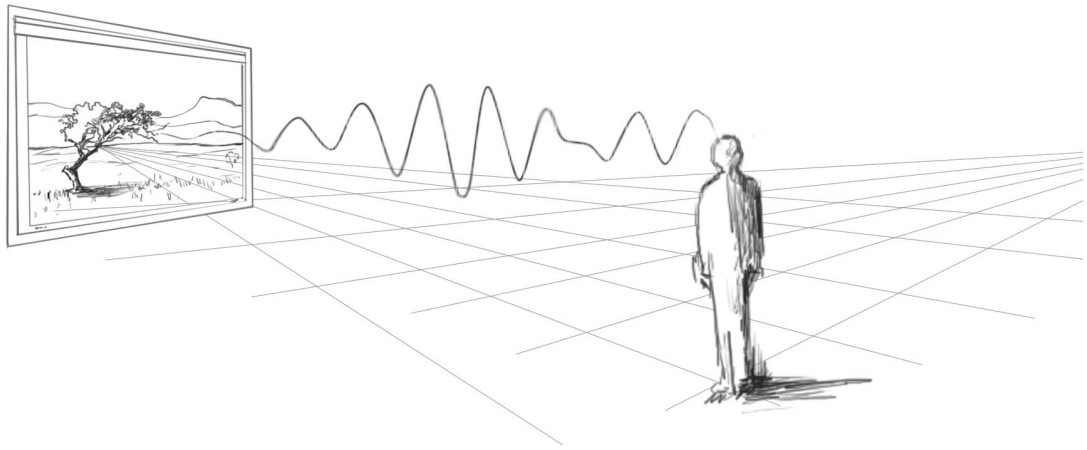
Agnieszka Anna Olszewska

Contemplative Values of Urban Parks and Gardens

Applying Neuroscience to Landscape Architecture



Department of Geosciences, Environment and Spatial Planning,

Faculty of Sciences, University of Porto

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Contemplative Values of Urban Parks and Gardens

Applying Neuroscience to Landscape Architecture

Thesis submitted at the Faculty of Sciences of the University of Porto
for the degree of Doctor in Landscape Architecture and Urban Ecology
Research supervised by Prof. Paulo Farinha Marques and
Co-supervised by Prof. Fernando Barbosa.

Department of Geosciences, Environment and Spatial Planning,
Faculty of Sciences, University of Porto
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To the future of our cities.

“Charm of natural scenery is an influence of the highest curative value; highest, if for no other reason, because it acts directly upon the highest functions of the system, and through them upon all below, tending, more than any single form of medication we can use, to establish sound minds in sound bodies.”

— Frederick Law Olmsted

Summary

This thesis presents research about the contemplative values of the landscape settings that can be found and designed in contemporary cities. The research focuses on how these contemplative values can influence human brain activity, which may contribute to the improvement of mental health and well-being, as well as the overall quality of life, in urbanized areas. The investigation consists of two complimentary studies, each of which applies different methods and approaches.

The first study sought after identification of the contemplative features of the landscape, meaning all the factors that make the particular landscape a contemplative one. The tool used to establish these factors was an expert classification of the landscapes using the Contemplative Landscape Questionnaire (CLQ). This study resulted in a set of landscape photos ranked according to their contemplativeness. In addition, the CLQ was tested for its reliability and validity measures, and showed satisfactory results.

The second study was a neuroscientific laboratory experiment, which attempted to prove that the brain activity pattern while observing the landscapes classified as the most contemplative is similar to the patterns associated with the state of mindfulness (associated with left frontal alpha and theta activity). The study had the form of an electroencephalography (EEG) laboratory experiment, in which the six most contemplative and the six non-contemplative landscape settings (presented in the form of 3D images) were displayed in two blocks of stimuli to 32 subjects, while simultaneous EEG signal recording was performed.

The experiment showed that the brainwave pattern that occurred while viewing the most contemplative landscapes cannot be associated with the patterns of mindfulness currently established, which proves the hypothesis false. Nevertheless, supplementary analyses showed that the most contemplative landscape images induced significantly stronger activation of the brain in right temporal regions, compared to the non-contemplative ones. This suggests alternations in the attention mechanisms that the contemplative landscapes may have induced. Moreover, we observed higher activation on the left frontal lobe while observing both types of landscapes (which is associated with positive emotional states), with the contemplative landscapes showing an increased trend to induce this phenomenon.

The presented research confirms that contemplative landscape designs can influence the brain activity patterns of the people viewing them. Applying methods of neuroscience to landscape architecture is an innovative approach, and could help

create principles of evidence-based design that would contribute to the continuous endeavor of improving the quality of life in urbanized areas.

Keywords: contemplative, contemplation, contemplativeness, mindfulness, landscