although they observed what users do in areas that are characterized differently. Refuge and Nature were strongly associated with stress and needs for more restorative environments in Grahn and Stigsdotters study (2010). All characteristics are connected to walking activities except Prospect (Stigsdotter and Grahn, 2011).

In Tartu most of the landscape characteristic are walkable. Garden design through landscape characteristics is not too abstract, unfamiliar or challenging, but rather supportive of intended actions in terms of healing needs. There are two personal characteristics, Wild and Rich in species. The hardest to create is Festive, which generates different feelings. These landscape characteristics are also found in other areas, indicating that they do not have to work only with people in hospital settings. Findings of this study indicate that at least five out of the eight landscape characteristics should be found in a garden for it to be classified as a healing garden.

Improving health is very sensitive to disruption because the Serene, Space and Rich in species dimensions require large areas of land (Stigsdotter *et al.,* 2010), as confirmed by the present study in parks. Bell (2012) refers to personal and impersonal feelings as distance senses. The overlapping of descriptions is a problem associated with landscape characteristics, and although they do not overlap through descriptions while reading the landscape, it is important to keep all eight. This can be accomplished in a given area by using layers such as themes, topics and characteristics. Wilderness and Serenity, Refuge and Space and Culture and Festivity exist together in Tartu green spaces. All Visual aspects were correlated with Serenity. Kaplan mentioned that while in a logical position, if transitioning from one room to another is smooth and the area is perceived as a

whole (Kaplan, 1995) it is a good landscape. Festive and Culture, Festive and Space, Serene and Wild, Serene and Space, Festive and Prospect are statistically represented in large parks. Landscape characteristics are developed further in Perceived Sensory Dimensions (PSD) and in the current work for landscape reading. While dividing landscape characteristics from general to specific (Maikov, 2014), I found that basic connections are divided equally in Estonian culture rooms. Wild (presence of nature), is perhaps the most essential dimension experienced in Urban Green Areas (UGAs). Wild seems to be the basic characteristic common to all green space combinations. Overall, that size of the area is not important. In Estonia, tall trees will give the feeling of "higher being", described here as Being away.

Design and the context of the outdoor environment seem to be important for the recovery of a stressed individual visiting that environment. It is important to have person-environment interaction. The correlation between design and the senses was unexpected because few landscape design accessories actually have another dimension. EBLA (Evidence-Based Landscape Architecture) is for the evaluation of existing projects (Brown and Corry, 2011). This process should support the decisions in a design process with knowledge based on experiments studied with this method. Biesta (2010) developed Evidence-Based Practice (EBP) which is an alternative approach for the same thing.

6.3. Open green spaces and earlier research

The results tend to agree with previous studies. Kaplan and Kaplan (1989), Hartig et al. (1991), Kaplan (1995), Hartig et al. (1997b) and Laumann et al. (2001) claim that restorativeness is higher in natural environments than in artificial surroundings. However, artificial environments may include natural components that make it possible for people to perceive some degree of restorativeness in urban surroundings. The PRS Tartu analysis shows that artificial environments with natural components (e.g., Kassitoome valley - CL) may have some restorative potential. Additionally, natural environments with artificial components (e.g., the Tartu Adventure Park – AK) show positive results, suggesting that natural and artificial elements may offer people the opportunity to recover from everyday disturbances.

However, natural and artificial elements must be proportional and in harmony. A setting may have a strong Being away perception, but if it is not attractive enough (i.e., the first impression is not attractive enough), people will not enter the area. Similarly, areas such as BD, BB and AÖ (codes on the map of the green spaces) may be important for local people (good forest for picking mushrooms, a source of fresh air, etc.) but uninteresting to strangers. Van den Berg et al. (2010) said that natural environments offer a more efficient way to recover from mental fatigue and stress than the urban surroundings.

We found that when comparing the UGS in the centre of the town (e.g., O, CP, CL) to those on the outskirts (AB, BB, AÄ, AP), the PRS analysis showed that urban environments can offer more restorative opportunities in a short time than a forest-like area outside of town. People appreciate customary green spaces in their everyday environment, whose value (including restorativeness) increases, rather than decreases. This supports Nordh et al. (2009b), who found that even the smallest UGS in the neighborhood may possess significant restorative features and that UGS that are closer to home may be more popular and preferred for restoration just because of their location. Nordh et al. 2009b stated that the size of the UGS does not necessarily affect its power of perceived restorativeness.

Restorativeness is more likely to be influenced by people's preferences and the existence of different elements, which can be illustrated by comparing Tõnisson Square (J) and Politsei Square (K). Several authors (Kaplan and Kaplan, 1989; Kaplan, 1995; Hartig *et al.,* 1997b; Laumann *et al.,* 2001; Tyrväinen *et al.,* 2014) have claimed that artificial (urban) spaces may impact restorativeness highly but in a negative way by increasing stress reactions, which is supported by this study. For example, the restorativeness of Tartu Town Hall Square (P) is not as strong as that of Pirogov Park (CN), although the correlation indicates that Town Hall Square is an attractive place ($r=0.524$, $p<0.05$). It is well organized and has landmarks (e.g., rows of lights and different colour paving stones.) that facilitate traffic. Unfortunately, this square lacks elements that are necessary for Being away because the large crowds of people, open-air restaurants and artificial materials impose stress and draw focus from our minds. Korpela and Hartig (1996) have said that strong Compatibility cannot be found in a place that lacks elements for Being away, Fascination and Extent, indicating that these items are inter-related.

6.4. Forested landscape preferences of people

The following observations were made in the forest preference study:

1. The views were representative of the Estonian natural forest environment but were limited in terms of the managed forest environment, which covers the majority of forests in Estonia;
2. The views encompassed the entire range of the environmental preference matrix; and
3. Expert and non-expert assessments were compared. Complexity was of low significance in our results.

The most attractive elements were those that visually indicated the good condition of the environment, including healthy, vital trees or elements with an interesting or peculiar appearance. The main findings of the study were linked to Mystery, the attractive elements noted by test subjects. This may indicate that higher Mystery levels were accompanied by interesting, large, old trees. It was found that a detailed explanation of the definition of mystery is needed with very low levels of visual access, where Mystery is often confused with surprise. In the case of surprise, new information is suddenly revealed rather than promised, as is the case of Mystery (Hansson *et al.,* 2012 p 312).

Perception is described as the process of attaining an awareness and understanding of sensory information (Bell, 2012). Tactile sensations and touch involve numerous sensory cells, such as those registering temperature, humidity, touch, pressure, the feeling of texture and other sensations. Some of the basic senses can be classified as distance senses (vision, hearing, and smell), while others are nearness senses (Bell, 2012). Other studies have shown that information is coded through sub-symbolic, symbolic imaginary and symbolic verbal processes (Bucci, 2003). Sub-symbolic processes operate sensory and motor skills. They represent visual pictures. Ehrenzweig (2000) suggests that sensory information that is perceived and stored unconsciously can be called "depth perception". Stern (1993) defines the same information as "vitality affects" because an environment is perceived, evaluated and understood through cognitions and emotions.

Emotions which guide the cognition are dealt by Korpela *et al.,* 2002. It also means that characteristics in the environment are immediately given cognitive and emotional labels.

Grahn *et al.,* (2010) presented a theory titled, "The Scope of Meaning". It states that our senses, emotions and cognitions affect how we relate to the external environment and our ability to communicate with the surrounding world. Our actions are different while experiencing crises when compared to our "Scope of action" in secure and stabile environments. Based on this theory, some environments seem more permanent than others, including non-human environments, and some simple elements of the natural environment can be considered essential resources (Grahn *et al.,* 2010).

CONCLUSIONS

- This study has demonstrated that the eight room characteristics, which were originally developed for evaluating urban parks, can also be used to describe and evaluate healing gardens. The selected room characteristics are easy to recognise in healing gardens. This work has added to the comprehension of the roles of personal and impersonal user opportunities, and interprets them from the point of view of a landscape designer. Different environments have demonstrated their culture representatives by landscape characteristics. For example Rich in species and Festive in case of USA and Space and Common in England.

- The method, which was developed on a human scale (garden scale), allows for a description and feeling of surroundings from a user's point of view (healing purpose). The method uses the same landscape characteristics, but is read from the landscape in a garden or user's journey. Its potential benefit lies in the possibility to develop a more effective garden journey for users with special needs. Landscape characterisation at this scale and context is a useful tool used to describe landscape from a health perspective. Tartu green spaces exhibit high recreational and healing potential within the sensory dimension. This study added visual dimensions to Searle's elements (stone/water, plants, animals, other people) and the main aspects that influence the user in the landscape.

- Within one town, it is possible to find major parks/places that illustrate the distinctive characteristics of a specific cultural space. At least six of these areas exist in Tartu, including at least three of the PRS subscales (Being-Away, Fascination, Extent and Compatibility). These locations include Toome Hill and the surroundings of the Tartu Observatory, Kassitoome, Pirogov Park, the Botanical Gardens of the University of Tartu and the Tartu Adventure Park. The PRS analysis showed that urban environments can offer more restorative opportunities in a short time than a forest-like area outside of town. Based on the results of the study, Tartu can be classified as a healing city based on green spaces.

- There are a range of preferences for different types of natural forest landscapes in Estonia. Those containing high degrees of mystery

and Coherence, in that order, were judged to be most preferred. The elements that were most attractive, excluding the general landscape composition and structure, were those that enhanced Mystery. There are clear correlations between factors and preferences, with Mystery emerging as the most significant, followed by Coherence and Complexity. Recreational area planners, trail designers and natural or managed forests managers should use these findings to enhance Mystery in their landscapes.

In summary, this work has shown that there are many possibilities to introduce and to use theories of salutogenic and healing landscapes at a range of scales and that Estonia has plenty of places where this can take place. The newly developed Emotional Character Line Method for assessing green spaces is a potentially valuable tool for extracting the number of specific characteristics related to healing properties from a specific place and it also has potential as a means for designing or retrofitting parks and other green spaces to make them more salutogenic. As postulated in the introduction, interest in the links between health, well-being and landscape is currently intense and research evidence building. Policies and practices to transfer the research knowledge from academia to planners and designers is underway in many countries. Estonia offers many possibilities to use this knowledge and the results of this research advance it considerably.

SUMMARY IN ESTONIAN

MAASTIKU TERVENDAVAD OMADUSED: UURIMUS TERVENDAVATEST AEDADEST METSAVAADETENI

Sissejuhatus

Maailmas suureneb huvi teadustulemuste järele, millest nähtub, kuidas füüsiline keskkond mõjutab inimese tervist ja heaolu. Tervise edendamine loodusel põhinevate ravimeetodite ja keskkonna abil on suhteliselt uus uurimisteema. Keskkonna mõju avaldub rohealade teadlikus kasutuses tervisedenduse ja rehabilitatsiooni valdkonnas. Rohealad on sobiv keskkond taastumiseks, vastates inimese vaimsele tasemele.

Eestis käsitlevad rohealasid dendroloogia ja ajalugu. Inimesed veedavad taastumiseks ja energia saamiseks aega näiteks linnapargi roheruumides. Seetõttu on oluline neid alasid kirjeldada ja uurida. Uuem lähenemine on maastiku lugemine, st tajumine ja hindamine keskkonnapsühholoogia teooriate ja mõõdikute abil. Käesolevas uurimuses kasutatakse järgnevaid meetodeid: Searlesi teooria kommunikatiivsed elemendid maastikus (1960), maastikukarakteristikud ehk ruumiomadused (Berggre-Bärring ja Grahn, 1995), tujumõjutamise aspektid maastikul (Tyson, 1998), tähelepanu restaureerimise teooria Kaplani järgi (1989, 1995), taju restaureerimise skaala Hartigi järgi (1996) ja maastikuvaadete eelistused Kaplani maatriksi põhjal (1989).

Teadlased on jõudnud järeldusele, et inimesed on psühholoogiliselt, emotsionaalselt ja vaimselt looduskeskkonnaga tugevalt seotud (Wilson, 1984; Frumkin, 2001). Keskkonnateaduste valdkonnas sai 1995. aastal pärast Clare Cooper Marcuse ja Marni Barnesi raamatu „Gardens in Healthcare Facilities" ilmumist aktuaalseks tervendavate aedade teema. Rootsi põllumajandusteaduste ülikooli Alnarpi üksuse uurimisrühm Patrik Grahni juhtimisel uurib, kuidas inimene tajub loodust ja sellest lähtuvalt kasutab keskkonnapsühholoogial põhinevat aiateraapiat.

Eesti rohealasid saab käsitleda inimeste terviseallikana. Suure osa Eesti maastikest moodustavad metsad, kuid on vähe teada, milliseid maastikke eelistavad inimesed taastumiseks. Väitekirja autor on seisukohal, et rohealadel võib olla tervendava maastiku omadusi. Tervendava maastiku kriteeriume mõistetakse ühtemoodi ühe kultuuriruumi piires, neid kriteeriume uuriti

inglise ja ameerika tervendavate aedade ja Eesti kultuuriruumis Tartu parkide näitel. Arvestades eeltoodut, püstitati selle väitekirja uurimisküsimused:
1. Suurbritannia ja Uus-Inglismaa (USA) tervendavate aedade maastikuomaduste analüüsimine Berggre-Bärringi ja Grahni maastikukarakteristikute abil (**I**);
2. Tervendavate aedade maastike hindamismeetodi loomine (**I**);
3. Tervendava potentsiaali määramine Tartu linna rohealadel (**II**);
4. Taju restaureerimise skaala rakendamine ja Searlesi teooria kommunikatiivsete elementide leidmine Tartu linna rohealade hindamisel (**II**, **III**);
5. Metsavaadete eelistuste väljaselgitamine ja kirjeldamine Eestis Kaplani eelistuste maatriksi abil (**IV**).

Materjal ja metoodika

Maastiku lugemiseks kasutati Searlesi teooria kommunikatiivseid elemente, maastikukarakteristikuid, tujumõjutamise aspekte maastikul, tähelepanu restaureerimise teooriat, taju restaureerimise skaalat ja maastikuvaadete eelistusi Kaplani maatriksi põhjal. Kõikides uuringutes kasutatakse eksperthinnanguid.

Maastiku uurimiseks valiti välja Suurbritannia ja USA tervendavad aiad haiglate aladel olenemata aiatüübist ja esindatuse alusel andmebaasis Therapeutic Landscapes Network. Aedu uuriti Suurbritannias 2005. aasta ja USAs 2006. aasta suvel. Aedu käsitleti roheruumide kaupa. Jalgteedel liikudes hinnati maastikukarakteristikute olemasolu skaalal 0–3 (0 – ei eksisteeri, 3 – esindatud tugevalt). Hindamisskaala astmed on samaväärsed. Maastikukarakteristikud esitatakse nimetustega 'selgus', 'metsik', 'pidulikkus', 'naudingute aed', 'kultuur', 'liigirohkus', 'ruum' ja 'ühine'.

Samade maastikukarakteristikutega hinnati Tartu linna rohealasid tervikuna. Rohealad valiti välja asukoha järgi, uuringusse kaasati 92 ala, kaasates ka alad, mida läbis linnapiir (lisa 4). Rohealasid hinnati taju restaureerimise skaala, mis on kohandati maastiku hindamiseks ja saadi vastused tajust sõltuvatele küsimustele maastiku kohta. Tujumõjutamise aspektid maastikul esitatakse uurimuses protsentides ja Searlesi teooria kommunikatiivsed elementide esindatus maastikul jah/ei vastusena.

Metsamaastike vaadete hindamiseks valiti 2000 pildi seast maastikuvaadete eelistuste maatriksi abil välja 27 maastikupilti. Pilte hindasid eksperdid ja 97 keskkonnaõppekavade üliõpilast. Vastused anti Likerti statistilisel

skaalal viiepallisüsteemis (1 – üldse mitte, 5 – vägagi). Sarnasust ekspertide ja tudengite hinnangute vahel hinnati Z-testiga.

Uuringutes kasutatud statistika ülevaade on esitatud tabelis 4. Kolmes uuringus (aed ja kaks parki) kasutati Pearsoni lineaarset korrelatsiooni. Usaldusväärsust mõõdeti Cronbachi alpha järgi. Metsavaadete uuringus testiti seeria ennustatavust lineaarse regressiooni abil ning selle efektiivsust tähistati kokkuvõtlikult statistilise avaldisega R^2.

Tulemused

Kõige tugevamad Suurbritannias ja USAs esindatud maastikukarakteristikud on 'liigirohkus' ja 'ühine'. Uuringus on inimese meeltega tajutav jaotatud 'personaalseks' (katsumine ja maitsmine) ja 'mittepersonaalseks' (nägemine, kuulmine, haistmine). Personaalseim maastikukarakteristik on 'naudingute aed'. Mittepersonaalne maastikukarakteristik on 'selge' ja seda tajutakse kõikidel rohealadel. Doktoritöö tulemusena leiti, et Suurbritannia ja USA tervendavad aiad sisaldavad erinevate maastikukarakteristikutega roheruume. Suurbritannias on enim esindatud nimetused 'selge', 'liigirohke' ja 'metsik', inglise kultuuriruumi esindajatena korreleeruvad maastikukarakteristikud 'ühine' ja 'ruum'. Ameerika kultuuriruumis prevaleerivad 'pidulik' ja 'naudingute aed' (**I**).

Eelnevast tulenevalt koostas väitekirja autor meetodi, millega saab maastikku käsitleda roheruumidena ja määrata mööda jalgteid liikudes maastikukarakteristikuid. Selle meetodi abil on võimalik edaspidi välja töötada näiteks haiglaaedade vajadustele vastav teekond aia roheruumides ja sel moel ala kasutajat mõjutada emotsionaalselt ja erineva ajalise kestvusega. Tartu parkides on enimlevinud maastikukarakteristik 'ruum'. Samuti on olemas 'selgus', 'naudingute aed', 'pidulik' ja 'kultuur'. Maastikukarakteristik 'liigirohkus' esineb sagedamini kõikide rinnete olemasolul. (**II**)

Tartu parke iseloomustab nende kujunduse mõju meeltele. Tartu pargid pakuvad enim meelerahu ja neil on avatud ruumi omadusi. Maastikukarakteristik 'selgus' on seotud meelerahu ja visuaalidega. Oodatav tulemus oli karakteristiku 'metsik' seos suurte puudega. Koos esinevad 'naudingute aed' ja 'vaated'. Tartu parkides on inimesel maastikuga võimalik suhelda järgmiselt: pooltel juhtudel leidub vee-elemente või maakive, 99% juhtudest esineb taimestikku, 64% juhtudest on näha loomi (oravaid), ja 78% ulatuses on võimalik ühel või teisel moel suhelda kompleksselt kõigi elementidega.

Taju restaureerimise skaala kirjeldab keskkonna mõju inimese meeltele. (**III**) Tartu ikoonpark on Toomemägi. Tartu linnaparkide omapära on 'tähelepanu siin asuvatele väga huvitavatele elementidele' ja 'siin olemine on kui igapäevarutiinist põgenemine', mis on omavahel tugevas korrelatsioonis.

Kõige eelistatum metsavaade (**IV**) on väga ühtne ja salapärane, parajalt keeruline, samas tuttav ning on tajutav loomulikuna. Metsavaate regressioonanalüüs näitas, et vaate eelistuse ennustamiseks on 'mõistatuslik' statistiliselt kõige olulisem muutuja. Metsavaate kõige atraktiivsemad elemendid on 'suur kõver kaheharuline mänd', 'suur ja paks mänd', 'madal pehme alusmets', 'puujuured'. Mitteatraktiivsed elemendid on 'kuivad oksad', 'langenud puud', 'lehtpuude kaugus', 'väiksed kuused'. (Hansson jt., 2012).

Järeldused

Doktoritöö peamised järeldused on
1. Suurbritannia ja USA tervendavates aedades on kõige tugevamini esindatud roheruumide maastikukarakteristikud 'liigirohkus' ja 'ühine'. Karakteristikut 'selge' leidub enamuses Suurbritannia ja USA tervendavates aedades. Suurbritannia haiglate tervendavates aedades on esindatud maastikukarakteristikud 'selge', 'liigirohke' ja 'metsik'. Kultuuriruumi iseloomustava elemendina esinevad koos karakteristikud 'ühine' ja 'ruum'. Ameerika tervendavates aedades esinevad koos maastikukarakteristikud 'pidulik' ja 'naudingute aed'.
2. Maastikukarakteristikud mõjutavad ala kasutajat tõhusalt, kui need on esindatud tugevalt.
3. Tartu parkide eripära seisneb nende kujunduse mõjus meeltele.
4. Kõige eelistatum vaade on ühtne ja salapärane, parajalt keeruline, samas tuttav ning on tajutav loomulikuna.

APPENDIX 1. LIST OF HOSPITAL GARDENS IN ENGLAND

1. Blackthorton hospital
2. Chesterfield and North Derbyshire Royal Hospital
3. Edward Street Hospital
4. Greenhill House Cheshire Home
5. Homerton University hospital
6. Joseph Weld Hospice hospital
7. Lambeth Community Care Center
8. Retreat hospice hospital
9. Royal Bromton National Heart and Lung Hospital garden
10. Sant Georges Hospital
11. St Marys Hospital
12. St Thomas Hospital
13. Trinity hospice garden
14. Retrietment home garden in Bath
15. West Dorset Hospital three gardens
16. Whittington Hospital garden
17. William Merrit Disabled Centre garden

APPENDIX 2. LIST OF GARDENS IN USA

18. Children's Hospital Boston - The Prouty Terrace and Garden
    Boston, MA, USA
    Olmsted Brothers
19. Massachusetts General Hospital
    Boston, MA, USA
    Acute Care General
20. Volunteers of America Alzheimer's Garden
    Boston, MA, USA
    Design for Generations, LLC
21. Beth Israel Hospital
    New York, NY, USA
    Jonathan Parker Abramson Garden, "A Safe Harbor"
    T. Delaney, Inc./SEAM Studio

22. Cardinal Cooke Health Care Center - Joel Schapner Memorial Garden
    NY, NY, USA
    AIDS
    Rooftop garden
    Dirtworks, Inc., David Kamp, ASLA
23. 80th Street Residence - Alzheimer's Therapy Garden
    New York, NY, USA
    Design for Generations, LLC
24. Howard A. Rusk Institute of Rehabilitation Medicine
    New York, NY, USA
    Children's; Rehabilitation Care
    Enid Haupt Glass Garden; children's play garden;
    other healing gardens
    Johansson Design Collaborative Inc. (Play garden)
25. Queen of Peace Residence
    Queens, NY, USA
    Nursing Home
26. St. John Neumann Nursing Home
    Philadelphia, PA, USA
    Alzheimer's
    Adult Social Day Care Alzheimer's Garden
    Design for Generations, LLC
27. Friends Hospital
    Philadelphia, PA, USA
    Psychiatric
28. Hearthstone at New Horizons
    Marlborough, MA, USA
    Alzheimer's
    Martha Tyson and John Zeisel
29. Medical Center of Central Massachusetts
    Worcester, MA, USA
30. Kimball Medical Center
    Lakewood, NJ, USA
    Acute Care General
    Healing garden
    Design for Generations, LLC
31. Meadow Lakes CCRC
    Hightstown, NJ, USA
    Alzhiemer's
    Courtyard garden

Design for Generations, LLC

32. Immaculate Mary Nursing Home
    Philadelphia, PA, USA
    Nursing Home
    Intergenerational Courtyard Garden
    Design for Generations, LLC
33. St. Mary Manor Nursing Home
    Lansdale, PA, USA
    Alzheimer's
    Design for Generations, LLC
34. Willow Glen CCRC - Alzheimer's Garden
    Lancaster, PA, USA
    Design for Generations, LLC
35. Methodist Country House
    Wilmington, DE, USA
    Alzhiemer's
    Courtyard garden
    Design for Generations, LLC
36. Butler Hospital
    Providence, R I , USA
    Psychiatric
    110-acre landscaped campus
    H.W.S. Cleveland, ca. 1860

APPENDIX 3. LIST OF HEALING GARDENS IN OTHER COUNTRIES

Paimio hospital, Finland.
Scientific healing garden in Alnarp, Sweden.

APPENDIX 4. MAP OF TARTU

ACKNOWLEDGEMENTS

Kalev Sepp – Thank you for giving me opportunity to be in this study.
Simon Bell – Thank you for giving me feedback about my work.
Daiga Zigmunde – Thank you for being my opponent.
Erja Rappe –Thank you for being my pre-opponent.
Ulrika Stigsdotter – Thank you for three memorable days in University of Copenhagen.
Lii Ranniku – Thank you for layout of my work.
Kristel Kirsimäe – Thank you for all documental work.
Andres and Martin Maikov – Thank you for being my support at home.

REFERENCES

Adevi AA and Lieberg M (2011) Stress Rehabilitation through Garden Therapy- A caregiver perspective on factors considered most essential to the recovery process. Urban Forestry and Urban Greening 11(1):51-58.

Adevi AA and Martensson F (2013) Stress rehabilitation through garden therapy: The garden as a place in the recovery from stress. Urban Forestry and Urban Greening 12 (2): 230-237.

Antonovsky A (1979) Health, Stress and Coping. San Francisco: Jossey-Bass. 1st edition, 255 p.

Bagot KL (2004) Perceived restorative components: A scale for children. Children Youth and Environments. 14(1): 107-129.

Barnhart SK, Perkins NH and Fitzsimonds J (1998) Behaviour and outdoor setting preferences at a psychiatric hospital. Landscape and Urban Planning 42: 147-156.

Bell S (2012) Landscape: Pattern, perception and process. 2nd Edition. Abingdon: Routledge.

Benedict, MA and McMahon, ET (2006) Green Infrastructure: linking landscapes and communities.

Bengtsson A and Grahn P (2014) Outdoor environments in healthcare settings: A quality evaluation tool for use in designing healthcare gardens. Urban Forestry and Urban Greening 13(4): 878-891.

Berggren-Bärring AM and Grahn P (1995) Importance of a single park area on experienced characteristics. Ecological aspects of Green Areas in Urban Environments. IFPRA World Congress Proceedings. 110. Antwerp. Flanders. Belgium.

Berleant A (1992) Aesthetics of Environment, Philadelphia: Temple University Press.

Berto R (2005) Exposure to restorative environments helps restore attention capacity. Journal of Environmental Psychology 25(3): 249-259.

Biesta G (2010) A new logic of emancipation: The methodology of Jacques Rancière. Educational Theory 60(1): 39-59.

Brown RZ and Corry RC (2011) Evidence-Based Landscape Architecture: The Maturing of a Profession. Landscape and Urban Planning 100: 327-329.

Bucci W (2003) Varieties of dissociative experiences. Psychoanalytic Psychology 20: 542-557.Cervinka R, Röderer K and Hefler E (2012)

Are nature lovers happy? On various indicators of well-being and connectedness with nature. Journal of Health Psychology 17(3): 379-388.

Clay GR and Daniel TC (2000) Scenic landscape assessment: The effects of land management jurisdiction on public perception of scenic beauty. Landscape Urban Planning 49(1-2): 1-13.

Coley RL, Kuo FE and Sullivan M (1997) Where does community grow? The social context created by nature in urban public housing. Environment and Behaviour 29(4): 468-492.

Cooper Marcus C and Barnes M (1995) Gardens in Health Care Facilities: Uses, Therapeutic Benefits and Design Considerations. Martinez, CA, The Center of Health Design.

Cooper Marcus C and Barnes M (1999) Healing Gardens: Therapeutic Benefits and Design Recommendations. Wiley. Canada.

Cordell KH, Tarrant MA, McDonald BL and Bergstrom JC (1998) How the public views wilderness: More results from the USA Survey on Recreation and the Environment. International Journal of Wilderness 4: 28-31.

Council of Europe (2000) http://www.coe.int/et/web/landscape, 1.02.2016.

Daniel TC (2001) Whither scenic beauty? Visual landscape quality assessment in the 21st century. Landscape Urban Planning 54: 267–281.

Daniel TC and Boster RS (1976) Measuring landscape aesthetics: the scenic beauty estimation method. U.S. Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station. 66 p.

Dilani A (2001) Psychosocial supportive design — Scandinavian Healthcare Design. In: Alan Dilani. Design and Health - The Therapeutic Benefits of design: 31-38.

Eckerling M (1996) Guidelines for Designing Healing Gardens. Journal of Therapeutic Horticulture (8): 21-25.

Ehrenzweig A (2000) The Hidden Order of Art: A Study on the Psychology of Artistic Imagination. Phoenix, London.

Frumkin H (2001) Beyond toxicity: Human health and the natural environment. American Journal of Preventative Medicine (20): 234-240.

Gibson JJ (1977) The Theory of Affordances. In Perceiving, Acting, and Knowing, Eds. Robert Shaw and John Bransford, ISBN 0-470-99014-7.

Gillis AR (1974) Population density and social pathology: The case of building type, social allowance and juvenile delinquency. Social Forces 53: 306-314.

Grahn P (1991) Om parkers betydelse. Dissertation. Department of landscape planning, SLU and Movium: Stad and Land 93, Alnarp.

Grahn P and Sorte GJ (1985) Hur används parken? (How are urban parks used?) Part 1. Stad and Land no 39. Alnarp: Swedish University of Agricultural Sciences.

Grahn P and Stigsdotter UK (2010) The relation between perceived sensory dimensions of urban green space and stress restoration. Landscape and Urban Planning 94(3-4): 264-275.

Grahn P, Tenngart IC, Stigsdotter UK and Bengtsson IL (2010) Using affordances as a health promoting tool in a therapeutic garden. In: Thompson CW, Bell S and Aspinall A (Eds). Innovative research in landscape and health. London: Taylor and Francis.

GSS (2010) Global Spa Summit, https://www.sri.com/sites/default/files/publications/gss_sri_spasandwellnessreport_rev_82010.pdf, 01.02.2016.

Hancock T (1993) Health, human development and the community ecosystem: three ecological models. Health Promotion International 8:41-47.

Hansson K, Külvik M, Bell S and Maikov K (2012) A preliminary assessment of preferences for Estonian natural forests. Baltic Forestry 18(2): 299-315.

Hartig T (2001) Guest editor's introduction [special issue on restorative environments]. Environment and Behaviour 33: 475-479.

Hartig T and Cooper Marcus C (2006) Healing gardens – Places for nature in healthcare. The Lancet 368: 36-37.

Hartig T, Böök A and Garvill J (1996) Environmental influences on psychological restoration. Scandinavian Journal of Psychology 37(4): 378-393.

Hartig T, Kaiser FG and Bowler PA (1997a) Further development of a measure of perceived environmental restorativeness. Working Paper No. 5. Uppsala University, Institute for Housing Research. Gävle. Sweden.

Hartig T, Korpela K, Evans GW and Gärling T (1997b) A measure of restorative quality in environments. Scandinavian Housing and Planning Research 14(4): 175-194.

Hartig T, Mang M and Evans GW (1991) Restorative effects of natural environment experiences. Environment and Behaviour (23): 3-26.

Hartig T, van den Berg A, Hagerhall C, Tomalak M, Bauer A, Hansmann R,Ojala A, Syngollitou E, Carrus G, van Herzele A, Bell S, Camilleri Podesta MT and Waaseth G (Eds.) (2010) Health Benefits of Nature

Experience: Psychological, Social and Cultural Processes in Forests, Trees and Human Health, Springer Verlag.

Hauru K, Lehvävirta S, Korpela K and Kotzea DJ (2012) Closure of view to the urban matrix has positive effects on perceived restorativeness in urban forests in Helsinki, Finland. Landscape and Urban Planning 107: 361-369.

Honeyman MK (1990) Vegetation and stress: a comparison study of varying amounts of vegetation in countryside and urban scenes. Paper presented at the National Symposium on the Role of Horticulture in Human Well-being and Social Developments. Washington D.C.

James W (1890) The principles of psychology. New York: Henry Holt.

Jiang Y (2009) Two examples of western medical gardens Chinese Landscape Architecture 25(8): 16-18.

Kaplan R (1983) A Model of person-environment compatibility. Environment and behaviour 15: 311-332.

Kaplan R (1993) The Role of Nature in the Context of the Workplace. Landscape and Urban Planning 26: 193-201.

Kaplan R and Kaplan S (1982) Cognition and Environment: Functioning in an uncertain world. New York: Praeger.

Kaplan R and Kaplan S (1989) The Experience of Nature: A Psychological Perspective. Cambridge: Cambridge University Press.

Kaplan R, Kaplan S and Wendt JS (1972) Rated preference and complexity for natural and urban visual material. Perception and Psychophysics 12(4): 354-356.

Kaplan S (1995) The restorative benefits of nature: toward an integrative framework. Journal of Environmental Psychology 15(3): 169-182.

Kim, T (2010) Human brain activation in response to visual stimulation with rural and urban scenery pictures: A functional magnetic resonance imaging study Science of the Total Environment, 408(12): 2600.

Kjellgren A and Buhrkall H (2010) A comparison of the restorative effect of a natural environment with that of a simulated natural environment. Journal of Environmental Psychology 30: 464-472.

Knopf RC (1987) Human behaviour, cognition, and affect in the natural environment, Handbook of environmental psychology. In: Stokols D and Altman I (Eds). New York: John Wiley and Sons. 783-825.

Knox P (2011) Cities and design. Routledge.

Korpela K and Hartig T (1996) Restorative qualities of favourite places. Journal of Environmental Psychology 16: 221-233.

Korpela K, Hartig T, Kaiser F and Fuhrer U (2001) Restorative experience and self-regulation in favourite places. Environment and Behaviour 33: 572-589.

Korpela KM, Klemettilä T and Hietanen JK (2002) Evidence for rapid affective of environmental scenes. Environment and Behavior 34: 634-650.

Lamb RJ and Purcell AT (1990) Perception of naturalness in landscape and its relationship to vegetation structure. Landscape and Urban Planning 19: 333-352.

Laumann K, Gärling T and Stomark KM (2001) Rating scale measures of restorative components of environments. Journal of Environmental Psychology 21(1): 31-44.

Lei Y, Jin H and Wang J (2011) The current status and prospect of healing garden. Chinese landscape architecture 4: 31-36.

Li Q (2008) Visiting a Forest, but Not a City, Increases Human Natural Killer Activity and Expression of Anti-Cancer Protein. International Journal of Immunopathology and Pharmacology 21: 117-127.

Louv R (2008) Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder ISBN 13:978-1-56512-605-3.

Ludlow AM (1976) The function of windows in buildings. Lighting Research and Technology 8(2): 57-68.

Maikov K (2014) Landscape characteristics in Tartu City parks – user influences through Design. Sustainable city. In: Zubir SS and Brebbia CA (Eds). Sustainable City VIII. Vol I. Ashurst, UK: WIT Press. 353-364.

Muir J (1901) http://vault.sierraclub.org/john_muir_exhibit/writings/our_national_parks/chapter_1.aspx, 01.02.2016.

Nightingale F (1859) Notes on Nursing. Gutenberg Project: public domain.

Nordh H, Grahn P and Währborg P (2009a) Meaningful activities in the forest, a way back from exhaustion and long-term sick leave. Urban Forestry and Urban Greening 8(3): 207-219.

Nordh H, Hartig T, Hagerhall CM and Fry G (2009b) Components of small urban parks that predict the possibility for restoration. Urban Forestry and Urban Greening 8(4): 225-235.

Ottosson J and Grahn P (2007) The Role of Natural Settings in Crisis Rehabilitation. Landscape Research 33:51-70.

Pasha S and Shepley M (2013) Research note: Physical activity in Pediatric Hospital Gardens. Landscape and Urban Planning (118): 53-58.

Peschardt K, Schipperijn J and Stigsdotter UK (2012) Use of Small Public Urban Green Spaces (SPUGS). Urban Forestry and Urban Greening 11: 235-244.

Peschardt U and Stigsdotter UK (2013) Associations between park characteristics and perceived restorativeness of small public urban green spaces. Landscape and Urban Planning 112: 26-39.

Pollard R, Pevsner N and Sharples J (2006) Lancashire: Liverpool and the Southwest, Yale University Press.

Purcell AT and Lamb RJ (1984) Landscape perception: An examination and empirical investigation of two central issues in the area. Journal of Environmental Management 19: 31-63.

Richman N (1977) Behavior problems in pre-school children: Family and social factors. British Journal of Psychiatry 131: 523-527.

RWJF (Rober Wood Johnson Foundation) (2008) Where We Live Matters for Our Health: Neighbourhoods and Health ISSUE BRIEF 3: NEIGHBORHOODS AND HEALTH http://www.commissiononhealth.org/PDF/888f4a18-eb90-45be-a2f8-159e84a55a4c/Issue%20Brief%203%20Sept%2008%20-%20Neighborhoods%20and%20Health.pdf, 01.02.2016.

Searles H (1960) The nonhuman Environment in Norman Development and in Schisophrenia. New York: International University Press.

Sherman SA, Varnib JW, Ulrich R and Malcarned VL (2005) Post-occupancy evaluation of healing gardens in a pediatric cancer center. Landscape and Urban Planning 73: 167-183.

Skärbäck E (2007) Landscape planning to promote well-being: studies and examples from Sweden. Environmental Practice 9(3): 206-217.

Stern DN (1993) The role of feelings for an interpersonal self. In: Neisser, U (Ed). The Perceived Self - Ecological and Interpersonal Sources of Self-knowledge, Cambridge University Press. 205-215 p.

Stigsdotter AK and Grahn P (2002) What makes a garden a healing garden? Journal of Therapeutic Horticulture (13): 60-69.

Stigsdotter UK and Grahn P (2011) Stressed individuals' preferences for activities and environmental characteristics in green spaces. Urban Forestry and Urban Greening 10(4): 295-304.

Stigsdotter UK, Eksholm O, Schipperijn J, Toftager M, Kamper-Jørgensen

F and Randrup TB (2010) Health promoting outdoor environments – associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey. Scandinavian Journal of Public Health 38(4): 411-417.

Tenngart Ivarsson C and Hagerhall CM (2008) The perceived restorativeness of gardens: assessing the restorativeness of a mixed built and natural scene type. Urban Forestry and Urban Greening 7(2): 107-118.

The History of the Germ Theory (1888) The British Medical Journal 11415: 312.

Thompson CW, Roe J, Aspinall P, Mitchell R, Clow A and Miller D (2012) More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. Landscape and Urban Planning 105(3): 221-229.

Timmermann C, Uhrenfeldt L and Birkelund R (2013) Cancer patients and Positive Sensory Impressions in the hospital Environment – A Qualitative Interview Study. European Journal of Cancer Care 22 (1): 117-124.

Tinsley HEA and Johnson TL (1984) A preliminary taxonomy of leisure activities. Journal of Leisure Research 16: 234-244.

Tsunetsugu Y, Park BJ and Miyazaki Y (2010) Trends in research related to "Shinrin-yoku" (taking in the forest atmosphere or forest bathing) in Japan. Environmental Health and Preventive Medicine 15(1): 27-37.

Tyrväinen L, Mäkinen K and Schipperijn J (2007) Tools for mapping social values of urban woodlands and other green areas. Landscape and Urban Planning 79(1): 5-19.

Tyrväinen L, Ojala A, Korpela K, Lanki T, Tsunetsugu Y and Kagawa T (2014) The influence of urban green environments on stress relief measures: A field experiment. Journal of Environmental Psychology 38: 1-9.

Tyson M (1998) The healing landscape: Therapeutic Outdoor Environments. New York: McGrow-Hill.

Ulrich R (1983) Aesthetic and affective responses to natural environments. In: Altman I and Wohlwill J (Eds). Behavior and the Natural Environment. New York, Plenum 6: 86-125.

Ulrich R (1984) View through a Window May Influence Recovery from Surgery. Science 224: 420-421.

Ulrich R (1986) Human response to vegetation and landscapes. Landscape and Urban planning 13: 29-44.

Ulrich R (1999) Effects of gardens on health outcomes: theory and research. In: Marcus CC and Barnes M (Eds). Healing Gardens: Therapeutic Benefits and Design Recommendations. New York: John Wiley. 27-86.

Van den Berg AE, Maas J, Verheij RA and Groenewegen PP (2010) Green space as a buffer between stressful life events and health. Social Science and Medicine 70: 1203-1210.

Van den Berg AE, Vlek CAJ and Coeterier JF (1998) Group differences in the aesthetic evaluation of nature development plans: a multilevel approach. Journal of Environmental Psychology 18: 141-157.

Vroom MJ (1994) Designing with plants in rural and urban environments. The case of Netherlands. Acta Horticulturae 353: 112-117.

Wang X and Li J (2012) Analysis of the healing landscape and its relevant conceptions. Journal of Beijing University Agriculture 27(2): 71-73.

Warner SB (1995) Restorative Gardens: Recovering Some Human Wisdom for Modern Design. Unpublished paper.

Wence C (2016) http://www.ramboll.com/projects/viewproject?projectid=F73AC734-B657-48A0-AE92-0C8A85C8992A, 01.02.2016.

WHO (World Health Organization) (2006) Physical activity and health in Europe: Evidence for action. Copenhagen. WHO Regional Office for Europe.

WHO (World Health Organization) (1986) http://www.who.int/health-promotion/conferences/previous/ottawa/en/index1.html, 01.02.2016.

William J (1890) The Principles of Psychology. Vol 2. Dover Publications.

Wilson EO (1984) Biophilia. Harvard University Press.

I

ORIGINAL PUBLICATIONS

I

Maikov, Kadri; Bell, Simon and Sepp, Kalev (2008)
A comparison of the evaluation of room characteristics of healing gardens.
Design and Nature IV.
Wessex Institute of Technology Press. 223-232

An evaluation of the design of room characteristics of a sample of healing gardens

K. Maikov, S. Bell & K. Sepp
Landscape Architecture Department,
Estonian University of Life Sciences, Estonia

Abstract

The present paper discusses the evaluation and description of the landscape characteristics of a sample of healing gardens from the USA and England. Healing gardens are designed in such a way as to influence the visitor by provoking positive emotions and to help relieve the symptoms of stress or depression. The aim of the paper is to analyse a sample of healing gardens on the basis of eight characteristics that, according to the literature, should be present in a garden for it to be classified as a healing garden and that may also be considered some of the fundamental building blocks of parks and gardens in general. The term "room" is used to convey a sense that each garden consists of a set of distinct spaces that are separated from each other and which are experienced by visitors as part of a sequence. Rooms can be generally described using a specific name to which a set of characteristics is attached. Each room type (Serene, Wild, Rich in Species, Space, the Common, the Pleasure garden, Festive, Culture) was evaluated in terms of the degree to which the characteristics were present using the following scale: 0 – not present, 1– weak, 2 – medium, 3 – strong. Following this a description of the design characteristics was carried out from the point of view of landscape design elements and structure, including an assessment of presence of the sense of the personal/impersonal. The purpose of the investigation is to determine which characteristics are mostly frequently used in the design of healing gardens, which characteristics most strongly feature and to analyse the main design elements. In total, 40 healing gardens were visited, 20 from England (summer 2005) and 20 from various states in New England in the USA (summer 2006). There were no apparent differences between the characteristics of healing garden rooms between the countries (t-test). Correlations were found between the types "Rich in Species" and "Festive" (0.85) and "Culture" (0.85) which tends to be found together in the gardens. The types "Space" and "The Common" had a high correlation (0.8) in England. "Rich in Species" and "Festive" had a correlation (0.9) in the USA. Of the gardens studied, the types "Rich in Species" and "the Common" are distinguished by the strongest presence. The personal characteristic was found to be present less than the impersonal. The characteristic "The Pleasure garden" does not exist in most of the gardens – it is possibly an expensive solution. The existence of the characteristics in the gardens does not depend on the idea of the design as a whole, and the strength of the characteristics will tend to influence the users the most.

Keywords: healing garden, design, room characteristics, USA, England.

WIT Transactions on Ecology and the Environment, Vol 114, © 2008 WIT Press
www.witpress.com, ISSN 1743-3541 (on-line)
doi:10.2495/DN080231

1 Introduction

Berggren-Bärring and Grahn have evolved the concept of the landscape room containing different characteristics [1] that are necessary for a landscape in order to make it a healing landscape [8]. The idea of a room is a separate space that may be experienced separately from other spaces, perhaps in a predefined sequence, in a garden or landscape. The characteristics of each room type together constitute symbols that manifest themselves through many different sensations: via sight, hearing, locomotion, etc [3–5, 8].

Some landscape room characteristics are found in conventional gardens, but their presence alone does not make a garden a healing garden (in this context to help the recovery from a number of mental health problems/illnesses such as clinical depression). A healing garden is therefore designed specifically to provide experiences to users through their senses, speeds up the healing process involving other therapies and study methods and gives support for low-key actions. The environment of a healing garden is bounded/guided/involving.

The experience of nature affects people differently, depending in part on their life situation [11]. There are different levels of action by human beings in outdoor areas (ranging from active behaviour with other people to sitting alone). How much does the environment support these actions? People use their senses differently on different occasions, but if outdoor situations (wind, sun, colours) are normal, there is participation in the environment by the senses on two different levels:

a) Impersonal experience: looking, hearing, smelling – receiving stimuli passively
b) Personal experience: looking, hearing, smelling + touching and tasting – seeking out stimuli actively.

In everyday life, people may tend to use the first level and, for deeper purposes, the second level. Among the eight selected characteristics studied in this research, five of them can be considered as impersonal room characteristics (see Appendix 1). In addition, the environment itself will suggest possible actions to the visitor. For healing purposes, the garden user has to engage with the landscape at the personal level.

Nowadays, in landscape design it may not be enough to deal merely with classical design themes, styles or client's wishes, but also its healing or restorative aspects should be given more attention. Design therefore should provide more than a sequence of outdoor spaces or rooms and views, but also develop place identity and if desired, should support different healing stages (by the use of stone/water, plant, animals, other people). There has been a little evaluation of the garden rooms where the healing process takes place outdoors. Area range of different therapies may be used by practitioners in the garden, but how is it possible to tell if the garden supports action? What characteristics occur most frequently in the rooms? Which of them are used less and why? If only impersonal and personal possibilities are taken into account without considering what people can do in different areas possessing different characteristics - there are interesting values which may remain hidden.

The healing gardens assessed in this study are generally not publicly accessible and are mainly used by patients and staff in different hospitals or institutions. In England the gardens are, as a rule, meant for purposes of rehabilitation or general use by convalescing people in hospitals, while in the United States they are for general use in hospitals. The gardens of both countries belong to two different generations of design and degree of maturity. In most gardens, cognitive therapies are used by therapists with different patients.

2 Method

The sample of healing gardens was obtained from a public database [6] and the compliance of these with best practice was checked from published literature. Altogether, 40 healing gardens were visited, 20 in England (summer 2005) and 20 from different states in New England in the USA (summer 2006). The choice was based only on the presence of a garden region. Garden types (such as specifically for Alzheimer patients, rehabilitation, child treatment, etc.) were not differentiated in this study because the sample size of each was insufficient for statistical analysis. Where possible, the healing gardens were designed to be divided into physical "rooms" – some being more natural areas, made of living materials and bordered with trees as enclosure and separation from each other. Each "room" was evaluated separately.

Each room was evaluated in terms of the degree of presence of the thematic attribute: "Serene", "Wild", "Rich in Species", "Space", The Common", "The Pleasure Garden", "Festive" and "Culture" (see Table 1) using a four-point scale (0 – not present, 1 – weak presence, 2 – medium presence, 3 – strong presence). Table 2 describes the criteria for each theme against the scale. There were no statistically significant differences between the characteristics of healing garden rooms in either country (t-test).

3 Results

Table 3 shows the complete set of scores for each room type across the samples, firstly for the entire sample and then the English sample followed by the American sample. Bold numbers denote scores with a significance of density of appearance.

3.1 Analysis of the characteristics of the sampled healing gardens

Overall, a high proportion of the evaluated characteristics received a very low score. The quality of the gardens and characteristics showed extreme values: there were some gardens, the design of which included all aspects while others only included a few characteristics. The most strongly represented characteristic in most gardens is "Serene" (55% of the cases) while the "Pleasure garden" is rarely found (25% of the cases). Other characteristics tend to be show a weak presence (40%).

Table 1: Name and description of the room characteristics used in the study [1] with personal-impersonal division and picture by author.

The eight garden room characteristics	Description of the garden rooms	Personal or impersonal characteristic	Picture of the character
A. Serene	Peace, silence and care. Sounds of wind, water, birds and insects. No rubbish, no weeds, no disturbing people	impersonal	
B. Wild	Fascination with wild nature. Plants seem to be self-sown. Lichen- and moss grown rocks, old paths	personal	
C. Rich in Species	A room offering a variety of species or animals and plants	personal	
D. Space	A room offering a restful feeling of "entering another world" a coherent whole, like a beech forest	impersonal	
E. The Common	A green, open place providing vistas and inviting the user to stay	impersonal	
F. The pleasure garden	An enclosed, safe and secluded place, where you can relax, be yourself and also experiment and play	personal	
G. Festive	A meeting place for festivity and pleasure	impersonal	
H. Culture	A historical place offering fascination with the course of time	impersonal	

Table 2: Description of ratings.

Serene	
1	None
2	Too much confusion to the senses – does not achieve the goal
3	Is present and produces the desired sensations
4	All characteristics are present in all rooms. Strong man-made feeling yet powerful sense of the serene
Wild	
1	None
2	Link to nature with at least one characteristic (e.g. Wild trees). Weakly tied with "wild" character meaning.
3	Connects to nature. Living material naturally belongs there.
4	Deep fascination of nature with culture taste
Rich in Species	
1	None
2	Not so rich in species. Design is developed more to reflect other characteristics
3	Different feelings in different rooms – made by variety of living material. On average rich in species
4	Rich in diversity of both animals and plants
Space	
1	None
2	Space present, but no restful feeling
3	Different characters in different rooms with strong ability to connect (eg beech, water)
4	To "other world" through use of plants
The Common	
1	None
2	Present in lonely places/corners where some interesting design solutions are used. Consists of only one element
3	Green, open, but does not invite the user to sit there or invites the user to sit, but is not open: incomplete character
4	All elements are present,
The Pleasure garden	
1	None
2	Weak, pleasurable aspects are not well designed together
3	Close, safe, separated, user can be his or herself in a well designed setting
4	All features present, one room available for one person to enjoy
Festive	
1	None
2	Presented weakly, with only one key character present
3	Both characters present but, one stronger than the other or neither very strong
4	Easy, open space offering gatherings in any way ; versatile space
Culture	
1	None
2	Presented weakly, attractive for a short time, user can enjoy touching an object
3	One main element present enabling the user to forget the time – connecting the users of the area
4	Significant part of the garden, strong characteristics presented enabling users to forget the time and environment completely

Table 3: Evaluation results of marks together and by country in graphic.

All together

	A	B	C	D	E	F	G	H
3	**55,0%**	15,0%	22,5%	17,5%	22,5%	15,0%	7,5%	10,0%
2	17,5%	15,0%	22,5%	20,0%	17,5%	7,5%	**25,0%**	17,5%
1	17,5%	**37,5%**	**40,0%**	**37,5%**	**45,0%**	2,5%	**47,5%**	**40,0%**
0	10,0%	**32,5%**	15,0%	**25,0%**	15,0%	**75,0%**	20,0%	32,5%

England

	A	B	C	D	E	F	G	H
3	**55,0%**	**25,0%**	**30,0%**	30,0%	20,0%	10,0%	10,0%	15,0%
2	15,0%	5,0%	15,0%	5,0%	20,0%	10,0%	20,0%	5,0%
1	20,0%	**35,0%**	**40,0%**	**40,0%**	**50,0%**	5,0%	**45,0%**	**40,0%**
0	10,0%	**35,0%**	15,0%	**25,0%**	10,0%	**75,0%**	**25,0%**	**40,0%**

USA

	A	B	C	D	E	F	G	H
3	**55,0%**	5,0%	15,0%	5,0%	**25,0%**	20,0%	5,0%	5,0%
2	20,0%	**25,0%**	**30,0%**	**35,0%**	15,0%	5,0%	**30,0%**	**30,0%**
1	15,0%	**40,0%**	**40,0%**	**35,0%**	**40,0%**	0,0%	**50,0%**	**40,0%**
0	10,0%	**30,0%**	15,0%	**25,0%**	20,0%	**75,0%**	15,0%	**25,0%**

In England, the healing gardens sampled are designed with strong constructed views, a sense of cohesion and use of natural voices, with non-disturbing factors used to induce calm. On the basis of the evaluation results, the strongest scores were: "Serene" – 55%, "Rich in Species" – 30% and "Wild" – 25%. There is a tendency for country gardens to be more nature-oriented in their design and to have more opportunities for personal contact. The "Pleasure Garden" was only found in 25% of the cases. Other characteristics are found to a lower degree. The two themes "Space" and "The Common" were strongly correlated (0.8), indicating that they are frequently found together in gardens. This could be accounted for by the use of the typical approaches to English garden design.
In the USA, the same characteristics tended to have lower scores than in England. High scores tended to be associated with impersonal characteristics like "Serene" – 55% and "The Common" – 25%. While other characteristics were almost equally represented at a low level in England, by contrast the gardens of the American sample show a low and middle level of presence (average of 40%). Cohesive characteristics are associated strongly with "Festivity" and the "Pleasure Garden" – in both cases the correlation was (0.9). There are fewer personal characteristics to be found in the landscape than impersonal ones.

3.2 Completion of descriptions of room characteristics

Detailed descriptions of the characteristics were developed for the evaluation of the garden rooms in a similar fashion to those adopted for parks in urban areas.

The goal was to complete a description specifically considering aspects of healing gardens. Through the perspective of a landscape designer the following descriptions were developed from the initial descriptions found in Berggren-Bärring and Grahn [1].

A. Serene You will find peace, silence and a sense that the emotions of the visitor are reflected by the room itself. Sounds of wind, water, birds and insects are present while rubbish, weeds, or disturbing people are absent [1]. Clean and clear areas in man-made nature are highly preferred. Well-cared for area and natural sounds are the key words that describe this theme, together with a strong safe man-made feeling. This atmosphere suits the purpose of the garden and has a safe environment, especially appropriate in hospital situations. The design should create as natural an environment as possible; the most frequent activities are one-person, passive and impersonal.

B. Wild This theme shows a strong fascination with wild nature. Plants are designed to seem self-sown. Lichen- and moss-grown rocks and old paths reinforce this [1]. Nature itself is a very inspiring element in the design. The room characteristic is achieved by playing with a mix of live and non-living or dead materials to show a sense of safe mixed nature. The purpose of the characteristic is to stimulate the user to see and touch, to make the user discover their surroundings and to make them feel. This can be used by groups and individuals with personal contacts included in the opportunities.

C. Rich in Species The room includes a variety of species of animals and plants [1]. The characteristics will show the diversity of nature. It is used to draw the users' attention to different elements, compositions, and colours. Richness itself offers personal contact and a lot of social factors between users and their inner life. A range of design techniques are strongly recommended for this theme.

D. Space This theme presents a room offering a restful feeling of "entering another world", a coherent whole, for example a beech forest [1] or *Salix fragilis* 'Bullata'. There is a good opportunity to create a single, simple structure in order to create or stimulate clear, easy understandable, mystical feelings. It allows for working more with the user's inner life, where it is good to use the environment simply to breathe in and out, enabling a person to stay in the area for a longer time. It shows an impersonal characteristic.

E. The Common A green, open place allowing vistas and encouraging users to stay [1]. It is an open characteristic room with another room material. Simple sitting opportunities with different types of views, vistas, textures and colours play in the distance, creating safe man-made views. In this open space the visitor is visible to other users and therefore is less likely to be as relaxed as in some of the other room types.

F. The Pleasure Garden An enclosed, safe and secluded place where you can relax and be yourself and also experiment and play [1]. It is usual to have small gardens suitable for individuals inside larger ones with promising elements to use. The gardens should be designed with living materials that can be moved from one place to another - big-leafed plants that provide a sense of security are preferred – so as to be able to create different spaces and experiences. This type is intended mainly for personal actions.

G. Festive A meeting place for festivity and pleasure [1]. There are opportunities to feel free and without constraints. There could also be a small garden element for performance, such as an extra room, for example a lawn area for gathering on any occasion. This theme offers impersonal communication.
H. Culture A historical place, offering fascination with the passing of time [1]. It is good to focus on man-made or natural elements of different ages, such as stones. Materials such as stones or plants which change their texture or colour according to different weather conditions are also preferred. It is a room of open-character with some strong vistas.

4 Discussion

The aim of the design is to create garden rooms that are not too abstract, unfamiliar, or challenging [5], but supportive of the intended actions in terms of healing needs. According to Grahn, when person is going to the garden, then he or she first touches a stone or some water, then plants and animals after which he or she expects to see another human being. Some characteristics can be found almost everywhere in outdoor spaces, but this does not mean that these rooms or themes are linked or are related to the user in the same way as in a healing garden context.

The room characteristics under comparison received some extreme values, from very high to very low or absent. In most cases, the sampled gardens scored quite low ratings. The American sample contained most of the selected room characteristics, usually having average scores. According to Berggren-Bärring and Grahn of the eight garden room characteristics the types “Serene”, “Space” and “Culture” appeal to many people. “The Common” tends to appeal to vulnerable people and the “Festive” to stressed people. It is easy to understand the existence or non-existence of the characteristic in the landscape. However, the characteristics also have to be interpreted in terms of local meanings. The current study has also demonstrated that at least five of the eight characteristics should to be present in order for a garden to be classified as a healing garden, which confirmed the results of previous studies [7]. To see the situation in terms of personal/impersonal characteristics there should be more personal than impersonal. There could be more opportunities for landscape design to create more linkages between spatial elements, design materials, and people.

In terms of the analysis of the results some interesting pictures emerged. “Rich in Species” had high correlations with “Festive” (0.85) and “Culture” (0.85). This connection suggests that a good combination in a design includes all impersonal action categories are linked with personal contact possibilities through the richness of materials used to create a coherent design; the characteristics have to be more strongly differentiated in order to support the actions of users and to assure their safety. In the sample, the “Serene” and “Festive” are distinguished by a generally stronger presence.

There are also some differences between the gardens of England and the USA. English gardens are found to be more orientated towards closeness to nature than the American, which are more supportive of social actions.

There are fewer personal characteristics found in the rooms than impersonal characteristics. It was also interesting that the "Pleasure garden" type is rarely found (25%). The reason for this may be the expense of construction and maintenance. The types "Wild" and "Space" also received a low rating, 32.5%, and 25% respectively.

There are two personal characteristics, "Wild" and "Rich in Species", that rated as being strong presences and which communicated the most with garden users; these are also the only room characteristics that are impossible to imitate indoors. It also appears that the characteristic "Festive", which helps to generate different feelings in different life situations and for the mood of users that it is most difficult characteristic for a designer to create.

The completion and extension of the characteristics of each theme type described here and related to user activities and therapeutic values should help designers to adapt and develop spaces so as to increase the healing potential of the rooms. This implies that following the descriptions requires understanding of the designer's point of view and language.

The evaluation method adopted in this study appeared to work well in differentiating between different room characteristics of all the samples and therefore it should be widely applicable as a tool for evaluating any healing garden.

The general idea was to find the key room characteristics that relate strongly to certain types of healing processes. Walking through the rooms helps users to orientate themselves and also to find the rhythm in the design. The next step of the scientific task is to find out if the order of the rooms is important for the most effective healing process. It is also important to understand how the message of the journey from room to room affects the healing process.

5 Conclusions

Evaluations of the characteristics of rooms within healing have so far not been attempted from the point of view of the design elements. This study has demonstrated that the eight room characteristics, originally developed for evaluation of urban parks, could also be used in the description and evaluation of healing gardens. The selected room characteristics are easy to recognise in healing gardens. This work has also added to the comprehension of the role of the personal and impersonal user opportunities and interprets them from the point of view of a landscape designer. Room characteristic descriptions were completed from the sample of gardens. The next stage of development is to understand the role of sequence and how to develop rooms that reflect different personal characteristics in order to relate to the user's inner life. The analysis of the strength of the existence of the characteristics yielded an extreme range in the English sample and a different set of associations in the American examples. "Rich in Species" had a high correlation with "Festive" (0.85) and "Culture" (0.85). "Space" and "The Common" had a high correlation (0.8) in England. "Festivity" and the "Pleasure Garden" both showed a correlation of (0.9) in the USA. This work developed and completed descriptions of room characteristics

so as to be useful for designers; the existence of these characteristics in the sample gardens showed some correlations. The current work provides a better guide to the design of healing gardens. The next steps, having improved the description of the individual room's types is to test the order of the rooms in different sequences to meet different therapeutic goals. It is also important to determine how such sequences contribute to the message of the journey and how this affects the therapeutic response.

References

[1] Berggren-Bärring A-M and Grahn P, Importance of the single park area on experienced characteristics. *Ecological aspects of Green Areas in Urban Environments.* IFPRA World Congress Proceeding, 110. Antwerp, Flanders, Belgium: September 1995

[2] Cooper Marcus and Barnes *Healing gardens: Therapeutic benefits and design recommendations.* New York: John Wiley and Sons 1999

[3] Grahn, P Om parkers betydelse. *Stad & Land* . Movium/institutionen för landskapsplanering, Sveriges Lantbruksuniversitet, Alnarp. 1991

[4] Berggren-Bärring, A-M. & Grahn, P. Grönstrukturens betydelse för användningen: En jämförande studie av hur människor i barnstugor, skolor, föreningar, vårdinstitutioner m fl organisationer utnyttjar tre städers parkutbud. *Landskapsplanering Rapport 95:3,* Alnarp. 1995

[5] Berggren-Bärring A-M. & Grahn, P. Importance of the single park area on experienced characteristics. *Ecological Aspects of Green Areas in Urban Environments.* IFPRA World Congress Proceedings, 110. Antwerp, Flanders, Belgium: September. 1995

[6] Hedfors, P. & Grahn, P. Soundscapes in urban and rural planning and design. *Yearbook of Soundscape Studies* 1: 67–82, 1998

[7] Maikov, K. A comparison of the room characteristics of healing gardens in landscape design on the example of the United States and England. COST E39 conference publications. 2007

[8] Stigsdotter U, Grahn P. What makes a garden a Healing garden? *Journal of Therapeutic Horticulture*, vol 13, pp 60–69, 2002

[9] Stigsdotter U, Grahn P. Experiencing a Garden: A Healing Garden for People Suffering from Burnout Diseases, Journal of Therapeutic Horticulture, vol 14, pp 38–49, 2003

[10] THERAPEUTIC LANDSCAPE DATABASE, http://www.healinglandscapes.org/, 12.06.2006

[11] Ottosson, J. & Grahn, P. Utemiljöns betydelse för äldre med stort vårdbehov. *Stad & Land 155.* Movium/institutionen för landskapsplanering, Sveriges Lantbruksuniversitet, Alnarp 1998

II

II

Maikov, Kadri (2014)
Landscape characteristics in Tartu City parks –
user influences through Design. In: Zubir SS and Brebbia CA (Eds).
Sustainable City VIII. Ashurst, UK: WIT Press.
353-364.

Landscape characteristics in Tartu City Parks: user influences through design

K. Maikov
Estonian University of Life Sciences, Estonia

Abstract

The greeneries on city maps are usually covered in large green areas, but that does not reveal much. The important factors to be considered in relation to greenery are, for example, distance, visiting frequency and accessibility. In the current study, *all* of the 92 urban green spaces (UGS) of the Estonian city Tartu are explored from a health perspective along with the landscape characteristic. The main purpose is to prove statistically how the parks are influenced by landscape elements using Sears' theory (1960) and main aspects. The CAD maps are represented by topics and graphs illustrating the situation in Tartu. Green room elements are found using Sears' theory: water/stone, plants, animals and other people. The main aspects are trees/plants, peace/openness, senses and visual elements. The health-promoting landscape characteristics are serene, wild, rich in species, spacious, prospective, refuge, festive and cultural. The parks were assessed by an expert group in the summer of 2011. The work is unique, thanks to the fact that the information is gained from greenery – albeit can be found and felt (information from the surrounding environment and direct reflections of consciousness through the senses). Green spaces characterised by serenity have a statistical correlation (Pearson) with peace/openness ($r=0.459$, $p<0.01$) and with senses ($r=0.486$, $p<0.01$). Wilderness characteristic and trees/plants are also in correlation ($r=0.423$, $p<0.01$). According to literature, design is the least influential aspect in landscape. The author can statistically prove that design is strongly correlated with user influence through the senses ($r=0.501$, $p<0.01$), and not visual aspects, as was expected in the case of Tartu. Landscape characteristics are the attributes that landscape architects can use for design work.
Keywords: PSD (Perceived Sensory Dimensions), CAD maps.

WIT Transactions on Ecology and The Environment, Vol 179, © 2013 WIT Press
www.witpress.com, ISSN 1743-3541 (on-line)
doi:10.2495/SC130301

1 Introduction

1.1 Tartu

Tartu received its first public park Toomemägi from Emperor Paul I of Russia thanks to the University of Tartu in 1799. The activities in the park were designed by architect J. W. Krause [1]. Tartu is well equipped with greeneries. Tartu is a healthy and health-promoting city [2] with 390.3 ha (10.1%) of parks and greeneries. All the residents are living within a 300 m zone from a public space (79%, 79,385 people) [3]. More than 50% of the space in the Ihaste neighbourhood is under greenery. All 92 greeneries were evaluated. They were located as follows: 24 UGS in the city centre, 11 in Tähtvere, 8 in Ihaste and Annelinn, 7 in Raadi-Kruusamäe, Karlova and Ülejõe, 6 in the Maarjamõisa neighbourhood, 4 in Tammelinn, 3 in Jaamamõisa, 2 in Ropka and the Ropka industrial district and 1 in Veeriku, Vaksali and Supilinn. There were none in Ränilinn.

1.2 Landscape characteristics

Landscape characteristics [4]/PSD [5] are a landscaping concept entailing different space properties [4], which are necessary in order to make a landscape a healing one [6]. In a healing environment of landscape characteristics [5], each space property manifests itself through the senses such as sight, hearing, movements [4, 6, 7].

1.3 Tyson

Tyson [8] has found that most users – 69% – are influenced by trees/plants (trees, flowers, colours, seasonality), 50% are influenced by psychological aspects (peace/openness), 26% by senses (animals, wind, fresh air), and 17% by visual values (design, views, elements). The greenery in Tartu looks modest.

1.4 Public health

Public health has always been an important objective in city planning. Evidence about the positive impact that natural environments have on people is based on evolution theories. According to some authors, features such as vegetation, bubbling water, openness, savannah-like spaces, birds and safety impart a sense of belonging to people [9]. Evidence gathered from historical research and surveys indicates that most city residents attach considerable importance to urban forests and parks, and that views of trees, grass and open spaces provided by such settings are considered to be very important environmental amenities [10, 11]. At a general level, one consistent finding has been that the presence of vegetation, especially trees, has a positive impact on preference [12]. It appears that many, if not most urbanites derive greater benefit from viewing natural scenery and passively enjoying other natural amenities in parks than from active

recreation [12]. In total, an estimated average of 220 hours per person is spent in urban open green spaces every year [13].

1.5 Some senses

Some senses can be defined as distance senses (vision, hearing and, to some extent, smell), while other senses are nearness senses. The brain interprets information from all our senses together with memories of earlier episodes, which gives us a full experience and understanding of our environment [14].

1.6 Sears

Sears [15] also pointed out that signals from nature act as a catalyst, sparking creative processes that are important for restoration. Our relations to other people are the most complex, while the simplest ones happen between inanimate objects, e.g. stones, and us. Plants and animals remain somewhere in between.

1.7 Design issues

Greeneries have been well-known throughout history and dendrology. The designs have simply incorporated trees and used only a few accessories in different areas that are small or have no space. Trees are used as accents, there are views to lawn areas etc.

2 Methods

2.1 Evaluation of parks

The group visited all parks together during four days, spending approximately 15 minutes in each park or UGS. While in the park, the group discussed and agreed upon an evaluation. All the theories were read out loud in every single park and, the park/UGS was evaluated according to the scale (impression of the entire park), and the result was entered into prepared tables. Public spaces were valued under the topic: green living city nature.

2.2 Expert group

The expert group was hired by the main author. The members had graduated with a landscape architect degree, had followed an environmental psychology course and were familiar with the theories and methods used in the study thanks to their lectures and exercises. A three-person expert group evaluated the parks in the summer of 2011.

2.3 Creation of CAD MAPS

Various topic maps were created using layers named after topics. The assessment scale was transformed into three colours (0 – was not used on CAD maps): light-

toned – low presence (1); mid-toned – medium presence (2); dark-toned – strong presence (3).

2.4 Statistical analysis

The data were entered in an Excel table and analysed in SPSS (version 2.0). Information about each park was coded. The main codes followed the assessment scale (0–3). The correlation matrix in SPSS was made using the Pearson linear correlation, following a probability level for finding connections. In this paper, strong connections start from the value 0.4. For statistical significance, the following was used – $p<0.01$. Very important connections (99% believable) are marked with ** in the tables.

2.5 Theories: landscape characteristics

In this study, the author used the original terminology related to the theory.

Serene – peace, silence and caring. Sounds of wind, water, birds and insects. No rubbish, no weeds, no disturbing people [4]. The main aim is to hear sounds, and the main senses are hearing, thinking and feeling the temperature. In such a landscape one can find pure city nature that one expects to be comfortable; something that all parks possess.

Wild – fascination with the wild. Plants seem to be self-sown. Lichen and moss grow on rocks, there are old paths [4, 6]. The park is described as dynamic and having inner vitality contained in untouched nature, where plants are still growing and maintaining themselves. The space offers users the opportunity to feel the power of nature and its dominance over humans. The atmosphere makes people feel safe and imparts a feeling of togetherness [16]. Untouched natural environments are assessed according to criteria concerning public spaces.

Rich in species – a space that offers a variety of species or animals and plants [4]. Characteristics that offer experiences with different forms of life and diversity (birds, animals, butterflies, flowers). People are very keen to gain experiences through cognition [16]. The space is expected to be rich in species and abundant in greenery.

Space – a space that offers a relaxing feeling of "entering another world", a coherent whole, such as a beech forest [4]. The feeling is based on openness and freedom, and the different parts of the space are felt as a whole [16]. Typically, there are collections of tree trunks in well-maintained areas.

Prospect – a green, open space that provides vistas and invites the user to stay [4]. The space is characterised by openness, crudeness through panoramic views, and lots of room for activities that need it (ballgames, picnics, social events) [16].

Refuge – an enclosed, safe and secluded place, where you can relax, be yourself and also experiment and play [4]. The user can see others engaging in activity, many trees, bushes, and higher plants [16]. There are little intimate places inside larger areas.

Festive – a meeting place for festivity and pleasure [4]; a space that offers a place for entertainment or social events. Everything is organised and the users do

not have to engage in preparing the space [16]; landforms such as small hills and fossa.

Culture – a historical place that lets the users feel fascinated by the passing of time [4]. The characteristic itself entails human culture. The significant issues are the historical aspects, how people created value from the environment and how they interconnected the context of culture and nature, where myths and symbols played an important role [6, 16]. In the case of Tartu, these aspects are ruins.

2.6 Theories: Tyson's main aspects

Plants, psychological aspects, senses and visual values were counted as a percentage of greenery.

2.7 Theories: Sears' elements

Water/stone, plants, animals and other people are found by answering "Yes/No", while noting the elements' accessibility.

3 Results

3.1 Landscape characteristics (Figures 1 and 2)

Overall, the author can say that the landscape characteristics can be found in the parks, at least on a low level (1). In that context, the author can divide the landscape characteristics into overall characteristics such as Serene, Wild, Space, Rich in species, and specific characteristics such as Culture, Festivity, Prospect, Refuge. In Tartu, serenity is represented in mid-toned colours in larger greeneries. Wild is mostly found in mid-tones; it is very much present in the perimeter greeneries of the city, based on the historical background. Half of the greeneries are Rich in species thanks to the dendrologic variety of our parks; species-richness is highly represented in the south-west greeneries. Space can be found in the larger areas of the greeneries at the city's perimeter. Festivity is present in certain special places (Toomemägi, ERM and the Botanical Garden) in square-shaped small areas, and represented by mid-toned colours. Culture, Prospect and Refuge can also be found in some special areas.

3.2 Elements of Sears' theory

A connection between a person and water/stone was felt in 55% of the cases. Ülejõe and Vaksali had an advantage thanks to a fountain. Neither of the two could be touched in the Supilinn and Veeriku neighbourhood. Plants growing in the Tartu City greeneries can be found in 99% of the cases. The missing one percent comes from the front yard of the University of Tartu Library. Animals were present in 64% of the parks (Veeriku, Vaksali and Supilinn). 78% of all the greeneries are conversation-friendly. There are no possibilities for conversation in the Ropka neighbourhood.

Figure 1: Landscape characteristics in Tartu (strong presence).

3.3 Main aspects (see Tables 1 and 2, Figure 3)

The author can statistically prove that design is strongly correlated with user influence through the senses ($r=0.501$, $p<0.01$). Senses/peace and openness are correlated as follows: $r=0.412$, $p<0.01$. The main aspects provide a variety of senses and different types of visual experiences – mostly various constructed views in case of Tartu. The characteristic serenity is in correlation

with peace/openness ($r=0.459$, $p<0.01$), with senses ($r=0.486$, $p<0.01$) and with visuals ($r=0.412$, $p<0.01$). The characteristic wilderness correlates with trees/plants ($r=0.423$, $p<0.01$). The characteristic prospect is connected with visuals ($r=0.431$, $p<0.01$).

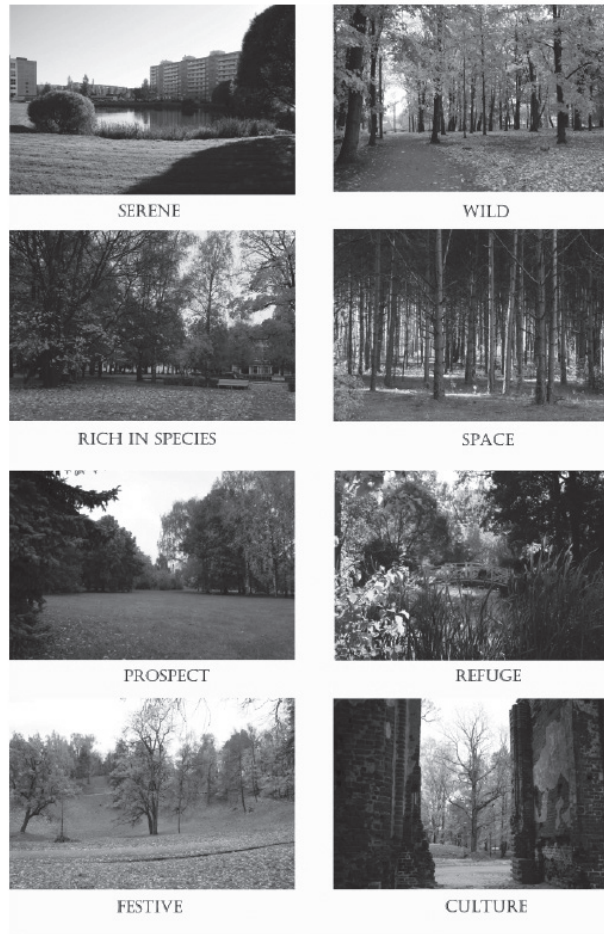


Figure 2: Photos of the landscape characteristics in Tartu parks.

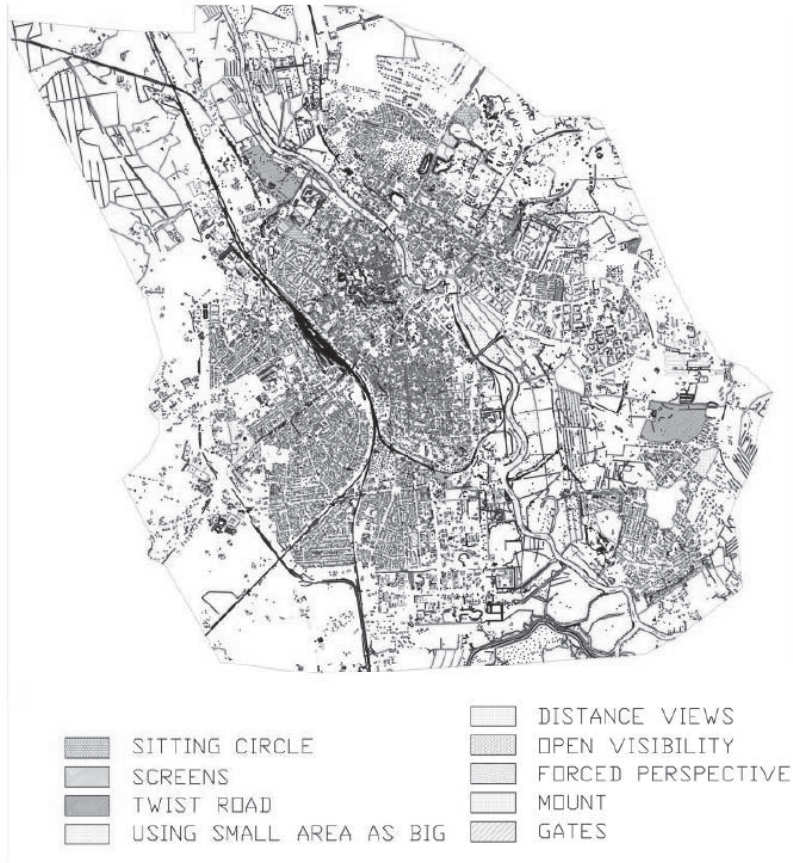


Figure 3: CAD MAP Tyson_visual aspects (different types of views).

Table 1: Main aspects to influence user in landscape through design N=92.

	Trees/plants	Peace/wideness	Senses	Visuals
Trees/plants	1			
Peace/wideness	-0,017	1		
	0,873			
Senses	,238*	,412**	1	
	0,022	0		
Visuals	,231*	,373**	,501**	1
	0,027	0	0	

Table 2: Landscape characteristic versus Main aspects N=92.

	Trees /plants	Peace /wideness	Senses	Visuals
Serene	,389**	,459**	,486**	,412**
	0	0	0	0
Wild	,423**	0,124	0,148	-0,057
	0	0,238	0,158	0,589
Rich in Species	,294**	0,141	0,111	0,167
	0,004	0,179	0,292	0,111
Space	,397**	0,196	0,079	,301**
	0	0,061	0,452	0,004
Prospect	0,145	,227*	0,173	,431**
	0,168	0,029	0,098	0
Refuge	,218*	,220*	,296**	,244*
	0,037	0,035	0,004	0,019
Festive	-0,2	0,09	0,1	0,103
	0,056	0,394	0,341	0,329
Culture	-0,056	0,06	0,143	,342**
	0,593	0,571	0,173	0,001

4 Discussion

4.1 Landscape characteristics

Literature on forest aesthetics clearly indicates that observers prefer park-like settings [17] as city residents get greater benefit from viewing the natural city scenery [12], which is also confirmed by visual aspects. Health promotion is the most sensitive to disruption, because these dimensions – Serene, Space and Rich in species – require large areas of land [4]. This study can confirm that Serene can be found in large green areas [5]. The author's earlier works confirm the same results while looking at the environment through landscape characteristics, considering the presence of the personal/impersonal feeling [18]; Bell calls these distance senses [14]. The overlapping of descriptions is a problem associated with landscape characteristics [19]. There can also easily be several landscape characteristics in one place – the most influential is the one marked in bold tones. Looking at the landscape, it is important to find eight characteristics, which do not overlap. Based on characteristics and theories, there can be many layers in the same place (design themes or topics). It is also easier to work with natural material in the city – there are no changeable factors, the user can experience many different aspects. If such information is gathered directly from the landscape with exact descriptions, it is also easier to find the characteristics and the results will be clearer – an average person (without any disabilities) can get the same results even after decades (landscape characteristics are developed based on the park environment). This paper confirms that the characteristic of Prospect and visuals are related. As landscape characteristics function in one cultural room, this study confirms that the wilderness characteristic in Estonia is connected with trees and plants. Considering studies carried out in Sweden, it is

comparable to the ancient wilderness found in the forest. Comparing the existence of the serenity characteristic to the healing gardens of England, then it can be said that serenity is prominent in Estonia [18]. While the information is related to greeneries that are similar, then the statistical results are not so highly correlated in case of parks due to the level of the work method used. Compared to papers on healing garden characteristics [5], there are stronger correlations in healing gardens. Serenity is connected with all the expected visual dimensions. In order to have more characteristics in a park, smaller gardens could be incorporated into larger ones. The authors of landscape characteristics have revealed that serenity, spaciousness and culture appeal to many people; vulnerable people often see commonness and stressed people see festivity. Based on the existence of characteristics in Tartu, and the other articles published, the author showed that the characteristics wilderness and serenity, refuge and space, culture and festivity exist together in Tartu greeneries.

4.2 Main aspects and elements

All the visual aspects were correlated to serenity. Considering greenery, it can be said that the descriptions of characteristics do not focus on the absence of things, but on all three visual main aspects.

4.3 Design

The design and the contents of the outdoor environment seem to be of importance for the recovery of a stressed individual visiting the environment [13]. These findings suggest that when designing gardens and selecting garden features, attention should be paid to person–environment transactions in addition to person–person transactions [20]. Landscape architects require more than knowledge of the types of preferred settings; the designed settings must also support the behaviours they were intended for if they are to be successful [21]. The design-to-senses correlation was a surprise, because few landscape accessories in design actually have another dimension.

5 Conclusion

Landscape characteristics are developed further to PSDs and the author found that there are also other ways such as landscaping, the interaction between the user and other dimensions. They were developed on the basis of city parks and are excellent for evaluating parks. This paper added some visual dimensions like Sears' elements and the main aspects that influence the user most in the landscape, and interpreted them from the point of view of a landscape designer. Some of the results that came up were very useful, such as the finding that the design and the senses are connected in Tartu. Judging from the results, the author can say that Tartu is a healing city based on greeneries. It is important to keep all eight landscape characteristics in the landscape arena. It's important to know all the information there is to know about the landscapes where people are sent to heal, while talking about gardens and stressed people who use public parks.

Acknowledgements

Digital CAD-MAP was received from Tartu City Government through a bilateral agreement between them and Estonian University of Life Sciences.

References

[1] Kudu E, Toome pargi ajalugu, 1971.
[2] TARTU LINNA TERVISEPROFIIL 2008, Tartu LV, 2010.
[3] Aleksandrovaite, L. Tartu elanike juurdepääs avalikele haljasaladele ning avalike haljasalade kvaliteedi analüüs. EPMÜ KKI. Tartu, 2004.
[4] Berggren-Bärring A-M and Grahn P, Importance of the single park area on experienced characteristics. Ecological aspects of Green Areas in Urban Environments. IFPRA World Congress Proceeding, 110. Antwerp, Flanders, Belgium, 1995.
[5] Stigsdotter, U. K., Grahn, P., Stressed individuals' preferences for activities and environmental characteristics in green spaces. Urban Forestry & Urban Greening, 10(4), pp. 295–304, 2011.
[6] Stigsdotter, U. A., Grahn, P. What makes a garden healing garden? Journal of Therapeutic Horticulture, 13, pp. 60–69, 2002.
[7] Berggren-Bärring, A-M. & Grahn, P. Grönstrukturens betydelse för användningen: En jämförande studie av hur människor i barnstugor, skolor, föreningar, vårdinstitutioner m fl organisationer utnyttjar tre städers parkutbud. Landskapsplanering Rapport 95:3, Alnarp. 1995.
[8] Tyson M, The Healing Landscape: Therapeutic Outdoor Environments, McGraw-Hill, 1998.
[9] Ulrich, R, Effects of gardens on health outcomes: Theory and research. Healing Gardens: Therapeutic Benefits and Design Recommendations. New York: John Wiley, pp. 27–86, 1999.
[10] Driver, B. L., Dustin, D., Baltic, T., Elsner, G. and Peterson, G. L. Nature and the Human Spirit: Toward an Expanded Land Management Ethic. Venture Publishing, Inc., State College, PA., 1996.
[11] Kaplan, R., The role of nature in the urban context, Behavior and the Natural Environment. Plenum, New York, NY, pp. 127–162, 1983.
[12] Ulrich, R, Human responses to vegetation and landscapes, Landscape and Urban Planning, 13, pp. 29–44, 1986.
[13] Grahn P. and Stigsdotter U. Landscape planning and stress, Urban Forestry and Urban Greening, 2003.
[14] Bell S, Landscape: Pattern Perception and Process, E & F N Spon, London, 1999.
[15] Sears HF, The Nonhuman Environment in Norman Development and in Schizophrenia. International Universities Press, New York, 1960.
[16] Grahn, P., Stigsdotter, U. K., The relation between perceived sensory dimensions of urban green space and stress restoration. Landscape and Urban Planning, 94, pp. 264–275, 2010.

[17] Patey and Evans, Identification of scenically preferred forest landscapes, Berkeley, CA. pp. 532–53, 1979.
[18] Maikov, K; Bell, S; Sepp, K, A comparison of the evaluation of room characteristics of healing gardens. Design and Nature IV, Wessex Institute of Technology Press, pp. 223–232, 2008.
[19] Skärbäck, E, Landscape planning to promote well-being: studies and examples from Sweden. Environmental Practice, 9(3): pp. 206–217, 2007.
[20] Sherman A., Varni W, Ulrich R, Malcarne L, Post-occupancy evaluation of healing gardens in a pediatric cancer center, Landscape and Urban Planning, 2005.
[21] Barnhart SK, Perkins NH, Fitzsimonds, Behaviour and outdoor setting preferences at a psychiatric hospital, Landscape and Urban Planning 42, pp. 147–156, 1998.

III

III

Rennit, Piret and **Maikov, Kadri** (2015)
Perceived restoration scale method turned into (used as the) evaluation tool for parks and open green spaces, using Tartu city parks as an example. City Territory and Architecture 2:6.
The Springer Open Production.
DOI 10.1186/s40410-014-0020-3

Rennit and Maikov *City, Territory and Architecture* (2015) 2:6
DOI 10.1186/s40410-014-0020-3

City, Territory and Architecture
a SpringerOpen Journal

RESEARCH ARTICLE Open Access

Perceived restoration scale method turned into (used as the) evaluation tool for parks and open green spaces, using Tartu city parks as an example

Piret Rennit and Kadri Maikov*

Abstract

Estonian parks are well known for their history and dendrology. Usually, city maps show no nuances of the green areas, they could be for example abandoned areas, parks, green squares, usable/non-usable areas for the community. In this study ALL 92 parks and urban open green spaces (UGS) of the Estonian city Tartu are explored using a PRS method tool for evaluating open green spaces. Due to the densification of cities, which is also a current issue in Estonia, it is important to provide a variety of knowledge of UGS to support the everyday life of city dwellers. We know a lot about the connections between nature and human well-being, but how do we really evaluate the greenery? Tartu's parks and UGS were analysed by an expert in the summer of 2013, by using the Perceived Restorative Scale (PRS) through tools like Being away, Fascination, Coherence, Compatibility. PRS method is used to evaluate the green areas along these lines: 0-do not exist, 1-low existence, 2 – medium existence, 3-high existence. The study includes 92 UGS, of which 24 are located in the city center, 11 in Tähtvere borough, 8 in Ihaste and Annelinn, 3 in Jaamamõisa, 2 in Ropka and Ropka industry division and 1 in Veeriku, Vaksali area and in Supilinn. There were no UGS in Ränilinn. Description of green spaces is based on detailed level of item question correlation results and CAD MAPS are created by average results of one subscale question (described in detail on method part). The main results are as follows: Item of *Fascination* 'This place has fascinating qualities' and item of *Being away* 'Being here is like an escape experience' correlate ($r = 0.760$, $p < 0.05$) in areas BS, AM, AK, CO, CL, CP, CN, O, BJ, AR, AE, BÕ (See Figure 1. Item of *Fascination* 'My attention is drawn to many interesting things' correlate with items of *Being away* 'Being here is like an escape' ($r = 0.689$, $p < 0.05$) and 'This place makes it possible for me to rest from daily routine'($r = 0.771$, $p < 0.05$). Both correlations were highly esteemed in areas BS, AÜ, AK, CL, CP, CO, O, CN, AR, BÕ (See Figure 1/Group III.) The outcome: A CAD-file showing where the different qualities are located in the city. Based on the results the authors can confirm that such UGSs as the Toome Hill and Kassitoome Park can be considered the model parks of the city of Tartu.

Keywords: CAD MAP; Example parks; Descriptions

* Correspondence: kadri.maikov@emu.ee
Department of Landscape Architecture, Institute of Agricultural and Environmental Sciences, Kreutzwaldi street 58A/3, 51014, Estonia

Background

Introduction to topic

Why do we need city parks- the research shows that high-rise housing is associated with behavioural problems (Gillis 1974). Nature offers its users the possibilities for mental development by acquiring knowledge about themselves, about nature and surroundings, their contained elements and people (Gibson 1979; Stigsdotter & Grahn 2002; Stigsdotter and Grahn 2011, Wilson 1993). The general functions that city parks offer: contact with nature, in the broad sense of the word; possibility for physical recreation – not organised; experiencing art – garden art, pieces of art; possibility of human contact; also space for innovations and the contribution to the "mental map". It is necessary that people could trust their reactions, reflexes and emotional reactions to outdoor surroundings. In the unnatural environment of the city people cannot trust their own reactions, emotions etc. Green spaces in proximity to their home or workplace reduce the sense of mental condition imposed by urban life and significantly improve satisfaction and well-being (Kaplan 2001). Coley et al. (1997) found that the presence of trees and vegetation in outdoor public spaces was associated with the greater use of these spaces by both youth and adult population. Research shows that a small intimate park close to one's home is often highly valued and the nearer the park is to one's home the more extensive is its use (Nordh et al. 2009). They also claimed that the restorative value of a small park with one listed component, e.g. water, was almost as big as that of a medium size one component park. Similarly, a medium-sized park (with four ART components) had the same restorative value as a big park with the same number of components. Restorative environment helps to restore diminished emotional and functional resources and abilities, decrease stress. It limits negative thoughts and provokes positive emotions, as well as increases the activity of parasympathetic nervous system (regulates the recovery during recreation). Kaplan and Kaplan (1989) say that nature is especially rich in restorative potential and also that preferred environment is more likely to be a restorative environment (p 189). In the environment where all four components (ART, PRS) are represented intensively people can have a three-stage progressive recovery:

- Clearing the head –having random ideas in mind and then letting them go;
- Directed attention and focus recovery level;
- Let go to psychology gathered material of less internal noise and higher feeling calmness, what helps soft fascination. Needs from environment all components, then long time distance involvement and it stay in priorities, actions, goal etc. reflections (Han 2003; Rosenblad 2002).

PRS does not focus on one environment only, but handles several restorative environments, stressing certain qualities or the quality between the Man and the environment (Kaplan & Kaplan 1989).

Introduction to PRS

PRS was first applied in 1996. One of the main aims of this scale is to give the designers a measurement tool that could be used to assess the impact of existing and prospective settings on people (Ivarsson & Hagerhall 2008). It is based on Attention Restoration Theory, ART. The main ideas of ART rest on the works of William James in 1892 that contain his psychological conception on directed attention, which by nature is not interesting as it requires a lot of energy and effort. In order to restore from mental fatigue ART suggests taking up activities that require involuntary attention. Kaplan (1995) suggests perception, which gives one the sensation of feeling far away from the every-day-life, makes it possible to do something at one's free will, encourages thinking and exploration and is in harmony with one's personal needs. The scale is based on four ART characteristics, which have several variations that have developed over the years since their implementation (Kaplan 1995; Korpela & Hartig 1996; Hartig et al. 1997a, b; Bodin & Hartig 2003). PRS has been used in a lot of research, e.g. Hartig et al. 1996; Hartig et al. 2001; Korpela et al. 2001; Laumann et al. 2001; Berto 2005; Tenngart & Hagerhall 2008; Nordh et al. 2009. According to the Italian version the scale consists of 26 items, which measure the perception on the basis of five restorative characters, which are *Being away, Fascination, Scope, Coherence* and *Compatibility*. In his ART theory Kaplan (1995) regards *scope* and *coherence* as one and the same characteristic he calls *extent*. Italian version states that restoration is carried out in a place where everything is in the right dimension (*Coherence*), without any limits on time and/or space (*Scope*), far from everyday life (*Being away*) and with relaxed (*Fascination*) and pleasant (*Coherence*) activity. Each characteristics is assessed on a 11-point scale, where 0 means 'not at all', 6 means 'rather a lot' and 10 'totally' (Pasini et al. 2009). It must be taken into account that PRS has been changed several times, which means that pursuant to different date we may talk about 16; 58; 29 (Hartig et al. 1996); 24 (Bodin & Hartig 2003) or even 44 characteristics (Tian 2012). The scale created by Hartig et al. (1997a, b) with its 26 items to describe the human-environment relations with its four subscales is the best-clarified and most easily accessible scale. The four

subscales are: *Fascination*, *Being away, Extent*, and *Compatibility*. Each subscale is assessed on a 7-grade scale, whereas 1 = not at all; 2 = very little; 3 = rather little; 4 = so-so (not little, not much) 5 = quite a lot; 6 = very much; 7 = absolutely adore it (Haurua et al. 2012). In order to give a better overview of these four characteristics, they have been handled separately. (In current work the same method is used as evaluation items of greeneries, where specialists are evaluating the greenery in 4 point scale).

In current work, specialists are adopting same evaluating method of greeneries, using a 4-grade scale.

Fascination

This feature plays an important part in ART, offering the depleted power of observation some rest. *Fascination* can stem from different sources: process (e.g. narrative, solving different problems) or content (e.g. people, water, fire, animals, nature itself). These above-mentioned stimuli flatter people and do away with boredom; they make it possible for the Man to perform without the need to apply directed attention. (Berto et al. 2008) *Fascination* may, in addition to functionality, also have the dimension of attractiveness and intensity. Directed attention is used when the place lacks *Fascination* and other restorative features (Pasini et al. 2009). *Fascination* is related to the specific features of the surrounding landscape (e.g. landscape that is different from the surroundings, such as drumlins, mountains, as well as parkways lined by trees that create a private room in a specific environment). Other examples of F*ascination* include big meadows or open areas in a park where people like to be on sunny days, the movement of clouds in the sky, the rustle of leaves in the wind or the sound of a rivulet foaming across the stones.

Being away

Referring to this feature Kaplan and Kaplan (1989) describes three possibilities: escape from the unwanted and disturbing surroundings, retreating from everyday work and its reminders, stop purposeful or systematic activities. Town dwellers may prefer to visit a big or closed urban forest to escape from the disturbing stimuli and achieve the feeling of *Being away*. Restorative environment must be in harmony with the preferences and inclinations of the observer. Needs and expectations of specific people may differ (by eras, by generations, etc.). Therefore the perceptible restorative characteristics in a specific environment are not constant (Kaplan 1995). In a landscape *Being away* can be characterised by vegetation different from everyday surroundings (e.g. tall trees), relief; visually pleasant elements including artificial details (pavilions, plant walls). Fresh air also makes people feel that they are away from their daily routines and their physical environment (e.g. office). *Being away* means moving to another situation; without certain restorative qualities this situation is less likely to support restoration (Hartig et al. 1997a, b). Kaplan suggests *extent* as the next component (Kaplan & Kaplan 1989).

Extent

Extent refers to a setting that has sufficient content to engage the mind for a long enough period to allow directed attention to rest. Environments with *Extent* are not necessarily large in size, but have interesting content. Japanese gardens form a good example here, for they may be small on a physical scale, but they have enough content and structure to engage the mind (Herzog et al. 2003). Restorative environment is tightly connected with the studies on the unity of scope and space, so that a person in the environment would not get lost or disoriented. *Extent* is also defined through two factors: *Connectedness* and *Scope*. *Scope* refers to the environment that has been extended both in space and time, so that people recognise the possibility for entering and spending their time there (Hartig et al. 1997a, b). Additionally, one can find familiar elements in extended settings, e.g. trees, bushes, flowers, decorative elements in the garden, etc. Trees and bushes create a visual space that is easy to perceive. Recurring common elements (e.g. benches with the same design, dustbins, etc.) create an environment that is perceived as a whole. Kaplan in his primary Swedish version used *Coherence* instead of *Extent* (Ivarsson & Hagerhall 2008). *Coherence* was added to *Extent* and it would refer to both physical (e.g. the size of the area) and abstract level (a feeling that the space extends over the observed frames and time) (Haurua et al. 2012). *Coherence* is the primary stage of connectedness (Hartig et al. 1996).

Compatibility

An environment that is a good fit between the activities an individual wants to take part in, and the kind of activities that an environment lends itself toward has high *Compatibility* for that person (Kaplan 1995). On the basis of *Compatibility* people make their choices in everyday life. Research confirms that *Compatibility* can be found in settings where the desired activities comply with what the environment enables or supports (Hartig et al. 1997a, b). Although restorative action can take place with only one component present (e.g. physically being away), ART claims that restorativeness would be higher in an environment that involves all four components (Bagot 2004). This is also confirmed by research. For example, high *compatibility* is impossible in settings lacking high scores in *Fascination, Being away* and *Extent* (Korpela & Hartig 1996).

Research questions

Goal: Based on above-mentioned PRS method items to describe Tartu's green (open) spaces through item representation (statistically) to set an example in our culture room and found places on Tartu map. For example, it is hard to evaluate the result while there are no evaluations to green areas first. We know the connection between the Man and environment, we know the Man generally well. On environmental side however dendrology and history are not saying much about on the subject, what we can do there and what actions our surroundings are supporting. Concept is to finding it out. In different cultures the results are different. While thinking a bit further, it's a background for hospital areas, where garden therapy is used. If we know the culture background fully, then we can offer the similar environment for recovery for example in Estonia, because here the treatment is cheaper than in Denmark. Aim is to assess the PRS of Tartu City Parks and UGS in order to answer to following questions:

1. To find statistically high quality correlation descriptions about Tartu city parks with example of parks and find the areas in CAD MAP.
2. To find few example high score restoration features in Tartu and descriptions through evaluation items.

Methods

Questionnaire

The version of PRS used in this study is based on the version by Hartig et al. (1997a, b), which has 26 items that fall into four subscales: five items are assessed in subscale *Being away* (e.g. 'It is a place to get away from it all', 'Spending time here gives me a break from my day-to-day routine'); eight items in *Fascination* (e.g. 'This place has fascinating qualities', My attention is drawn to many interesting things'); four items in *Extent* (e.g. 'There is a great deal of distraction', 'It is chaotic here'); nine items in *Compatibility* (e.g. 'Being here suits my personality', 'I can do things I like here'). In this paper has been measured the four characteristics, i.e. judgement is made in green area on a four-point scale, where 0 means 'no, doesn't exist'; 1 'weak existence', 2 'medium existence', 3 'strong existence' from UGS (See Table 1). One parameter evaluation scale (0-3) is divided equally large. Evaluation took place by using park as evaluation scale. All parks and UGS (incl. what is in and out of city border) were chosen to current research.

Table 1 PRS questionnaire on a four-point scale

Factor	Item	0	1	2	3
Being away	1. Being here is an escape experience				
	2. Spending time here gives me a break from my day-to-day routine				
	3. It is a place to get away from it all				
	4. Being here helps me to relax my focus on getting things done				
	5. Coming here helps me to get relief from unwanted demands on my attention				
Fascination	6. This place has fascinating qualities				
	7. My attention is drawn to many interesting things				
	8. I want to get to know this place better				
	9. There is much to explore and discover here				
	10. I want to spend more time looking at the surroundings				
	11. This place is boring				
	12. The setting is fascinating				
	13. There is nothing worth looking at here				
Extent	14. There is too much going on				
	15. It is a confusing place				
	16. There is a great deal of distraction				
	17. It is a chaotic place				
Compatibility	18. Being here suits my personality				
	19. I can do things I like here				
	20. I have a sense that I belong here				
	21. I can find ways to enjoy myself here				
	22. I have a sense of oneness with this setting				
	23. There are landmarks to help me get around				
	24. I could easily form a mental map of this place				
	25. It is easy to find my way around here				
	26. It is easy to see how things are organized				

Map creation

Firstly the CAD map was created by borders and codes, after evaluation CAD map was created through topic named layers. The assessment scale was transformed into three positive answer colours: Light tone of colour – low presence; Middle tone of colour – medium presence; Dark tone of colour – strong presence. The greenery codes on the map are marked in capital letters, for example A, AV, CD. Same codes are used in tables. Map is made according to the correlations i.e 2 questions, where one has the score (value) of 0-1 and other has the score (value) of 0-1, then the result is low. For example: area AA, N… (the ones marked as Low on the map), such as area BG, where all the questions received the mark (rating) 0 or 1. However, if the score (value) of one question is 2 and score (value) of second question is 2 or 3, then the outcome is average (intermediate/medium result). For instance the ones that are marked on the map as Middle. Area BS, where all results

are positive (Being Away, Fascination, Compatibility), has received the mark 2 or 3. Finally, if first question received the mark 3 and second question received mark 3 as well, then we have high result. For example: areas CL, CO.. (the ones marked as High on the map), that have received mark 3 on all (Being Away, Fascination and Compatibility) questions. In case of Extent the result is negative, therefore, to receive grade HIGH (HIGH score), score has to be 0. In other words, the lack of negative score (position). For better orientation the groups in map are created by groups.

Evaluation procedure

Parks and UGS are found able in Tartu as being connected to river Emajõgi or perimeter of town where main roads go out. While working in "green area/park scale" the results shows overall and "direction" result what you can find there. Assessor was instructed both orally and through written material with notes. Assessments were digitalised in Excel and in an Auto-CAD map. Assessment was carried out in Tartu on June 19, 20 and 27, 2013 by expert/author. Data was collected in similar weather conditions, it was sunny and the air temperature relatively warm. The author has been connected with most of the green areas for three years already; each green area was assessed at least 15 minutes, however more time was allocated on the bigger and less well-known areas (e.g. code AB). The assessments were done according to the questionnaire with 26 items on the earlier prepared questionnaire on paper per park (see Table 1). The evaluation was based on the overall impression of the whole park/UGS.

Statistical data processing

In order to process the data, data was fed from the paper to MS Excel, and then entered to SPSS 2.0. Information about the green areas was coded in the same way as on the digital map (e.g. A, AV, CD). Under column codes follow the assessing scale (0-3) to questions answered as following: 1 – yes, 0 – no. Descriptive table analyses, e.g. ratio analysis and Pearson linear correlation were used. Significant correlations in this paper start from 0.500 values, variance analysis are not too detailed. The results in this paper are based on the correlations found in statistical data processing, thus significant correlations have 95% credibility ($p < 0.05$). For description as one "culture room" uniqueness is coming out by one item question to question correlation result, there is no interpretation needed, for example Item of *fascination* 'My attention is drawn to many interesting things' correlate with item of *Being away* 'Being here is like an escape' ($r = 0.689$, $p < 0.05$) what is in very detailed level described the situation in greenery and are found able in map BS, AÜ, AK, CL, CP, CO, O, CN, AR, BÕ, (See Figure 1/Group III).

Results

To find statistically high quality correlation descriptions about Tartu city parks with example of parks and in areas in CAD MAP

Fascination + Being away

Items 'This place has fascinating qualities' and 'Being here is like an escape correlate ($r = 0.760$, $p < 0.05$) (see Table 2) in areas BS, AM, AK, CO, CL, CP, CN, O, BJ, AR, AE, BÕ (See Figure 1). Items 'This place has fascinating qualities' and item 'This place makes it possible for me to rest from daily routine' correlate ($r = 0.847$, $p < 0.05$). 'This place has fascinating qualities' correlates with 'It is the place to get away from it all' ($r = 0.864$, $p < 0.05$) and with being here helps me to focus on getting things done' ($r = 0.844$, $p < 0.05$). Examples with codes: BS, AM, AK, CO, CL, CP, CN, O, BJ, AR, AE, AC, BÕ (See Figure 1. Group II). Item of *fascination* 'My attention is drawn to many interesting things' correlate with item of *Being away* 'Being here is like an escape' ($r = 0.689$, $p < 0.05$) and 'This place makes it possible for me to rest from daily routine'($r = 0.771$, $p < 0.05$). Both correlations were highly esteemed in areas BS, AÜ, AK, CL, CP, CO, O, CN, AR, BÕ, (See Figure 1/Group III). Items 'My attention is drawn to many interesting things' and 'It is the place to get away from it all' correlate ($r = 0.780$, $p < 0.05$), when talking about coded areas BS, AK, CP, CO, CL, CN, AR and O. The first item here also correlates with 'Being here helps me to focus on getting things done' ($r = 0.777$, $p < 0.05$) and area coded OL is added to the list.

OL stands for the Sanatooriumi Park-forest, where thick undergrowth, different paths and varied relief give the impression of being temporarily away and enable to focus on one's own thoughts. But Riia Street with its heavy traffic and Raja Street that divides the park into two halves tends to distract attention. Item 'I want to get to know this place better' correlates with both 'Being here is like an escape' ($r = 0.700$, $p < 0.05$) and 'Spending time here gives me a break from my day-to-day routine' ($r = 0.803$, $p < 0.05$). Areas BS, AK, CP, CO, CN, O, AR, BÕ and CL achieved high marks with these correlations.

Relief at Kassitoome (CL) (including the concavity) attracts people and makes the place interesting, which encourages people to enter the area and explore what else interesting there is to find. In addition, the first-mentioned item also correlates with the item 'Being here helps me to focus on getting things done' ($r = 0.794$, $p < 0.05$), but instead of BÕ, the area mentioned is OL. Park-forest on Sanatooriumi Street offers more opportunities for gathering thoughts. The forest-like park makes one feel away from the urban environment. Different zones in the park-forest (forested area, tracks for running, training area) allow engagement in different activities without disturbing others.

Figure 1 Map 1.

Item 'this place has fascinating qualities' correlates (See Table 3) with 'Being here helps me to focus on getting things done' ($r = 0.724$, $p < 0.05$), 'Coming here helps me to get relief from unwanted demands on my attention' ($r = 0.731$, $p < 0.05$) and 'This place has fascinating qualities' ($r = 0.669$, $p < 0.05$). BS, AK, CP, CO, CL, CN and O are areas with strong correlation examples. Let us have a closer look at Karlova Park (BS).

BS – Karlova park

It is an area covered with deciduous trees, mainly limes (*Tilia cordata*), which offer shade and coolness in summer. The small amount of shrubbery makes the park airy and the existing lamps inviting. The well-maintained area seems safe and secure. With its several staircases and different levels, the park, raised higher than the streets, arouses immediate interest. The wall, made from quarry stones that at places seem to lay the foundation for the park, draws automatic attention (*Fascination*). The wall does not seem like a foreign body, but rather helps to form a whole. The park contains items that promote gathering thoughts and escape from unwanted distractions. These are features that confirm the saying 'the more the merrier' does not prove correct every time- nothing too lavish or lacking to block restorativeness. Nothing prevents you from taking along a blanket, spreading it out in the park, switching off your stressful thoughts that may burden your mental health (*Extent*).

Compatibility and fascination

Item of *compatibility* 'I can do things I like here' and item of *being away* 'Being here is an escape experience' correlate ($r = 0.670$, $p < 0.05$) (see Table 4), which comes forward very well in case of the following green areas: AK, CO, CL, CP, CN, O and BÕ. Besides that the item of *compatibility* 'I can do things I like here' also correlates to the

Table 2 Items under *Fascination* correlate with items under *Being away*

		Being here is an escape experience.	Spending time here gives me a break from my day-to-day routine.	It is the place to get away from it all.	Being here helps me to focus on getting things done.
This place has fascinating qualities.	Pearson Correlation	**.760****	**.847****	**.864****	**.844****
	Sig. (2-tailed)	.000	.000	.000	.000
	N	92	92	92	92
My attention is drawn to many interesting things.	Pearson Correlation	**.689****	**.771****	**.780****	**.777****
	Sig. (2-tailed)	.000	.000	.000	−000
	N	92	92	92	92
I want to get to know this place better.	Pearson Correlation	**.700****	**.803****	**−813****	**−794****
	Sig. (2-tailed)	.000	.000	−000	−000
	N	92	92	92	92
There is much to explore and discover here.	Pearson Correlation	**.721****	**−751****	**−804****	**.760****
	Sig. (2-tailed)	.000	.000	.000	−000
	N	92	92	92	92
I want to spend more time looking at the surroundings.	Pearson Correlation	**.747****	**−837****	**−811****	**.831****
	Sig. (2-tailed)	.000	.000	−000	.000
	N	92	92	92	92

**significance 95%.

following items of *fascination*: 'My attention is drawn to many interesting things' ($r = 0.831$, $p < 0.05$); 'I want to get to know this place better' ($r = 0.834$, $p < 0.05$); 'There is much to explore and discover here'($r = 0.816$, $p < 0.05$); 'I want to spend more time looking at the surroundings' ($r = 0.841$, $p < 0.05$); 'This place has fascinating qualities' ($r = 0.744$, $p < 0.05$).

In addition, in green areas CO, CL, CP and O the item of *compatibility* 'I have a sense that I belong here' correlates with the following items of *fascination*: 'My attention is drawn to many interesting things' ($r = 0.775$, $p < 0.05$); 'I want to get to know this place better'($r = 0.740$, $p < 0.05$); 'There is much to explore and discover here' ($r = 0.767$, $p < 0.05$); 'I want to spend more time looking at the surroundings' ($r = 0.829$, $p < 0.05$); 'This place has fascinating qualities' ($r = 0.780$, $p < 0.$). In areas CO, CP, CL, AE, O and AC item 'I have a sense of oneness with this setting' correlates with 'Spending time here gives me a break from my day-to-day routine' ($r = 0.701$, $p < 0.05$); 'It is the place to get away from it all' ($r = 0.754$, $p < 0.05$); 'Coming here helps me to get relief from unwanted demands on my attention' ($r = 0.732$, $p < 0.05$) and 'This place has fascinating qualities' ($r = 0.752$, $p < 0.05$).

J - Tõnisson Square

It is a tiny square at the corner of Ülikooli and Gildi Streets. Some trees grow there. The square is equipped with some benches and lighting and there stands a monument of Jaan Tõnisson. This area of about 300 m^2 draws attention (*fascination*) because it is so different from the surroundings. This is a part of the Old Town

Table 3 Item *Fascination* correlates with item *Being away*

		Being here is an escape experience.	Spending time here gives me a break from my day-to-day routine.	It is the place to get away from it all.	Being here helps me to focus on getting things done.	Coming here helps me to get relief from unwanted demands on my attention.
This place has fascinating qualities.	Pearson Correlation	**.636****	**.672****	**.724****	**.731****	**.669****
	Sig. (2-tailed)	−000	−000	−000	−000	−000
	N	92	92	92	92	92

**significance 95%.

Table 4 Items of *compatibility* correlate with the items of *being away* and *fascination*

		Being here is an escape experience.	Spending time here gives me a break from my day-to-day routine.	It is the place to get away from it all.	Being here helps me to focus on getting things done.	Coming here helps me to get relief from unwanted demands on my attention.	This place has fascinating qualities.	My attention is drawn to many interesting things.	I want to get to know this place better.	There is much to explore and discover here.	I want to spend more time looking at the surroundings.	This place has fascinating qualities.
Being here suits my personality.	Pearson Correlation	**.643****	**.696****	**.783****	**.753****	**.732****	**.777****	**.792****	**.716****	**−776****	**−805****	**−752****
	Sig. (2-tailed)	−000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	92	92	92	92	92	92	92	92	92	92	92
I can do things I like here.	Pearson Correlation	**.670****	**.763****	**.739****	**.718****	**.719****	**.770****	**.831****	**.834****	**.816****	**.744****	**.841****
	Sig. (2-tailed)	−000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	92	92	92	92	92	92	92	92	92	92	92
I have a sense that I belong here.	Pearson Correlation	**.633****	**.701****	**.762****	**.743****	**.741****	**.765****	**.775****	**.740****	**.767****	**.829****	**-.780****
	Sig. (2-tailed)	−000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	92	92	92	92	92	92	92	92	92	92	92
I can find ways to enjoy myself here.	Pearson Correlation	**.620****	**.704****	**.731****	**.693****	**.708****	**.748****	**.811****	**.830****	**.782****	**.719****	**.795****
	Sig. (2-tailed)	−000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	92	92	92	92	92	92	92	92	92	92	92
I have a sense of oneness with this setting.	Pearson Correlation	**.650****	**.701****	**.754****	**.732****	**.732****	**.752****	**.747****	**.713****	**.750****	**.777****	**.762****
	Sig. (2-tailed)	−000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	92	92	92	92	92	92	92	92	92	92	92
There are landmarks to help me to get around.	Pearson Correlation	.381**	.489**	.476**	.451**	.450**	**.513****	**.628****	**,. 20****	**.544****	**.578****	**.584****
	Sig. (2-tailed)	−000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	92	92	92	92	92	92	92	92	92	92	92

**significance 95%.

where the houses stand densely next to each other and streets or courtyards behind high fences form open spaces. Therefore this open space captures people's attention at once. It is not a typical space covered with lawn adds but a multi-level well-lit open area, where different materials have been used. At the same time it is a comfortable place for it is surrounded by different walls (lattice girder, concrete, pillars, etc.) that make people feel safe and, taking into account the small size of the walls, also isolated enough to feel well.

To find few example high score restoration features in Tartu and describe them through evaluation items

These are UGS-s (see Figure 2), where all or at least three of the ART subscales is strongly represented -high scores in PRS assessments and examples of strong correlations.

CP- Toome Hill (Including CO - the surroundings of the Tartu Observatory)

The park on Toome Hill consists of areas that are large in size and that are, for the sake of perception and comprehension, earmarked separately on the map so that the negative features of one area would not have an impact on the other areas. The analysis shows that in case of CP and CO the assessments are strongly positive and that is why they have been handled as a whole here. Different levels, but first and foremost the natural relief is the main attraction here. High and massive buildings that give an idea about the singularity and grandeur of this place intensify this feeling even more. Variability (playgrounds, monuments, historic and state buildings, bridges, etc.) attaches more value to this place. At the first glance it is difficult to perceive the *extent* of the area, but when spending more time there one starts to appreciate its coherence and harmony (*Extent*). Different zones (e.g. a playground at the foot of the hill) make it possible to use the area according to one's preferences and do not make Toome Hill with its history illiberally attractive to the historians only. Therefore this area calls for a longer stay and absorption even if in one's thoughts (*Being away*), which explains well, why it was necessary to split the area into two.

CL-Kassitoome

Kassitoome is an emotionally strong UGS (*Fascination*) in Tartu. It is a space with a varied relief and logically running paths (*Extent*), which make it possible to view the area from different levels. Airiness (scarce tall trees) and well-groomed park make it easier for the observer to perceive the scope, volume and unity of the area. The well-known Kassitoome Valley (an old sand- and gravel-pit) offers activities all the year round. Besides all that, it is nice to stroll about, feel secluded while sitting in the valley, have a look at the historic buildings surrounding the park and be absorbed in one's thoughts (*Being away*). The few trees and the shadows they cast, make the valley cozier and more natural, which on the basis of ART feels more genuine to people than urban environment. It is a good example of something artificial being conflated into the urban environment so that it seems natural. It is definitely a place, which has obtained its soul through human action. We might boldly say that it is the favourite place for a lot of people (*Compatibility*).

Figure 2 Areas with high-score restorative features in Tartu city centre.

Discussion

Open green spaces and earlier research

The results of the present paper comply with the results of earlier studies and articles based on them. Kaplan & Kaplan 1989; Hartig et al. 1991; Kaplan 1995; Hartig et al. 1997a, b; Laumann et al. 2001; Maikov 2013 claim that restorativeness is higher in the natural environment than in artificial surroundings. **However, the artificial environment may include natural components that make it possible for the people to perceive restorativeness in urban surroundings**. The PRS analysis in this paper shows that artificial environment with natural components (e.g. Kassitoome valley - CL) may have restorative potential. In addition, natural environment with artificial components (e.g. Tartu Adventure Park – AK) gives a positive result and proves that natural and artificial elements may offer people the opportunity to recover from every-day disturbances. But both elements must be in proportion and in harmony. A setting may have a strong *Being away* perception, but if it is not attractive enough (i.e. the first impression is not attractive enough) people will not enter the area. In the same way areas BD, BB and AÖ (See Figure 1) that may for some reason be important for the local people (good forest for picking mushrooms; a source of fresh air, etc.), but strangers may not understand that. They might appreciate the fresh air and admire the growing pines (*Pinus sylvestris*), but not the area as a whole. Van den Berg et al. (2007) said that natural environment offers a more efficient way to recover from mental fatigue and stress than the urban surroundings. On the basis of the present paper we may say that when comparing the UGS in the centre of the town (e.g. O, CP, CL) with the ones on the outskirts (AB,BB, AÄ, AP) the PRS analysis shows that **urban environment can offer more restorative opportunities in a short time than a forest-like area outside the town**. People appreciate the customary open spaces in their every-day environment, which value (including restorativeness) rather increases than decreases over the time. This, in its turn, proves the statement by Nordh et al. (2009) that even the smallest UGS in the neighbourhood may possess significant restorative features, and UGS that are closer to home may be more popular and preferred for restoration just due to their location. The comparison between large and small green areas supports the opinion of Nordh et al. (2009), which states that **the size of the UGS does not necessarily affect the power of perceived restorativeness**. Restorativeness is more likely influenced by the preference of the people and the existence of different elements. This can be illustrated by the comparison of Tõnisson Square (J) and Politsei Square (K). Several authors (Kaplan & Kaplan 1989; Kaplan 1995; Hartig et al. 1997a, b; Laumann et al. 2001) have claimed that artificial environment may have a smaller impact on restorativeness than natural environment and the present paper supports this idea. For example, the restorativeness of Tartu Town Hall Square (P) is not as strong as that of Pirogov Park (CN). At the same time the correlation ($r = 0.524$, $p < 0.05$) indicates that Town Hall Square is an attractive place. It is well organized and has landmarks (e.g. rows of lights, pavement stones of different colour, etc.) which facilitate traffic. Unfortunately, the place lacks the something that is necessary for *Being away* (e.g. large crowds of people, open-air restaurants and artificial materials impose stress) our minds are set on something else. Korpela & Hartig (1996) have said that **strong *Compatibility* cannot be found in a place which lacks the items of *Being away, Fascination* and *Extent*.** It means that the items are inter-related.

In all UGS that scored high in Compatibility there are features that are associated with *Being away, Fascination* and *Extent*. The examples in Tartu include CP, CO, CL, CN, O and AK. Bagot (2004) also confirms that restorativeness is greater if it includes items on all four ART subscales. The PRS analysis on the 92 Tartu UGS shows that in case of 22 green areas the items (e.g. *Being away* and *Fascination*) on two subscales (the value of each item is 'three') correlated and the restorativeness of these areas is scored 'average'. These are environments where restorativeness can be felt to a smaller or greater extent (See Figure 1). The codes of these UGS are: BS, AÜ, AM, AL, AK, BE, BR, BP, CO, CL, CP, CN, P, S, BO, O, J, BJ, AR, OL, CH, AB, AF, AE, AC, BC, BÕ, CB. Statistical data supports the hypothesis. In Tartu there are also places that attract people strongly, e.g. AK, CO, CL, CP, CN, O, AF, BÕ, BS, AÜ, BJ, AR, AE, AC, AM, OL, AB (See Figure 1). The analysis confirmed the second hypothesis: **Compatibility plays an important role between the perception of landscape and human perception, both within one component as well as between different components.** This constituted the bulk of positive results and it is characteristic of several green areas in Tartu. For example, the items of *Compatibility* (See appendix 1, items 18-23) correlate with all the items of *Fascination* and *Being away*. Korpela & Hartig confirm the strong inter-relation in their study in 1996, where they state that it is impossible to find high *Compatibility* in settings that lack such items as *Being away*, *Fascination* or *Extent*. The following green areas belong here: AK, CO, CL, CP, O, AE, BÕ, AC, CN, J, AF, P, BO, OL, AÜ (See Figure 1). The results confirming the third hypothesis **Within one town it is possible to find domineering parks/places that illustrate the distinctive character of a specific cultural space** show that in Tartu there are at least six areas, that include all or at least three PRS subscales (*Being away*, *Fascination, Extent and Compatibility)*. These are: Toome Hill together with the surroundings of the Tartu Observatory

(CP, CO), Kassitoome (CL), Pirogov Park (CN), Botanical Gardens of the University of Tartu (O) and Tartu Adventure Park (AK).

Using the method as evaluation tool for open spaces

The items chosen for evaluation look subjective, but authors believe that if a different evaluator from the same culture room would do such an evaluation again, the professional opinion would be the same, because the assessing scale 0-3 is very wide. Green spaces are only maintained, which means that they look similar for decades. UGS in Tartu are compact enough to evaluate the parks in 15 minutes. Method is repeatable in any landscapes. Maps also show that square shaped park areas are perfect to find the information about green spaces. Park scale could look too big; no subdivisions in the area, but our characteristics for green areas are the same, that's why we can do it on a big scale.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

KM carried out the healing gardens and environmental psychology studies in landscape architecture, and prepared the current study, and drafted the manuscript. PR have done master work of this study, drafted the manuscript, supervised by KM. Both authors read and approved the final version of the manuscript.

Acknowledgments

Digital CAD-MAP was received from Tartu City Government through bilateral agreement between them and Estonian University of Life Sciences.

Received: 8 July 2014 Accepted: 11 December 2014
Published online: 26 February 2015

References

Bagot KL (2004) Perceived Restorative Components: A Scale for Children. Children, Youth and Environments 14(1):107–129
Berto R (2005) Exposure to restorative environments helps restore attentional capacity. J Environ Psychol 25(3):249–259
Berto R, Massacessesi S, Pasini M (2008) Do eye movements measured across high and low fascination photographs differ? Addressing Kaplan's fascination hypothesis. J Environ Psychol 28:185–19
Bodin M, Hartig T (2003) Does the outdoor environment matter for psychological restoration gained through running? Psychology of Sport and Exercise 4(2):141–153
Coley RL, Kuo FE, Sullivan WC (1997) Where does community grow? The social context created by nature in urban public housing. Environ Behav 29:468–492
Gibson JJ (1979) The ecological approach to visual perception. Houghton Mifflin, Boston, p 332
Gillis AR (1974) Population density and social pathology: the case of building type, social allowance and juvenile delinquency. Social forces 53:306–314
Han KT (2003) A Reliable and valid self-rating measure of the restorative quality of natural environments. Landsc Urban Plan 64:209–232
Hartig T, Kaiser FG, Bowler PA (1997a) Further development of a measure of perceived environmental restorativeness. Working paper No. 5, Institute for Housing Research, Uppsala University. Working Paper No. 5
Hartig T, Kaiser FG, Bowler PA (2001) Psychological restoration in nature as a positive motivation for ecological behavior. Environ Behav 33(4):590–607
Hartig T, Korpela K, Evans GW, Gärling T (1996) Validation of a measure of perceived environmental restorativeness, No. 7. Göteborg Psychological Reports, Göteborg Psychological Reports 26.
Hartig T, Korpela K, Evans GW, Gärling T (1997b) A measure of restorative quality in environments. Scandinavian Housing and Planning Research 14(4):175–194
Hartig T, Mang M, Evans GW (1991) Restorative effects of natural environment experiences. Environ Behav 23:3–26
Haurua K, Lehvävirtaa S, Korpela K, Kotzea DJ (2012) Closure of view to the urban matrix has positive effects on perceived restorativeness in urban forests in Helsinki, Finland. Landsc Urban Plan 107:361–369
Herzog TR, Maguire CP, Nebel MB (2003) Assessing the restorative components of environments. J Environ Psychol 23:159–170
Ivarsson CT, Hagerhall CM (2008) The Perceived Restorativeness Of Gardens – Assessing The Restorativeness Of A Mixed Built And Natural Scene Type. Urban For Urban Green 7:107–118
Kaplan R, Kaplan S (1989) The experience of nature: A psychological perspective. Cambridge University Press, Cambridge
Kaplan S (1995) The restorative benefits of nature: oward an integrative framework. J Environ Psychol 15:169–182
Korpela K, Hartig T (1996) Restorative qualities of favorite places. J Environ Psychol 16(3):221–233
Kaplan R (2001) The nature of the view from home: Psychological benefits. Environ Behav 33:507–542
Korpela K, Hartig T, Kaiser FG, Fuhrer U (2001) Restorative experience and self-regulation in favorite places. Environ Behav 33(4):572–589
Laumann K, Gärling T, Stormark KM (2001) Rating scale measures of restorative components of environments. J Environ Psychol 21(1):31–44
Maikov K (2013) Landscape characteristics in Tartu City parks – user influences through Design. Wessex Institute of Technology Press, Sustainable city, 353–364
Nordh H, Hartig T, Hagerhall CM, Fry G (2009) Components of small urban parks that predict the possibility for restoration. Urban For Urban Green 8(4):225–235
Pasini M, Berto R, Scopelliti M, Carrus G (2009) Measuring the restorative value of the environment: Contribution to the validation of the Italian version of the Perceived Restorativeness Scale. Bollettino di psicologia applicata 257:3–11
Rosenblad Y (2002) Estonian landscapes as places for mental restoration. masterwork, Tallinn University
Tenngart IC, Hagerhall CM (2008) The perceived restorativeness of gardens – Assessing the restorativeness of a mixed built and natural scene type. Urban For Urban Green 7(2):107–118
Stigsdotter U, Grahn P (2002) What Makes a Garden a Healing Garden? Journal of Therapeutic Horticulture vol 13:60–69
Stigsdotter UK, Grahn P (2011) Stressed individuals' preferences for activities and environmental characteristics in green spaces. Urban For Urban Green 10(4):295–304
Tian L (2012) Waiting Areas of Airports as Restorative Environments for Travelers. A thesis submitted in fulfillment of the requirements for the degree of Mphil of Risk psychology, Environment and Safety at Norwegian University of Science and Technology
Van den Berg AE, Hartig T, Staats H (2007) Preference for Nature in Urbanized Societies: Stress, Restoration, and the Pursuit of Sustainability. J Soc Issues 63(1):79–96
Wilson EO (1993) Biophilia and the Conservation Ethic. In: Kellert S, Wilson EO (eds) The Biophilia Hypothesis. Shearwater Books, Washington, D.C, pp 31–40

IV

IV

Hansson, Karl; Külvik, Mart; Bell, Simon and **Maikov, Kadri** (2012)
A Preliminary Assessment of Preferences for
Estonian Natural Forests.
Baltic Forestry 18(2):299-315

A Preliminary Assessment of Preferences for Estonian Natural Forests

KARL HANSSON*, MART KÜLVIK, SIMON BELL AND KADRI MAIKOV
Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences
Kreutzwaldi 5, Tartu 51014, Estonia; e-mail: karl.hansson@emu.ee, phone: +372 508 8811

Hansson, K., Külvik, M., Bell, S. and Maikov, K. 2012. A Preliminary Assessment of Preferences for Estonian Natural Forests. *Baltic Forestry* 18(2): 299–315.

Abstract

Forests are a major element of the Estonian landscape and are visited by many people for recreational purposes. This article explores the Estonian natural forest environment from an aesthetic point of view. Previous studies have shown that natural landscapes are preferred over artificial, man-altered landscapes, yet little is known about preferences within natural settings in Estonia, where the forest forms an important aspect of the culture. The study reported here aimed to test the preferences for different natural forest stand structures using photographs shown to 97 participants. The evaluation was based on the environmental preference matrix of coherence, complexity and mystery formulated by Kaplan and Kaplan (1982, 1989), the photos being assessed for these factors by experts before the preference survey took place. Other elements were also evaluated to see which respondents found most attractive or unattractive and which might affect preference. The results were analysed to see which factors best explained preferences. Similarities between expert-group and lay-person assessments of predictor variables were also examined. Mystery proved to be statistically the strongest predictors of preference followed by coherence, as expressed by the test subjects, although the most preferred scenes were rated by experts as having high levels of coherence, showing some differences between experts and non-experts. The elements which most negatively affected preference were signs of death and decay as well as natural untidiness. This suggests that features inherent to natural landscapes and natural processes are not well understood or appreciated by the test population and that more information could be provided explaining why these are necessary parts of the natural landscape.

Key words: visual landscape perception, human-landscape interaction, environmental preference, natural forest views, naturalness of environment

Introduction

Forests make up a significant proportion of the Estonian landscape – some 51% of the land is covered by them (Estonian Environment Information Centre 2012) – and they are a constant part of almost every scene or vista. Being a relatively flat country with few hills (Arold 2005) the forest landscape is experienced as either a series of edges viewed across open fields or from within, when driving along roads or using the many forest trails for recreational purposes. Outdoor recreation is an important leisure activity for Estonians both in winter and in summer, 89% of Estonians visit forests at least once a year and around 30% at least once a month (Estonian Society of Forests 2008). The reasons most people give for visiting forests is to be close to nature, to get away from stressful daily lives and to undertake physical exercise (Kaplan and Kaplan 1989, Han 2003). Having distinct seasons, with a long snowy winter and a short but warm summer, very different activities are undertaken in each season. Skiing dominates the winter while hiking, camping and picking berries and mushrooms are popular in summer. According to some research in so-called "forest culture" and outdoor recreation patterns at an European level, Estonians have a close relationship to the forest as part of an identifiable "northern European culture", although affected by the history of being in the Soviet Union (Bell et al. 2005, Proebstl et al. 2010) and this influences the kind of activities and preferences for forests due to their dominance in the landscape.

Estonian forests have a mixed ownership, 40% being state owned and managed, the rest being privately owned or subject to privatization (Estonian Environment Information Centre 2012) but there is a right of access to all forests by everyone. The forests are an important source of timber and so are managed for its production, usually by small-scale clear cutting which results in a patchy pattern across the landscape with many areas being a mix of stands of different ages and composition. In addition the stand types vary according to soil types so that there may be quite a fine-scale variation on a particular territory. The RMK,

the state forest management organisation provides recreational facilities in many areas with lakes and other special attractions, where people can enjoy the forest. Many protected landscapes, of which Estonia has a relatively high proportion (25% of forests) (Ibid.) contain forests which are less-intensively managed or are unmanaged and these are also important and popular places for Estonians to find "real" nature, where the forest contains dead and dying trees, trees blown over by the wind and so on, offering a different experience from the managed forests so prevalent elsewhere. The question arises – what kind of natural forest landscape do people prefer? Which types of forest do they like to visit and should recreational forests in particular be managed for their aesthetic appeal? How do they view the elements of death and decay inherent to natural ecosystems?

Landscape preference studies have a history going back to the "Scenic Beauty Estimation Method" (Daniels and Boster 1976) where different scenes have been shown to respondents from different ages and backgrounds in many countries. These have been used to try to identify characteristic elements that should be included in the design and management of forests in order to make them attractive to people. In general, most studies suggest that people are most attracted to scenes of a natural character or landscapes with no dominant visible human impact (Kaplan and Kaplan 1989, Kaplan 1995, Gobster 1996, Simonič 2003, Rosenblad and Niit 2005). It has also been identified that access to nature has a positive psychological impact especially for urbanized people (Kaplan and Kaplan 1989, Ward Thompson 2002, Ward Thompson et al. 2010) and that visiting "nature" can help to reduce stress. Using green areas, especially forests, for their physical and mental health-promoting qualities is becoming a more significant element of public policy in many countries (Nilsson et al. 2010).

Based on Berleant's (1992) aesthetic theory, *environment* means nature, culture and ourselves (people) in an interconnected system. In this paper the term environment is narrowed down and interpreted through the notion of *landscape*, which is the field of our present actions – it is the part of environment that we can engage with at a given time (Bell 2012). In the words of the European Landscape Convention, landscape is "...an area of land as perceived by people..." (Council of Europe 2000); therefore, that through perception an aesthetic appreciation is an important benefit to be gained from the landscape. In the context of the Estonian landscape as noted above, with the focus on the internal setting as opposed to external vistas, Berleant's (1992) definition of *participatory landscape* is relevant. Participatory landscape, as opposed to panoramic landscape, develops a spatial and experiential continuity with a person. Here, space reaches out to encompass the viewer as a participant. Herein, the notion of natural environment has been equated with the notion of participatory natural forest landscape.

The field of ecological aesthetics pioneered by Leopold (1949) has been developing (Gobster 1995; Bell 2012) in which the aesthetic qualities of nature are deemed to include features associated with natural processes such as death and decay, exemplified in a forest by dead or wind-blown trees, insect attacks, fires and other features which tend to be managed out of most forests. This work suggests that people prefer not to see such signs in a landscape and that this affects the aesthetic response.

Preference for the landscape/environment is a result of a complex process which involves the perception of objects and spaces and a person's reaction to them, also taking into account their potential usefulness and support, what are known as "affordances" (Gibson 1979). Perception is also active – we seek out areas in a landscape with certain properties. Thus, aesthetics, at least to some extent, includes the functional suitability of spaces and objects with the needs of the perceiver, as well as their sensory qualities which may evoke beauty, for example (Bell 2012). Theories of landscape perception and aesthetics suggest that both the content and spatial organisation of landscape elements may affect landscape preferences and be a basis for a predictive framework.

The Kaplans' environmental preference theory (Kaplan and Kaplan 1982, Kaplan and Kaplan 1989) refers to two important purposes that concern people throughout their waking hours – making sense of and involvement with their surroundings. It is suggested that these two purposes probably had an important effect on the long-term survival potential of individuals and populations during the early evolutionary phases of the human species. Environments that support these purposes should therefore tend to be preferred. The Kaplan model is based on cognitive aspects of the landscape – not the physical characteristics *per se* but the informational content of the landscape as perceived.

Making sense and involvement are thus associated in the Kaplan model with four informational factors which form a preference matrix, these being *coherence*, *complexity*, *legibility* and *mystery*. All four factors are considered as positive characteristics, variables or predictors of preference. The matrix is divided into two parts, one describing the present, immediate two-dimensional environment (coherence and complexity), and the other describing the predicted, promised future three-dimensional environment (legibility and mystery). *Coherence* refers to being able to organize what one sees

into relatively few identifiable units, or informational chunks. Normally, natural landscapes are internally very coherent, since what can be seen is associated with and derives from natural processes. *Complexity* concerns whether there is enough present in the scene to keep one occupied or interested. Complexity is defined in terms of the number of different visual elements in a scene. *Mystery* is hidden in a scene, which gives the impression that one could acquire new information if one were to wander deeper into the landscape. Mystery is often associated with the notion of *surprise*. A critical difference between mystery and surprise is that in a surprise the new information is present and it is sudden. In the case of mystery the new information is not present, it is only suggested or implied; new information is continuous with what is already available. Herzog and Bryce (2007) have suggested (that there is some confusion with the standard definition of mystery using the notion of surprise. *Legibility* is a characteristic of an environment that looks as if one could explore it extensively without getting lost. Environments high in legibility are those that look as if they would be easy to make sense of as one wanders farther and farther into them. However, it is difficult to use in small-scale internal landscape scenes as there is often insufficient information visible to tell whether it extends for any distance and it is now considered to be the least important predictor of preference (Simonič 2003). Coherence, complexity and mystery have also been associated with the three so-called objectives of visual design or composition, namely unity (equated to coherence) diversity (equated to complexity) and *Genius loci* (equated to mystery) (Bell 2012) which allow them to be linked to activities such as landscape design and management and which are used in forest landscape design (Bell and Apostol 2008).

Behaviour settings are the landscapes or places within which activities such as recreation take place (Barker 1968, Schoggen 1989) and it is the interface between the patterns of behaviour and the environment in which the behaviour takes place so that the environment in some sense "matches" the "behaviour". Thus, if preferences for landscape or scenes as settings for behaviour such as outdoor recreation can be understood it potentially provides possibilities to guide managers of those landscapes as how best to protect or manage them so as to ensure positive settings, especially in natural landscapes where dead trees and naturally damaged or disturbed areas have to be taken into account.

Aims of the study

A lot of attention has been paid to investigating attitudes and preferences toward natural versus built environments, and different types of recreational landscapes, as noted above. Some research considering different aspects of environmental preference for forests has been carried out in the past but these focus mainly on the impact of broad categories of elements (Lee 1991) or different forest management approaches (Ribe 1991, Herzog and Barnes 1999). Less focus however, has been given to investigation of preferences within different natural landscape types or to the perceptual qualities of different natural vegetation types and elements.

The point of departure for the present study was visual preference for Estonian forest scenes of different visual composition in terms of the three main components of the Kaplan preference matrix. Previous studies have shown that people's reactions and assessments to the environment on the basis of photo views compared to being in the environment itself are rather similar, hence the results of a survey based on photo views can be considered credible. In order to discover preferences, pictures have become the substitutes of the real world (Shafer and Richards 1974, Daniel and Boster 1976, Hull and Stewart 1992, Ode et al. 2009).

The aim of the study was therefore to test preferences for Estonian natural forest landscapes for the first time using the Kaplan model as the theoretical basis and the three aspects of coherence, complexity and mystery as the dimensions for developing a predictive model. The research questions are:

Does the Kaplan model enable landscape preferences to be predicted in relation to the specific forest stand structures and their combinations found in natural Estonian forests?

Are there differences in the evaluation of the predictor variable between experts and non-experts?

Are the preferences affected by the presence of particular elements or features indicative of ecological processes and objectively measured "naturalness"?

Materials and methods

Panagopoulos (2009) has generalised the following three main techniques for direct aesthetic evaluation of forest landscapes: 1. the design expert approach, where landscape is evaluated and inspected by an expert, usually a landscape architect, with respect to a combination of abstract design parameters and relationships among these elements to classify each area in terms of complex formal characteristics that are considered relevant to landscape; this approach has been used extensively for design purposes (see Bell and Apostol 2008); 2. The ecological expert approach, where landscape is characterised in terms of species, ecological zones, succession stage or other indicators of ecolog-

ical processes; and 3. Psychophysical preference modelling, this is a quantitative, holistic technique of landscape evaluation objectively estimating public perception of aesthetic quality. Psychophysics is the study of measurement that attempts to relate environmental stimuli to human sensations, perceptions and judgments. In the psychophysical approach, biophysical and human-perception components are even-handed. These are typified in the approaches mentioned above such as those of Lee, Ribe, Daniel etc.

The method used here involves an ecological expert approach in selecting scenes that are considered by such an expert to represent "naturalness" in the content, structure and presence of elements; the design expert approach for assessing the degree of coherence, complexity and mystery of each scene and the psychophysical approach in the use of the questionnaire survey of preferences.

Selection of landscape views and expert assessments

Based on the Kaplan matrix of psychological environmental preference, a sample of pictures of 27 Estonian natural forest views was compiled from a pool of about 2000 photos held in an archive of nature photographs belonging to an environmental expert with an ecological background. The photographs were considered by the expert who selected them as being natural in the sense that there were only elements present which had arisen through natural processes and no direct management or human intervention had taken place. The photos were natural, original examples with no subsequent retouching work being carried out on them. The photos were selected to represent the "green" season, ie late spring to early autumn so as to keep the study to one main recreational season in Estonia and to contain a range of different stand structures typical of Estonian forests. The final selection of photos fully covered the previously described Kaplan's theoretical environmental preference matrix of coherence, complexity and mystery on the scale of low, medium and high occurrence. The qualities describing the informational content – *coherence*, *complexity* and *mystery* – were assessed for each view by four experts (landscape architects familiar with the Kaplans' theory) into low, medium and high occurrence. The variable of *legibility* was omitted in this survey for reasons already noted above. These assessments followed the general guidelines as shown in Table 1. In addition, the *occurrence of big trees*, *the occurrence of crooked trees*, the degree of the *visibility of the sky, the variability of relief* and *the degree of visibility into the stand* were also assessed by the experts (rating scale: low; medium; high) in order to gain information that may help to account for some of the preferences as suggested by earlier studies (Ribe 1991, Herzog and Kutzli 2002, Herzog and Kropscott 2004, Herzog and Bryce 2007, Herzog in Nasar 1988). Since these features are not equally distributed across all the views they have to be regarded as supportive aspects. The criteria in Table 2 were also applied to the choice of pictures in order to verify their comparability and naturalness.

Table 1. Categories of expert assessments of coherence, complexity and mystery

Coherence
Low: there are over five distinguishable elements or groups of elements in the view and / or objects do not fit together well.
Medium: there are up to five distinguishable elements or groups of elements in the view, of which some do not fit together well.
High: there are up to five distinguishable elements or groups of elements in the view, which fit together well.
Complexity
Low: there are up to three distinguishable elements or groups of elements in the view.
Medium: there are four to five distinguishable elements or groups of elements in the view.
High: there are over five distinguishable elements or groups of elements in the view.
Mystery
Low: view is open or closed; there is no hidden information.
Medium: view is mostly closed or mostly open; hidden information can be presumed.
High: view is half-open; hidden information is perceptible.

Table 2. Criteria for view comparability

It is a view of a participatory environment, not a panoramic view;
Views reflect forest landscape in the "green" period, from late spring to early autumn;
Views are taken horizontally from eye-level;
There are no visible human impacts (e.g. roads, technical facilities, forest management, etc);
There are no water elements which predictably strongly raise the assessments of preference;
There are no eye-catching objects that seem to be foreign bodies in the environment (e.g. people, animals, big rocks, significant variability of the relief, etc).

Test subjects

The experimental procedure consisted of a comparison between expert and non-expert subjects. The expert group consisted of four members with previous knowledge of the presented environmental preference theory and with an educational background in environmental sciences and landscape architecture. They assessed the pictures on the Kaplans' matrix as described above so these ratings could be compared to those of the test subjects. Students of environmental and technological specialities were used as the test group. Students are, in general, regarded as a suitable representative group of society or the common population for research on such areas as environmental

perception and landscape assessment, whose assessments can be regarded as a reflection of other groups of society (Han 2003, Hill and Daniel 2008, Herzog and Kropscott 2004). Students were chosen as the test group in order to get a quick and a reliable result. It is easier to organise a sufficient number of students at one time and in the same place (an auditorium), situation and condition for survey compared with members of the general public. Of course this may involve some bias in the results but only if the aim of the study is to find an answer to a question of general applicability to the wider population. In this case such a bias is not a major problem, especially if the students are either not studying the subject under investigation or are sufficiently early in their studies that they have not been exposed to the theories under investigation. For this study the test group consisted of a total of 97 18-28-year-old individuals (average age 20.3 years, women 68%) of whom 41 studied at the Estonian University of Life Sciences – 9 being students of landscape architecture and 32 of landscape protection and conservation and 56 participants studied at the Tartu College of the Tallinn University of Technology – 42 students of landscape architecture, 10 of building restoration, and 4 of product development and production technology. 89% of the test subjects were 1st or 2nd year students and 11% were attending 1st year of the master programme. So the majority of the test subjects did not have previous knowledge and practice in visual landscape assessment. The question of bias will be considered further in the discussion section.

Questionnaire and test procedure

The forest view preferences were assessed using means of a questionnaire (see Table 3 for a summary of questions) which was developed using typical examples of questions from previous studies, so as to enable the results to be evaluated in the context of other studies. All the answers were given on a 5-point Likert scale ranging from 1 (not at all) to 5 (very much). The key question of preference was how much the test subject liked the view (question 1), the notion of "liking" being equated with "preferring". Questions 3, 4, and 5 were formulated according to the descriptions of coherence, complexity and mystery, in order to understand the respondents' notion of the structure of the view and its impact on preference. As previous researches have claimed that the perceptible naturalness and familiarity of the environment also impact the preference (Kaplan and Kaplan 1982, Ribe 1991, Simončič 2003, Ode et al. 2009), questions about the perception of these qualities were asked to test such standpoints – respectively questions 2 and 6. The aim of questions 7 and 8 was to determine which landscape elements were considered the most attractive and least attractive; they were asked to name one element they liked the most and one which they liked the least in each view. Discovering such preferences and assessing familiarity is assumed to bring out opinions that may result from the cultural background and previous knowledge of the respondents.

The test was carried out on the sample population in five different sub-groups reflecting the availability of classes. The 27 landscape views were shown to the respondents by being projected onto a large screen in the auditorium. Each respondent was given a copy of the questionnaire to complete. The questionnaire and how it should be filled in was introduced in a five-minute presentation before the session commenced. The questionnaires had previously been labelled with numbers which corresponded to the numbers of the projected views. The views were presented in a random but predetermined order, the only condition being that two pictures with similar qualities would not appear in succession. In each sub-group, the views were presented in a different order to decrease the possible impact of assessments being affected by the order of the presentation of the views. Each view was shown until all respondents had signalled that they had filled in the relevant section of the questionnaire. The average duration of the survey was about 40 minutes.

Table 3. Questions used corresponding to variables (originally presented in Estonian language)

Preference – How much do You like the view?
Naturalness – How natural is the environment depicted in the view in Your opinion?
Coherence – Do objects in the view fit together in Your opinion?
Complexity – How complex is the environment depicted in the view in Your opinion?
Mystery – Does the environment depicted in the view seem so interesting to You that You would like to move about in it and find out more about it?
Familiarity – Does the environment seen in the view seem familiar to You?
The most liked object – Name one object You like the most in the view.
The least liked object – Name one object You like the least in the view.

The data were entered picture by picture into MS Excel spreadsheets. The data was statistically analysed in SPSS 16.0 and MS Excel statistics programs. The tests and the results are described in the next section.

Results

Reliability test

The statistical reliability analysis conducted in SPSS supported the reliability of the gathered data

filled in by test persons. The reliability measure (Cronbach's alpha) across the results of the whole questionnaire was 0.78, which is generally considered a good result. The reliability of the assessments of each questioned variable ranged from 0.83 to 0.91 (average 0.88). It can be concluded that the questionnaire was well understood and the respondents provided reliable results.

Preference order

The mean results of assessments of the test group and experts in test group preference order are shown in Table 4.

Table 4. Average results of the assessments given by the test group, experts and author in the order of preference returned by the test group

	Test persons						Expert group							
No of the view	Preference	Naturalness	Coherence	Complexity	Mystery	Familiarity	Complexity	Coherence	Mystery	Dominance of big trees	Visibility of the sky	Occurrence of slanted trees	Visual penetrability	Variability of relief
18	4.85	4.04	4.61	3.18	4.59	3.1	3	5	5	5	1	3	3	1
8	4.49	4.03	4.67	2.22	3.77	4.1	1	5	3	3	3	1	5	1
6	4.46	4.41	4.61	2.86	4.11	4.0	1	3	5	3	1	1	3	1
23	4.41	4.58	4.37	3.96	4.21	3.1	5	3	3	3	1	3	3	3
12	4.37	3.55	3.79	3.38	4.06	2.5	3	1	5	3	5	1	3	1
5	4.14	4.00	4.01	2.73	3.53	3.1	1	3	3	1	1	3	3	3
17	4.01	4.28	4.10	2.98	3.44	3.4	3	5	3	1	1	1	5	1
9	3.99	4.07	4.15	2.78	3.56	3.5	1	5	5	3	1	1	3	1
26	3.85	4.42	4.04	3.70	3.44	3.0	5	5	3	1	1	3	3	1
7	3.80	4.01	4.35	2.56	3.18	3.3	1	5	1	1	1	3	1	1
25	3.80	3.82	3.66	2.79	3.43	3.0	5	5	5	1	5	3	5	1
16	3.76	3.91	3.73	3.34	3.44	2.2	3	5	1	1	1	1	1	1
13	3.75	4.16	3.48	3.33	3.27	3.0	3	3	1	3	3	1	1	1
15	3.72	3.88	3.77	2.93	3.45	3.4	3	3	5	5	1	1	3	1
27	3.69	4.45	3.90	4.14	3.23	3.3	5	5	1	3	1	1	1	1
11	3.64	4.08	3.64	3.31	3.25	3.2	3	1	3	3	1	5	3	3
22	3.56	4.42	3.86	3.41	3.40	3.2	5	3	1	3	3	3	3	1
14	3.46	4.33	3.71	3.11	3.07	2.9	3	3	3	1	3	1	3	1
21	3.41	4.03	3.40	3.25	3.10	3.0	5	1	5	5	1	3	3	1
20	3.37	3.86	3.40	3.34	3.12	3.0	5	1	3	1	3	5	3	1
1	3.27	3.41	3.65	3.01	2.96	2.5	1	1	1	1	5	3	5	1
10	3.08	3.90	3.57	2.89	2.75	3.7	3	1	1	1	1	5	3	1
24	2.91	3.82	3.06	3.25	2.69	3.0	5	3	5	3	3	3	3	1
3	2.90	2.87	3.10	2.89	2.75	2.8	1	1	5	1	5	3	3	1
4	2.80	4.09	3.40	3.21	2.41	3.4	1	3	1	1	1	1	1	1
19	2.62	4.22	2.93	4.20	2.38	3.2	5	1	1	1	1	5	1	1
2	2.41	2.96	3.22	2.30	2.33	2.6	1	1	3	1	5	1	5	1

Prediction of preference

A regression analysis was performed to test the predictability of the independent variables of coherence, complexity and mystery on the dependent variable of preference using linear regression test in SPSS. The combined effectiveness of a series of predictors in describing preference is summarized in a statistical expression as R^2. The regression analysis was conducted in two parts as follows:

1. Assessments of preference of the test group. This was analyzed separately for the variables of each view and also for the average of all views (see Table 5).

2. Comparison of preference of the test group with the assessments of the expert group (see Table 6). Since the expert results were given as a consensus from the four experts together, only a regression analysis with average results was possible.

In the case of almost all views (except two) assessed by the test group the most significant predictor of preference (Table 5) was mystery. Coherence was the next most significant predictor followed by naturalness and complexity which were less important. The importance of familiarity in predicting preference was almost non-existent. From the results given by the expert group (Table 6) the most important variable predicting the test persons' preference of a view was coherence. Occurrence of big trees was also relevant.

Table 5. Prediction of preference by variables assessed by the test group. Significant coefficients ($p < 0.05$) are bold

		β-coefficients for each variable				
No of the view	R^2	Naturalness	Coherence	Complexity	Mystery	Familiarity
1	0.63	**0.16**	**0.27**	**0.16**	**0.45**	0.03
2	0.61	**0.36**	0.09	0.01	**0.52**	0.01
3	0.57	0.13	**0.31**	0.12	**0.40**	**-0.17**
4	0.54	0.04	**0.39**	-0.04	**0.44**	-0.04
5	0.52	0.15	0.10	0.13	**0.51**	0.13
6	0.63	**0.22**	**0.29**	-0.02	**0.48**	-0.02
7	0.53	-0.07	**0.24**	-0.05	**0.60**	0.05
8	0.31	-0.01	**0.27**	**0.23**	**0.36**	-0.04
9	0.52	**0.23**	**0.22**	-0.13	**0.46**	0.00
10	0.50	0.13	**0.31**	0.09	**0.44**	-0.11
11	0.45	0.13	**0.35**	-0.04	**0.38**	-0.06
12	0.50	**0.27**	**0.26**	-0.07	**0.35**	0.01
13	0.43	0.06	0.08	0.04	**0.62**	-0.10
14	0.50	0.11	**0.28**	**0.19**	**0.45**	-0.11
15	0.60	0.13	**0.26**	0.08	**0.59**	**-0.15**
16	0.57	0.06	**0.26**	0.05	**0.55**	0.12
17	0.59	0.12	0.08	**0.23**	**0.57**	-0.03
18	0.30	0.05	0.10	0.04	**0.46**	-0.11
19	0.55	0.16	**0.28**	0.01	**0.46**	0.03
20	0.67	**0.16**	**0.23**	-0.01	**0.63**	-0.05
21	0.50	0.16	**0.30**	0.02	**0.54**	-0.29
22	0.56	0.10	**0.22**	0.02	**0.54**	0.14
23	0.56	0.01	**0.43**	-0.11	**0.42**	-0.10
24	0.59	-0.02	**0.33**	-0.03	**0.52**	0.07
25	0.45	**0.19**	0.06	-0.02	**0.52**	0.10
26	0.59	-0.04	**0.50**	**-0.15**	**0.42**	0.01
27	0.44	0.16	**0.22**	-0.07	**0.42**	0.00
With mean values	0.97	0.13	0.14	-0.10	**0.81**	-0.02

Table 6. Prediction of preference by variables assessed by the expert group. Significant coefficients ($p < 0.05$) are bold

R^2	Coherence	Complexity	Mystery	Occurrence of big trees	Visibility of the sky	Occurrence of crooked trees	Visual penetrability	Variability of relief
0.61	**0.62**	-0.13	0.08	**0.40**	0.07	0.05	0.09	0.32

Comparison of the assessments of the test group and experts

In order to evaluate the similarity of the assessments of the test group and experts on the basis of the variables of coherence, complexity and mystery, a Z-test in MS Excel was conducted. This enabled the set of the test group's assessments to be compared to a

constant expert assessment value for each variable of each view. In Table 7 *p*-values <0.05 (marked bold) show where expert and test group assessments were significantly different. According to the Z-test about half of the assessments coincided and half did not. The values were most different for coherence and mystery.

Table 7. *p*-values of Z-test

No of the view	Coherence *p*-value	Complexity *p*-value	Mystery *p*-value
1	**0.00**	**0.00**	**0.00**
2	**0.00**	**0.00**	1.00
3	**0.00**	**0.00**	1.00
4	**0.00**	**0.00**	**0.00**
5	**0.00**	**0.00**	**0.00**
6	**0.00**	**0.00**	1.00
7	1.00	**0.00**	**0.00**
8	1.00	**0.00**	**0.00**
9	1.00	**0.00**	1.00
10	**0.00**	0.89	**0.00**
11	**0.00**	**0.00**	**0.02**
12	**0.00**	**0.00**	1.00
13	**0.00**	**0.00**	**0.00**
14	**0.00**	0.13	0.27
15	**0.00**	0.76	1.00
16	1.00	**0.00**	**0.00**
17	1.00	0.58	**0.00**
18	**0.00**	0.053	**0.00**
19	**0.00**	1.00	**0.00**
20	**0.00**	1.00	0.18
21	**0.00**	1.00	1.00
22	**0.00**	1.00	**0.00**
23	**0.00**	1.00	**0.00**
24	0.31	1.00	1.00
25	1.00	1.00	1.00
26	1.00	1.00	**0.00**
27	1.00	1.00	**0.00**

Secondly, the tendencies of the results of the test subjects and experts in regard to coherence, complexity, and mystery were compared. This was to overcome the fact that because the test subjects tended not to give very low average values overall, nevertheless the relative tendencies in variability might be similar between the two groups. The average results are compared in Table 8. The mean divergences and correlation coefficients for expert and test group assessments were also calculated for each variable. The correlation coefficient (0.72) is the highest and divergence (1.12) the lowest in the case of complexity. The correlation coefficient of coherence (0.63) is also moderately high while the correlation of mystery (0.39) is relatively low. Thus, the assessments of coherence and complexity were rather similar but assessments of mystery differed somewhat more between the experts and the test population.

In the assessment of *coherence*, the range of average assessments given by test group respondents ranged from 2.93 (view 19) to 4.67 (view 8). The greatest difference between the assessments of the test group and experts was 2.79 (view 12). The results show

Table 8. Comparison of the assessment of coherence, complexity and mystery of test group respondents and experts. Divergence of assessments less than 1 are marked in bold

Coherence				Complexity				Mystery			
No of the view	Test group's mean results	Experts' results	Divergence of results	No of the view	Test group's mean results	Experts' results	Divergence of results	No of the view	Test group's mean results	Experts' results	Divergence of results
8	4.67	5	**0.33**	*19*	4.2	5	**0.8**	*18*	4.59	5	**0.41**
6	4.61	3	1.61	*27*	4.14	5	**0.86**	*23*	4.21	3	1.21
18	4.61	5	**0.39**	*23*	3.96	5	1.04	*6*	4.11	5	**0.89**
23	4.37	3	1.37	*26*	3.7	5	1.3	*12*	4.06	5	**0.94**
7	4.35	5	**0.65**	*22*	3.41	5	1.59	*8*	3.77	3	**0.77**
9	4.15	5	**0.85**	*12*	3.38	3	**0.38**	*9*	3.56	5	1.44
17	4.1	5	**0.90**	*20*	3.34	5	1.66	*5*	3.53	3	**0.53**
26	4.04	5	**0.96**	*16*	3.34	3	**0.34**	*15*	3.45	5	1.55
5	4.01	3	1.01	*13*	3.33	3	**0.33**	*16*	3.44	1	2.44
27	3.9	5	1.10	*11*	3.31	3	**0.31**	*17*	3.44	3	**0.44**
22	3.86	3	**0.86**	*21*	3.25	5	1.75	*26*	3.44	3	**0.44**
12	3.79	1	2.79	*24*	3.25	5	1.75	*25*	3.43	5	1.57
15	3.77	3	**0.77**	*4*	3.21	1	2.21	*22*	3.4	1	2.4
16	3.73	5	1.27	*18*	3.18	3	**0.18**	*13*	3.27	1	2.27
14	3.71	3	**0.71**	*14*	3.11	3	**0.11**	*11*	3.25	3	**0.25**
25	3.66	5	1.34	*1*	3.01	1	2.01	*27*	3.23	1	2.23
1	3.65	1	2.65	*17*	2.98	3	**0.02**	*7*	3.18	1	2.18
11	3.64	1	2.64	*15*	2.93	3	**0.07**	*20*	3.12	3	**0.12**
10	3.57	1	2.57	*3*	2.89	1	1.89	*21*	3.1	5	1.9
13	3.48	3	**0.48**	*10*	2.89	3	**0.11**	*14*	3.07	3	**0.07**
20	3.4	1	2.4	*6*	2.86	1	1.86	*1*	2.96	1	1.96
21	3.4	1	2.4	*25*	2.79	5	2.21	*3*	2.75	5	2.25
4	3.4	3	**0.4**	*9*	2.78	1	1.78	*10*	2.75	1	1.75
2	3.22	1	2.22	*5*	2.73	1	1.73	*24*	2.69	5	2.31
3	3.1	1	2.1	*7*	2.56	1	1.56	*4*	2.41	1	1.41
24	3.06	3	**0.06**	*2*	2.3	1	1.3	*19*	2.38	1	1.38
19	2.93	1	1.93	*8*	2.22	1	1.22	*2*	2.33	3	**0.67**
Mean divergence			***1.36***				***1.12***				***1.33***
Correlation coefficient			***0.63***				***0.72***				***0.39***

that the assessments of test persons and experts were quite similar; higher and lower rates remain on the same side of the table; views No. 12 and 25 have to be regarded as exceptions. View 12 received the twelfth highest coherence rating (3.79) from the test group and the highest rating from experts. View 25 received the sixteenth highest assessment of coherence (3.66) from the test group and the fifth highest from experts.

In the assessment of *complexity*, the range of average assessments given by the test group was from 2.22 (view 8) to 4.20 (view 19). Here, it can also be seen that the assessments of the test group and experts are rather similar. Views 4 and 25 are exceptional here. View 4 received the thirteenth highest assessment of complexity (3.21) from the test group and also the highest rating from the experts. View 25, however received the twenty second highest assessment of complexity (2.79) from the test group and the fifth highest rating from experts.

In the assessment of *mystery*, the range of average assessments given by the test group was from 2.33

(view 2) to 4.59 (view 18). The assessments of the test group and experts differed somewhat more than in the case of coherence and complexity. The assessments of the eight highest ranking views can be considered to be rather similar, but there are more differences between the assessments in the lower part of the table. The greatest differences were observed for views 16, 22, 24 and 3. Views 16 and 22 have received considerably higher scores for mystery from the test group (respectively 3.44 and 3.40) than from experts (1). Views 24 and 3, however, have received considerably lower scores for mystery from the test group (respectively 2.69 and 2.75) than from experts (5).

Attractive and unattractive elements

In the survey, respondents were asked to name one element they liked the most and one object they liked the least in each view, in order to receive additional information which might help account for view preferences (see Tables 9 and 10). Elements that were named at least five times, meaning, by at least 5% of respondents, for a particular view were used in the results. Elements that were named by less than 5% of the respondents were abandoned; these results are marginal to make conclusions. Similar elements named differently by test respondents were grouped under one term. Answers that were unintelligible or had no clear connection with the view were excluded. The tables also present the number of views in which the respective element was named, and the relationship between the number of times the element was named and its representation in the views. This data should be considered as information supporting the results of the research, since the general representation of the elements in the views was not part of the view selection procedure. The elements regarded as most attractive were mostly those that apparently indicated that environment was in a "good condition" according to common understanding (although the opinions of environmental experts may differ) (Kolb et al 1995), such as healthy, vital elements or ones with an interesting or peculiar appearance. Respondents from the test group tended to prefer high and lush and also soft, mossy and low undergrowth. Young, vital trees and big, thick-stemmed and tall trees were important attractive elements. Unattractive elements were mainly those that might visually indicate the poor condition of the environment, eg dead or dying and decaying objects. Thus, bare, dry, crooked, broken, fallen trees and branches, weak young shaded trees, shabby or old naturally well pruned trees, and high undergrowth were considered unattractive.

Table 9. Pleasant objects named at least 100 times

Named object	Number of mentions	Number of views where mentioned	Quotient of mentions and views
high. lush underbrush or	354	12	29.5
low underbrush. moss	325	10	32.5
young conifers	286	10	28.6
birch. birch stem	226	10	22.6
big. thick. high tree	206	9	22.9
tilted. crooked tree	103	7	14.7

Table 10. Unpleasant objects named at least 100 times

Named object	Number of mentions	Number of views where mentioned	Quotient of mentions and views
dried trees and	334	15	22.3
fallen trees and	252	11	22.9
small peaky	161	11	14.6
thicket. very dense	124	10	12.4
broken tree	123	3	41
high underbrush.	117	10	11.7

The most and the least preferred forest views

Rather than present in detail the assessments of all the views, it may be more useful to identify the main features of the two most and two least preferred views as representing the extremes of the range and from this inferring some broad characteristics of these.

The test group assessed view 18 (see Figure 1) as the most preferred view (average rating of preference 4.85). Average assessment scores of the view are shown in Figures 2 and 3. This is also very coherent and mysterious, moderately complex and familiar, and perceived as natural. Regression analysis showed that mystery is statistically the most important variable in the prediction of preference. The values of the additional variables for this view were as follows: high

Figure 1. The most preferred view (Author of the photo Anneli Palo)

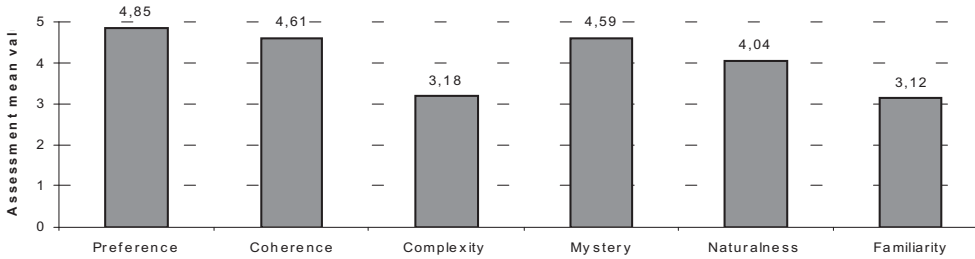


Figure 2. Average test group assessments of the variables of the most preferred view

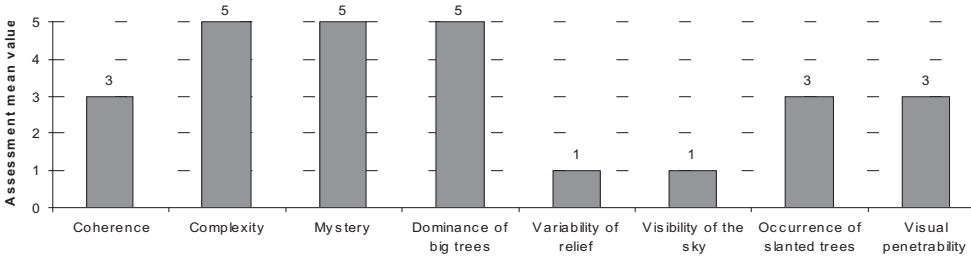


Figure 3. Expert group assessments of the variables of the most preferred view

occurrence of big trees, low variability of relief, low visibility of the sky, medium occurrence of leaning trees, and medium visual penetrability. Respondents from the test group named the following as the most attractive elements: crooked forked great pine-tree (45 respondents), big and thick pine-trees (24), low soft underbrush (12), tree-root (6), small white blossoms (5). The following elements were named as un attractive: dry branches (16), fallen branch (10), broadleaved trees in the distance (9), small fir-trees (9).

The second view in terms of preference was No. 8 (see Figure 4) (rating of preference 4.49). The average assessments of the picture are shown in Figures 5 and 6. According to the assessments of the test group the second view is very coherent, not complex, rather mysterious, very familiar and perceived as rather natural in terms of preference. The regression analysis showed that in the case of this view, mystery and coherence were statistically important variables in the prediction of preference. Assessments of the variables of the this view were as follows: medium occurrence of big trees; medium visibility of the sky; low occurrence of leaning trees; high visual penetrability. The test group respondents named the following as the most attractive elements or phenomena: high straight pines (34), underbrush, moss (33), neatness, order (11) coherence, spaciousness, view (6), wholeness (5). The following elements or phenomena were named as unattractive: branches on the ground (21), straight stem in the foreground (12), excessive order of trees (8). The most pleasant objects were straight, vital pines and soft, low underbrush. Dead objects like fallen branches proved to be unattractive, likewise, excessive simplicity and order was also sometimes perceived as unattractive.

Figure 4. The second most preferred view (Author of the photo Anneli Palo)

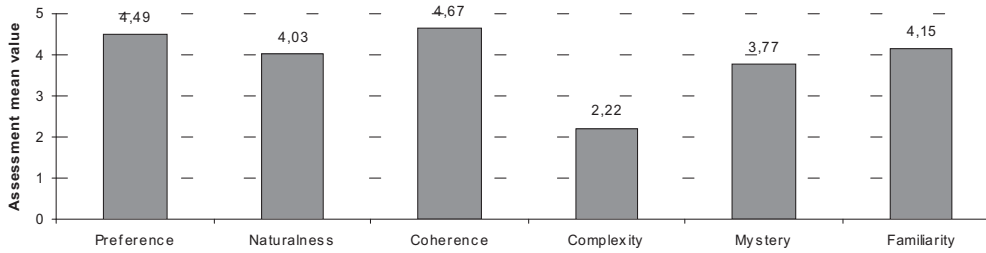


Figure 5. Average test group assessments of the variables of the second most preferred view

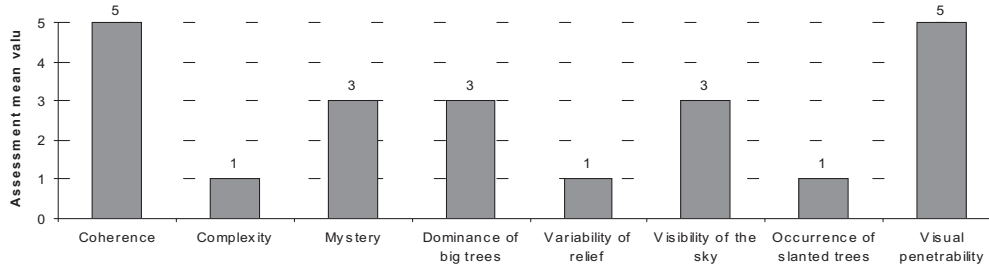


Figure 6. Expert group assessments of the variables of the second most preferred view

The least preferred view was No. 2 (see Figure 7) (rating of preference 2.41). The average assessments of the view are shown in Figures 8 and 9. According to the assessments of the test group the least preferred view is not very coherent, complex, mysterious, familiar, or natural. According to regression analysis, the most important predictors of preference of the view were mystery and naturalness. The assessment of the expert group was as follows: low coherence; low complexity; medium mystery. The values of the additional variables were: low occurrence of big trees, low variability of relief, high visibility of the sky, low occurrence of leaning trees, high visual penetrability. The test group respondents named the following as the most attractive elements: higher pines in the background (37), moss and green underbrush (17), heather (12), young trees (5). The following elements were named as the most unattractive ones: dry, bare trees (44), sky (7), tree with a broken stem (6), bigger trees in the background (6), burnt forest (5), and young thickset trees (5). Bigger and more vital and living trees and plants are seen as more attractive. Dry, bare and broken trees that refer to decay are perceived as unpleasant.

Figure 7. The least preferred view (Author of the photo Anneli Palo)

The test group assessed view 19 (see figure 10) (rating of preference 2.62) as the second least preferred view. The average assessments of the view are shown in Figures 11 and 12. According to the assessments of the test group the view is not very coherent or mysterious, was very complex, moderately familiar and rather natural. According to regression analysis, the most important predictors of preference were mystery and coherence. The assessment of the expert group was as follows: low coherence, high complexity, low mystery. The values of the additional variables were: low occurrence of big trees, low variability of relief, low visibility of the sky, high occurrence of leaning

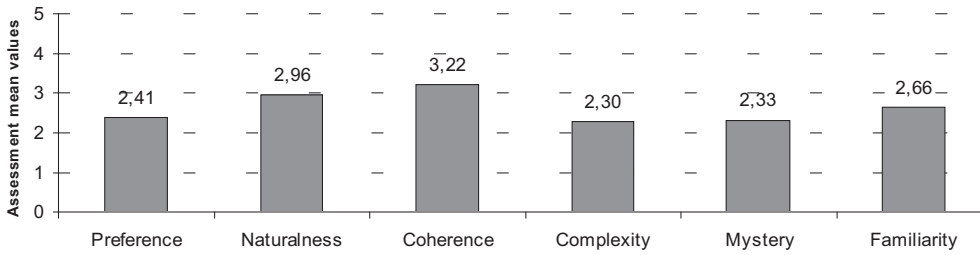


Figure 8. Average test group assessments of the variables of the least preferred view

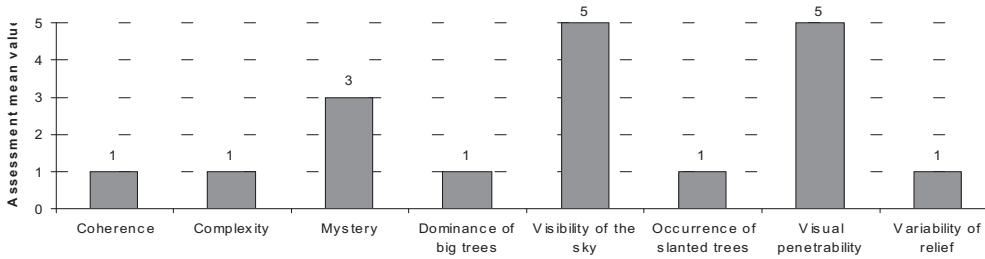


Figure 9. Expert group assessments of the variables of the least preferred view

trees, low visual penetrability. Test group respondents named the following as the most attractive elements: small fir-trees (27), root-stump, tree-stub (24), ferns (16), broken, fallen tree (7). The following elements or phenomena were named as the most unattractive: root-stump, tree-stub (23), brushwood, thicket (14) disorder, negligence (11), underbrush, high grass (10), broken, fallen tree (10), birch, white birch stem (6), small fir (6). Unattractive were mostly dead or decaying objects; likewise, excessive density of the stand, closeness of trees and mess was generally perceived as unattractive.

Figure 10. The second least preferred view (Author of the photo Anneli Palo)

Discussion

In the present study, all of the three techniques identified by Panagopolous (2009) have been linked in order to gain a consistent result. At the first stage, the ecological expert approach was implemented in choosing relevant natural forest photo views that could be differentiated from human-influenced landscapes. At the second stage the design expert approach was used in combining the collection of 27 views to cover the variable matrix of coherence, complexity, and mystery in terms of low, medium and high occurrence. At the third stage the psychophysical approach was applied in the design of the preference survey. Application of these three approaches in the study permits us to make the following observations: 1. the views were representative of the Estonian natural forest environment but were limited when it came to the managed forest environment which covers the majority of forests in Estonia; 2. the views contain a full range of the environmental preference matrix; and 3. expert and non-expert assessments could be compared.

The main findings about view preferences were that the most significant variable to emerge from the

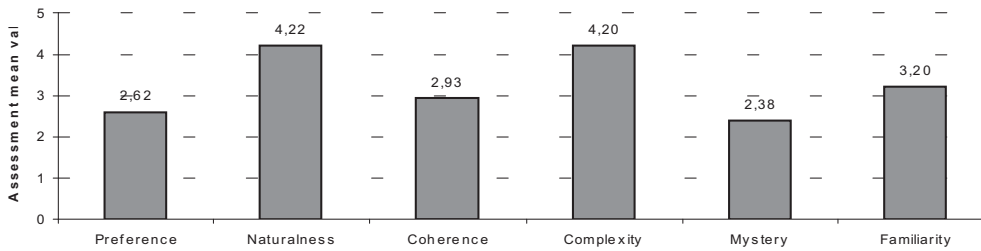


Figure 11. Average test group assessments of the variables of the second least preferred view

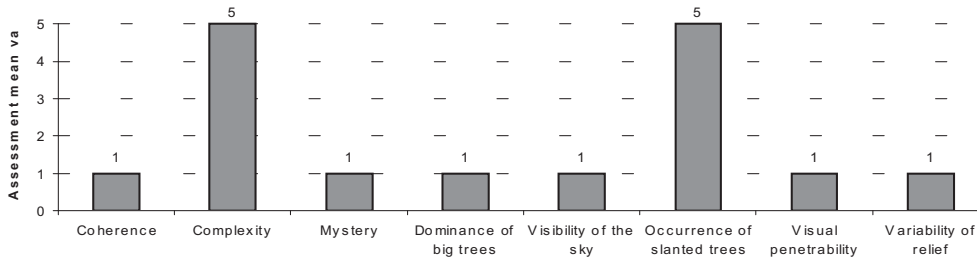


Figure 12. Expert group assessments of the variables of the second least preferred view

test group as the predictor of preference was mystery, while coherence was second followed by complexity. However, according to the expert group pre-evaluation assessments the most preferred scenes were ranked as being higher at the level of coherence than of complexity and mystery. Thus, experts see more coherence in the scene than the non-experts and mystery is more significant for non-experts. Contrary to predictions based on earlier studies (Kaplan and Kaplan 1989, Purcell and Lamb 1998, Ulrich 1986) naturalness was less significant in our case. However, this can probably be easily accounted for because all of the views had been selected especially for their natural character so there was no evidence of non-naturalness in the sample and none was identified by the viewers who saw them as being unnatural. Complexity was of low significance in our results. The role of complexity has been of variable importance in previous studies, too. This may be because in the discussions on the role of diversity in landscapes it has been asserted (e.g. Bell 2004) that low diversity (or complexity) is boring while too much is confusing so that there is a non-linear relationship. Therefore the lower significance may reflect the confusing effect of too much complexity in some scenes. The importance of familiarity in predicting preference was almost non-existent.

While the results generally coincide with and support those of previous research (e.g. Anderson in Kaplan 1989, Ribe 1991, Herzog and Barnes 1999, Simonič 2003), there are some differences in the relevance of variables in the prediction of preferences. In the present study, the most important variables predicting preferences were mystery and then coherence. This is rather different from the results of studies such as that of Simonič (2003) who studied a variety of different landscapes including a set of views ranging from forest wilderness to geometric anthropogenic settings. That study found coherence to be the most important variable predicting preference while mystery and complexity did not have much influence. Likewise, Herzog and Leverich (2003) found complexity to be a marginal predictor for preference. Anderson (in Kaplan 1989) found that coherence, mystery and also, contrary to our results, complexity influenced preferences most clearly. Views of spacious and varying landscapes received the highest preference rates. Complexity also seemed to predict preference to a reasonable level in a study by Kaplan et al (1972). Similar to the current study, however, Herzog and Barnes (1999) found mystery and coherence to be important positive predictors of preference in the case of field/forest environments. In contrast, there are recent findings that in the case of low-access forest environments mystery is uncorrelated with preference ratings unless the defi-

nition of mystery is expanded and introduced thoroughly to test subjects (Herzog and Bryce 2007). In the present study, although accessibility was not separately explored, mystery was a positive predictor of preference in case of all of the views even though some presumably low-access views were presented (views no 22, 27).

Our study has revealed additional predictors for view preferences in terms of elements that the test group respondents found attractive or unattractive the most. The most attractive elements were those that visually indicated the good condition of the environment: healthy, vital trees or elements with an interesting or peculiar appearance. Test group respondents liked high and lush, but also soft, mossy and low undergrowth. The elements they liked the least visually indicated the apparently poor condition of the environment: dead or dying, decaying objects. Thus, bare, dry, crooked, broken, fallen trees and branches, weak young shaded trees, untidy or old naturally well-pruned trees, and high undergrowth were not preferred. In general terms our results support the observations of Ribe (1991), that forest stands of an old-growth condition are visually preferred, and single veteran trees also add visual value to the forest landscape. Likewise Matsuoka and Kaplan (2008) have reported that, in general, the public prefers lush vegetation covering the forest floor. We have not studied man-altered forest stands such as clear-cuts or replanted stands, which gave the lowest preferences in Ribe's study. However, the least preferred forest pictures in our case resembled low-productivity young stands to some extent. This also corresponds to the fact that young, especially shaded trees or trees with a shabby appearance were often named as unattractive elements.

It may be possible to generalise the main findings in terms of the relationship between mystery, the attractive elements noted by test subjects and the design objective of Genius loci as noted in the introduction. This could be that the higher mystery levels when accompanied by interesting big old trees and other characterful elements together yield a greater sense of Genius loci. This is something that may be worth exploring further.

The evaluation of the similarity of the assessments of the test group and experts on the basis of coherence, complexity and mystery variables has shown that the assessment scores were slightly different in case of coherence and most dissimilar in the case of mystery. It can be explained by the innately different assessment contexts of the two groups. While test group respondents perceived natural forest views to be high in coherence and mystery in comparison to their previous experience of landscapes in general (including artificial and other disturbed landscapes with which they were familiar), then the experts were focused on finding different organizational views in the context of those specific natural forest environments contained within the images used in the test, not in landscapes generally. The experts also had a greater appreciation of the meanings of the terms coherence, complexity and mystery while the test subjects were confronted with the words and short, simple descriptions and may not have been able to articulate exactly what they meant in the landscape. This could mean that another way of evaluating the results would have been merely to test for preference and then to correlate the preference scores to the expert evaluation of the three variables. This would not have been so rewarding and would not have shown up the differences in either understanding or in context as shown by the two groups taking part.

The explanation of the phenomenon that natural forest landscapes did not receive very low values for any of these variables from test subjects could also be that natural landscapes are inherently perceived as coherent, are generally more complex by nature and less visually organized than artificial landscapes, and are generally perceived as more mysterious than everyday urban landscapes. Since expert assessments were focused on finding different organizational content within forest landscapes, not in landscapes generally low values had to be given to some views. This illustrates the need for studying different landscape types separately, as it gives a more thorough overview of preference factors within a specific landscape type than when comparing different landscape types in general.

If we look for more reasons for the greater divergence in the assessments of mystery, it might be explained, in the case of the test group, by unfamiliarity with the definition presented in the theory as already noted above, and an imperfect understanding of the question asked about mystery in the questionnaire, which was: "Does the environment depicted in the view seem so interesting to you that you would like to move on in it and find out more about it?". Respondents in the test group might have paid more attention to the first half of the question – "does the environment seem interesting?" – and, without taking into account the three-dimensional space and the existence of hidden information so relevant in the assessment of mystery, may have given assessments on the basis of other, two-dimensional, interesting features in the view. Therefore, the possibilities of rephrasing the questions should be considered in the future. The more precise rephrasing of the definition of mystery has been given as an option by Herzog and Bryce

(2007), in the same paper where the distinction between mystery and surprise was discussed. It was found that a longer explanation of the meaning of mystery is needed in very low levels of visual access, where mystery is confused with surprise, in which case new information is suddenly revealed, not promised as in the case of mystery.

The findings in relation to attractive or unattractive elements are also interesting. The focus on healthy trees and thriving undergrowth as being attractive and dead or decaying elements as being unattractive implies that death and decay is an unattractive aspect of nature. The developing field of ecological aesthetics (as noted in the introduction) suggests that since these elements are a natural and unavoidable part of life in its fullest expression then we should learn to appreciate them as part of the ecosystem, especially in natural landscapes. It is clear that this concept has yet to take root in Estonia among the test subjects at least.

We should also take into account some limitations when considering the results. First, the selection of photos that was used for visual stimuli had only one representative for each visual-informational composition. For better demonstration multiple views for each category could be used. However, in the present study, multiple samples were not used to prevent mental fatigue of the test subjects. Second, the test group was dominated by young and female students, which might not generalize to other age and gender groups (Herzog and Bryce 2007; Balling and Falk 1982; Herzog et al. 2000, Zube, Pitt and Evans 1983), although similar test groups have been accepted in similar studies before (Herzog and Bryce 2007, Han 2003, Han 2010, Herzog and Leverich 2003, Herzog and Kropscott 2004, Hill and Daniel 2008, Sevenant and Antrop 2009, Anderson 1981).

The use of photographs, which as has been discussed in the introduction, have been accepted for a long time as suitable surrogates for real landscapes, may work better in more open or panoramic scenes which we might be able to venture farther into if we were confronted with the real equivalent. However, in internal scenes two dimensional photos do not allow for adequate perception of depth and in Berleant's theory of the Aesthetic of Engagement (1992) and also affordance theory (Gibson 1979), movement through a landscape is necessary to appreciate it fully. This implies using different techniques for presenting images to viewers or conducting research in the field rather than the laboratory. Two non-field methods could be possible – the use of short videos to give a deeper image of the landscape and the use of virtual reality to enable test subjects to feel that they are in the landscape.

Conclusions

The aim of the study was to test preferences for Estonian natural forest landscapes for the first time using the Kaplans' model as the theoretical basis and the three aspects of coherence, complexity and mystery as the dimensions for developing a predictive model. The research questions were:

Can different specific Estonian natural forest landscape preferences be identified? From the results it can be concluded that there are a range of preferences for different types of natural forest landscapes in Estonia. Those containing high degrees of mystery and coherence, in that order, were judged to be most preferred. The elements which were most attractive besides the general landscape composition and structure were those which enhanced mystery and gave them character and an overall strong sense of Genius loci. These could be the types of landscape already chosen for protection but where such places occur elsewhere they could be identified and marked for special treatment so that the positive feelings evoked by the qualities could be safeguarded for the future. The findings that dead, decaying and untidy landscape elements are found to be unattractive is also noteworthy. While no one can be forced to like dead trees, the importance of dead wood and natural processes in the environment and ecosystem could be communicated to the general public so that forests in general are not over-managed in order to make them too tidy.

Does the Kaplan model enable landscape preferences to be predicted in relation to the specific forest stand structures and their combinations found in natural Estonian forests? It seems that the results demonstrate that under the limited conditions of this experiment there are some clear correlations between factors and preferences, with mystery emerging as the most significant, followed by coherence and then by complexity. Planners of recreation al areas, designers of trails and managers of natural or managed forests could use this understanding to ensure that the mystery in the landscape is enhanced.

Are there differences in the evaluation of the predictor variable between experts and non-experts? The evaluation of the degree of similarity of the assessments between the test group and experts for coherence, complexity and mystery has shown that the scores were most similar for complexity, slightly different for coherence and most dissimilar for mystery. Test group respondents perceived the natural forest views to be high in coherence and mystery when compared to their previous experience of landscapes in general, so very low values were not given. The experts focused on finding different visual organizational

patterns in the context of specific natural forest environments, not in landscapes generally, so the full range of values was represented and differences with test group assessment scores emerged.

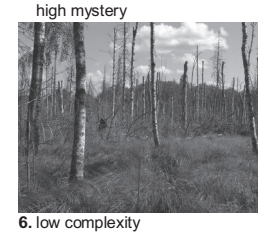
Are the preferences affected by the presence of particular elements or features indicative of ecological processes and objectively measured "naturalness"? It seems that the test subjects see the presence of elements representing death and decay or some kind of lack of "ecosystem health" or vitality as visually unappealing. This suggests that the role of some natural processes in natural ecosystems is not clearly understood or, if it is understood, is not seen as aesthetically meaningful. Nature protection organisations could consider increasing the awareness of this in their educational or interpretative materials.

Appendix 1. Views chosen by the expert group with assessed variables
Author of the photos Anneli Palo, except No. 25 by Peeter Vassiljev

1. low complexity
low coherence
low mystery

2. low complexity
low coherence
medium mystery

3. low complexity
low coherence
high mystery



4. low complexity
medium coherence
low mystery

5. low complexity
medium coherence
medium mystery

6. low complexity
medium coherence
high mystery

7. low complexity
high coherence
low mystery

8. low complexity
high coherence
medium mystery

9. low complexity
high coherence
high mystery

10. medium complexity
low coherence
low mystery

11. medium complexity
low coherence
medium mystery

12. medium complexity
low coherence
high mystery

Acknowledgments

The authors want to thank Anneli Palo and Peeter Vassiljev for providing the photos. We are also grateful to Ilmar Part for improving the English of the manuscript.

References

Anderson, L.M. 1981. Land use designations affect perception of scenic beauty in forest landscapes. *Forest Science* 27 (2): 343-400.

Balling, J.D. and Falk, J.H. 1982. Development of visual preference for natural environments. *Environment & Behavior* 14 (1): 5-28.

Barker, R.G. 1968. Ecological Psychology: Concepts and methods for studying the environment of human behaviour. Stanford University Press, Palo Alto, CA, 242 pp.

Bell, S. 2004. Elements of visual design in the landscape (2nd Edition). E & FN Spon, London, 196 pp.

Bell, S. 2012. Landscape: Pattern, Perception and Process (2nd Edition). Routledge, London, 350 pp.

Bell, S. and Apostol, D. 2008. Designing sustainable forest landscapes. Taylor and Francis, London, 356 pp.

Bell, S., Blom, D., Rautamaki, M., Castel-Branco, C, Simson, S. and Olsen, E.A. 2005. Design of urban forests. In: C. Konijnendijk, K. Nilsson, T.B. Ranmdrup and J. Schipperijn (Editors), Urban forests and trees. Springer Verlag, Berlin, p. 149-186.

Berleant, A. 1988. Aesthetic perception in environmental design. In: J. L. Nasar (Editor), Environmental aesthetics: Theory, research and applications. Cambridge: Cambridge University press, p. 84-97.

Berleant, A. 1992. The aesthetics of environment. Temple University Press, Philadelphia, 256 pp.

Council of Europe. 2000. European landscape convention. CoE, Brussels.

Daniel, T.C. and Boster, R. 1976. Measuring landscape aesthetics: the SBE method. Res. Pap. RM-167. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain and Range Experiment Station.

Estonian Environment Information Centre. 2012. Yearbook Forest 2010. Tartu, 226 pp.

Gibson, J. J. 1979. The ecological approach to visual perception. Houghton Mifflin, Boston, 332 pp.

Estonian Society of Forests. 2008. Mets on puhkamiseks, mitte raiumiseks [Forest is for recreation not for cutting]. www.metsainfo.ee/index.php?option=com_content&view=article&id=180%3Amets-on-puhkamiseks-mitte-raiumiseks&Itemid=156.

Gobster, P. H. 1995. Aldo Leopold's ecological aesthetic: integrating aesthetic and biodiversity values. *Journal of Forestry* 93 (2): 6-10.

Gobster, P.H. 1996. Forest aesthetics, biodiversity, and the perceived appropriateness of ecosystem management practices. In: M.W. Brunson, L.E. Kruger, C.B. Tyler, S.A. Schroeder (tech. eds). Defining social acceptability in ecosystem management: a workshop proceedings; 1992 June 23-25, Kelso, WA. Gen. Tech. Rep. PNW-GTR-369. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, p. 77-97.

Han, K.-T. 2003**.** A reliable and valid self-rating measure of the restorative quality of natural environments. *Landscape and Urban Planning* 64: 209-232.

Han, K.-T. 2010. An Exploration of Relationships Among the Responses to Natural Scenes: Scenic Beauty, Preference, and Restoration. *Environment and Behavior* 42: 243-270.

Herzog, T.R. 1988. A cognitive analysis of preference for field-and-forest environments. In: J. L. Nasar (Editor), Environmental aesthetics: Theory, research and applications. Cambridge: Cambridge University press, p. 343-356.

Herzog, T.R. and Barnes, G.J. 1999. Tranquility and Preference Revisited. *Journal of Environmental Psychology* 19 (2): 171-181.

Herzog, T.R. and Bryce, A.G. 2007. Mystery and preference in within-forest settings. *Environment and Behavior* 39 (6): 779-796.

Herzog, T. R., Herbert, E. J., Kaplan, R., & Crooks, C. L. 2000. Cultural and developmental comparisons of landscape perceptions and preferences. *Environment and Behavior* 32: 323-346.

Herzog, T.R. and Kropscott, L.S. 2004. Legibility, Mystery, and Visual Access as Predictors of Preference and Perceived Danger in Forest Settings without Pathways. *Environment and Behavior* 36: 659-677.

Herzog, T.R. and Kutzli, G.E. 2002. Preference and perceived danger in field/forest settings. *Environment and Behavior* 34: 819-835.

Herzog, T.R. and Leverich, O.L. 2003. Searching for Legibility. *Environment and Behavior* 35: 459-477.

Hill, D. and Daniel, T.C. 2008. Foundations for an ecological aesthetic: Can information alter landscape preferences? *Society and Natural Resources* 21: 34-49.

Hull, R.B. and Stewart, W.P. 1992. Validity of photo-based scenic beauty judgements. *Journal of Environmental Psychology* 12: 101-114.

Kaplan, S. and Kaplan, R. 1982. Cognition and Environment: Functioning in an uncertain world. New York: Praeger, 287 pp.

Kaplan, R. and Kaplan, S. 1989. The experience of nature: A psychological perspective. New York: Cambridge University Press, 340 pp.

Kaplan, S. 1995. The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology* 15: 169-182.

Kaplan, S., Kaplan, R. and Wendt, J.S. 1972. Rated preference and complexity for natural and urban visual material. *Perception And Psychophysics* 12 (4): 354-356.

Kolb, T.E., Wagner, M.R. and Covington, W.W. 1995. Forest Health From Different Perspectives. Details: In: L.G. Eskew (Editor), Forest health through silviculture: Proceedings of the 1995 National Silviculture Workshop; 1995 May 8-11; Mescalero, New Mexico. Gen. Tech. Rep. RM-GTR-267. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 5-13.

Lee, T.R. 2001. Perceptions, attitudes and preferences in forests and woodlands. Technical Paper 18, Forestry Commission, 166 pp.

Leopold, A. 1981 (first published 1949). A Sand County almanac. Oxford University Press, New York, 240 pp.

Matsuoka, R.H. and Kaplan, R. 2008. People needs in the urban landscape: Analysis of Landscape and Urban Planning contributions. *Landscape and Urban Planning* 84: 7-19.

Nilsson, K., Sangster, M., Gallis, C., Hartig, T. de Vries, S., Seeland, K. and Schipperijn, J. (Editors). 2011. Forests, Trees and Human Health. Springer, Berlin, 452 pp.

Ode, Å., Fry, G., Tveit, M.S., Messager, P., Miller, D. 2009. Indicators of perceived naturalness as drivers of landscape

preference. *Journal of Environmental Management* 90: 375-383.

Panagopoulos, T. 2009. Linking forestry, sustainability and aesthetics. *Ecological Economics* 68: 2485–2489

Proebstl, U., Wirth, V., Elands, B. and Bell, S. (Editors) 2010. Management of recreation and nature-based tourism in European **forests**. Springer-Verlag, Heidelberg, 336 pp.

Purcell, A.T. and Lamb, R.J. 1998. Preference and naturalness: An ecological approach. *Landscape and Urban Planning* 42: 57-66

Ribe, R.G. 1991. The scenic impact of key forest attributes and long-term management alternatives for hardwood forests. In: McCormick, Larry H.; Gottschalk, Kurt W., eds. Proceedings, 8th Central Hardwood Forest Conference; 1991 March 4-6; University Park, PA. Gen. Tech. Rep. NE-148. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 34-54.

Rosenblad, Y. and Niit, T. (supervisor). 2005. Eesti maastikud kui vaimseks taastumiseks sobivad paigad: magistritöö [Estonian Landscapes as Restorative Places: masters thesis]. Tallinna Ülikool, sotsiaalteaduskond, psühholoogia osakond. (in Estonian with English abstract)

Sevenant, M. and Antrop, M. 2009. Cognitive attributes and aesthetic preferences in assessment and differentiation of landscapes. *Journal of Environmental Management* 90: 2889–2899.

Schoggen, P. 1989.Behavior Settings: A revision and extension of Roger G. Barker's Excological Psychology, Stanford University Press, Stanford, CA

Shafer, E.L. Jr and Richards, T.A. 1974. A Comparison of Viewer Reactions to Outdoor Scenes and Photographs of those Scenes. USDA Forest Service Research Paper NE-302. Upper Darby, PA.

Simonič, T. 2003. Preference and perceived naturalness in visual perception of naturalistic landscapes. *Zbornik Biotehniške fakultete Univerze v Ljubljani. Kmetijstvo* 81 (2): 369-387.

Ulrich, R.S. 1986. Human responses to vegetation and landscapes. *Landscape Urban Planning* 13: 29-44.

Ward Thompson, C. 2002. Urban Open Space in the 21st Century. *Landscape and Urban Planning* 60 (2): 59-72.

Ward Thompson, C., Aspinall, P. and Bell, S. (Editors). 2010. Innovative approaches to researching landscape and health. Routledge, London and New York, 290 pp.

Zube, E.H., Pitt, D.G. and Evans, G.W. 1983. A lifespan developmental study of landscape assessment. *Journal of Environmental Psychology* 3: 115-128.

Received 15 April 2012
Accepted 30 November 2012

ПРЕДВАРИТЕЛЬНАЯ ОЦЕНКА ПРЕДПОЧТЕНИЙ ОТНОСИТЕЛЬНО ВИДОВ ЕСТЕСТВЕННЫХ ЛЕСОВ ЭСТОНИИ

К. Ханссон, М. Кюльвик, С. Белл и К. Маиков

Резюме

Леса являются главным элементом ландшафта Эстонии, используемым большим количеством людей в рекреационных целях. Эта статья впервые изучает среду естественных лесов Эстонии с эстетической точки зрения. Предыдущие исследования показали, что предпочтение отдается природным ландшафтам по сравнению с антропогенными. Несмотря на это, о предпочтениях среди разнообразия природных ландшафтов Эстонии, где лес формирует важный аспект культуры, известно очень мало. Целью данной работы было проанализировать предпочтения разных естественных типов леса, используя для этого демонстрацию фотографий 97 участникам. Оценка основывалась на матрице факторов согласованности, сложности и таинственности, сформулированной в работе Каплан и Каплан (1982, 1989) для определения предпочтений в окружающей среде. Перед проведением исследования предпочтений, фотографии были оценены экспертами по вышеупомянутым факторам. Оценивались также и другие элементы для выяснения, что респонденты считали наиболее или наименее привлекательным, и что влияло на их предпочтения. Результаты были проанализированы для нахождения факторов, наилучшим образом предсказывающих предпочтения. Сходства в оценках между группой экспертов и группой неопытных лиц также были провеерены. Как показали тесты неопытных лиц, фактор таинственности оказался статистически наиболее достоверным предсказателем предпочтения, с последующим фактором согласованности. Эксперты же, отдали наибольшее предпочтение видам с высокой степенью согласованности, показав некоторые различия в оценках экспертов и не экспертов. Самое отрицательное влияние на предпочтения оказывали признаки гибели и разложения, а также беспорядочность в природе. Предполагается, что неотъемлемые свойства ландшафтов и естественных процессов еще не так хорошо понятны и приемлемы для опрошенной популяции, и что необходимо давать больше информации, объясняющей, почему эти признаки присущи природным ландшафтам.

Ключевые слова: Визуальное восприятие ландшафта, взаимодействие человека и ландшафта, предпочтения окружающей среды, виды естественных лесов, естественность окружающей среды

CURRICULUM VITAE

Name Kadri Maikov
Date of birth 08.09.1978
Phone +372 5559 8155
E-mail kadri.maikov@emu.ee

Career
Institution and position held

2000 – Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Department of Landscape Architecture; Lecturer (1.00)

Education

2002-2015 Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Department of Environment Protection, doctoral studies, Environmental Sciences and Applied Biology

2001-2002 Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Department of Landscape Architecture, master studies, Landscape Architecture.

Research activity
Degree information

Kadri Maikov, PhD student, (sup) Kalev Sepp, (sup) Simon Bell, EXPLORING THE SALUTOGENIC PROPERTIES OF THE LANDSCAPE: FROM GARDEN TO FOREST, Eesti Maaülikool

Field of research Biosciences and Environment.

ELULOOKIRJELDUS

Nimi Kadri Maikov
Sünniaeg 08.09.1978
Telefon +372 5559 8155
E-mail kadri.maikov@emu.ee

Teenistuskäik

Töökoht ja amet 2000 – Eesti Maaülikool, Põllumajandus ja keskkonnainstituut, Maastikuarhitektuuri osakond, lektor (1.0).

Haridustee 2002-2016 Eesti Maaülikool, Põllumajandus- ja keskkonnainstituut, maastikukorralduse ja loodushoiu osakond, doktoriõpe, Keskkonnateadus ja rakendusbioloogia
2001-2002 Eesti Maaülikool, Põllumajandus- ja keskkonnainstituut, Maastikuarhitektuuri osakond, Magistriõpe, Maastikuarhitektuur.

Teadusorganisatsiooniline ja -administratiivne tegevus

2003–... WAYS lihtliige
2003–... LeNotre (Eclas)
2003–... EMAL
2000–... ELASA
1999–... EMÜS

Teadustegevus

Teaduskraadi info

Kadri Maikov, doktorant, (juh) Kalev Sepp, (juh) Simon Bell, EXPLORING THE SALUTOGENIC PROPERTIES OF THE LANDSCAPE: FROM GARDEN TO FOREST, Eesti Maaülikool

Teadustöö põhisuunad

Bio- ja keskkonnateadused

PUBLICATIONS

1.1. - 2 publications

Hansson, K.; Külvik, M.; Bell, S.; Maikov, K. (2012). A preliminary assessment of preferences for Estonian natural forests. Baltic Forestry, 18(2), 299 - 315.

Maikov, Kadri (2014). Landscape characteristics in Tartu City parks – user influences through Design. sustainable city, 353 - 364.

1.2. - 1 publications

Rennit, Piret; Maikov, Kadri (2014). Perceived Restoration Scale method turned into (used as the) evaluation tool for parks and open green spaces, using Tartu city parks as an example. City, Territory and Architecture, 2(6), 23

2.2. - 1 publications

Maikov, Kadri (2011). Tervendavad aiad. Tallinn: Pegasus

3.1. - 2 publications

Maikov, Kadri; Bell, Simon; Sepp, Kalev (2008). A comparison of the evaluation of room characteristics of healing gardens. Design and Nature IV (223 - 232).Wessex Institute of Techonology Press

Maikov, Kadri; Pihlak, Madis (2006). Is the pedestrian city relevant to the sustainable city? mobility, urbanization and health. The Sustainable city IV, Urban Regeneration and Sustainability (599 - 605).Wessex Institute of Techonology Press

3.2. - 1 publications

Maikov, Kadri; Sander, Heldur (2009). Bastionipargid [Tallinna]. Uurimisest hinnanguni. Mart Külvik, Juhan Maiste (Eds.). Park looduses ja kunstis (264 - 269). Tartu: Eesti Maaülikool

3.3. - 1 publications

Sander, H; Maikov, K. (2005). Rahvusvaheline projekt "Mets, puud ja inimese tervis ning heaolu". Toivo Meikar, Ivar Etverk (Eds.). Metsaalmanahh (65 - 66). Tartu: OÜ Vali Press

3.4. - 4 publications

Maikov, Kadri (2010). Landscape characteristics as approach to landscape design, Based to examples of Bastion parks in Tallinn. Contempo-

rary landscape design:new approaches and dimensions, St.Peterburg, 10-12.06.2010. (Eds.)Dr. Maria Ignatieva. St.Peterburg:, 124 - 124.
Maikov, Kadri; Sander, Heldur (2010). Cultural and Therapeutic aspects: The contribution of forests, trees and natural spaces to the therapy of people who are unwell, taking account of national and regional cultural aspects and how these are reflected in behaviour, institutions, health practice and health statistics Output related to identifying and recording good practice. COST Action E39: Trees, Forests and Human Health & Well-Being. Country Report of Estonia (24 - 35). EFI EUROFOREST
Maikov, Kadri (2009). Landscape characteristics as personal experience stimulators in healing gardens. In: Health and recreation in Forest and Landscape: Health and recreation in Forest and Landscape, Challenges, theories, empirical studies, and practical solutions. (Eds.) Hunziker Marcel, Bauer Nicole. Birmensdorf:, 110 - 110.
Maikov, Kadri (2005). View preferences in two Southern-Estonian hospital complexes. In: Forest, Trees and Human Health and Well-being: Thessaloniki, 2005. , 319 - 325.

3.5. - 1 publications

Maikov, Kadri (2002). Tartu ja Pärnu haiglate ümbruse maastikuarhitektuuriline iseloomustus. In: Üle-Eestiline Teaduskonverents Tervise edendamine eestis VI: Üle-Eestiline Teaduskonverents Tervise edendamine eestis VI, Tartu, 2002. , 14 - 15.

JUHENDATUD MAGISTRITÖÖD

Avalike alade kujundamine Euroopa Liidu nõuete põhiselt liikumispuuetega inimestele Rõhu õppemaastiku näitel. Erge Sonn. 2008. Tallinna Tehnikaülikool, TTÜ Tartu Kolledž. Kaasjuhendaja Sirle Salmistu.

Eesti looduslike metsavaadete eelistatuse analüüs.
Hansson, Karl. 2008. Eesti Maaülikool. Kaasjuhendaja Mart Külvik.

Heli-aiaelementide kasutamisvõimalused maastikukujunduses.
Kristiina Päss. 2009. Eesti Maaülikool.

Laste mängukeskkonna maastikukarakteristikud ja õpikeskkonna arendamine. Marion Aare. 2009. Eesti Maaülikool.

Vaegnägijate maastikulised ligipääsetavuse võimalused.
Kati Soonvald. 2009. Eesti Maaülikool.

Elava ja eluta materjali tekstuurid ja faktuurid väliruumis.
Erle Unt. 2010. Eesti Maaülikool.

Tervendavate teekondade võimalused Põhja-Eesti spaades.
Marika Luks. 2011. Eesti Maaülikool.

Integratsioon maastikuruumi omaduste ja mängu vahel.
Kristi Mitrofanov. 2012. Eesti Maaülikool.

Liikumispuudega laste puhkevõimalused Eesti maapiirkondade rekreatsioonialadel. Katre Järveläinen. 2012. Eesti Maaülikool.

Tervendav jõud lastehaigla aedade kujunduses.
Anu Parksepp. 2012. Eesti Maaülikool.

Tartu linna avalike rohealade hindamine taastuvuse skaala alusel.
Piret Rennit. 2014. Eesti Maaülikool.

Värvide psühholoogiline mõju maastikus.
Anna Pavlova. 2015. Eesti Maaülikool.

Roheala võimalused eesti hooldekodude ümber: Personali puhkevõimalused. Kungla, Liina. 2016. Eesti Maaülikool.

Tunnetusaed kui erivajadusega lapse arengu toetaja.
Kirke Kotkas. 2016. Tallinna Ülikool, Haridusteaduste instituut. Kaasjuhendaja Tiiu Tammemäe.

VIIS VIIMAST KAITSMIST

MARKO TEDER
NON-DESTRUCTIVE ASSESSMENT OF PHYSICO-MECHANICAL PROPERTIES OF STRUCTURAL TIMBER AND GLULAM
PUIDU JA LIIMPUIDU FÜÜSIKALIS-MEHAANILISTE OMADUSTE UURIMINE MITTEPURUSTAVATE MEETODITEGA
Professor Jaan Miljan, Dr. Xiping Wang (Forest Products Laboratory, USA)
29. august 2016

ALO ALLIK
DESIGN OF DISTRIBUTED ENERGETICS SOLUTION BASED ON THE INCREASING OF LOCAL RENEWABLE FRACTION
HAJAENERGEETIKA LAHENDUSE PLANEERIMINE LÄHTUDES KOHAPEAL TARBITAVA TAASTUVENERGIA OSAKAALU SUURENDAMISEST
Professor Andres Annuk
30. august 2016

ANNEMARI POLIKARPUS
MANAGEMENT AND ANIMAL EFFECTS ON THE BEHAVIOUR OF LACTATING DAIRY BUFFALOES (*BUBALUS BUBALIS*) AND COWS (*BOS TAURUS*) WHEN ENTERING THE MILKING PARLOUR
VESIPÜHVLITE (*BUBALUS BUBALIS*) JA KODUVEISTE (*BOS TAURUS*) KÄITUMINE JA SEDA MÕJUTAVAD TEGURID LÜPSIPLATSILE SISENEMISEL
Professor David Arney, Professor Giuseppe De Rosa (Univeristy of Naples Federico II, Italy)
22. september 2016

LILIAN PUKK
ANALYSIS OF MOLECULAR GENETIC AND LIFE-HISTORY TRAITS IN EURASIAN PERCH (*PERCA FLUVIATILIS L.*)
AHVENA (*PERCA FLUVIATILIS L.*) MOLEKULAARGENEETILISTE PARAMEETRITE JA ELUKÄIGUOMADUSTE ANALÜÜS
Dr. Anti Vasemägi, professor Riho Gross, professor Tiit Paaver
14. oktoober 2016

AIGI ILVES
THE LEVEL AND MAINTENANCE OF GENETIC DIVERSITY IN ENDANGERED PLANT POPULATIONS AT THE MARGIN OF THE DISTRIBUTION RANGE
GENEETILINE MITMEKESISUS JA SELLE PÜSIMINE OHUSTATUD TAIMELIIKIDE ÄÄREALADE POPULATSIOONIDES
Vanemteadur Kadri Tali
6. detsember 2016

ISSN 2382-7076
ISBN 978-9949-569-55-7 (trükis)
ISBN 978-9949-569-56-4 (pdf)

roheline trükis

Trükitud taastoodetud paberile looduslike trükivärvidega © Ecoprint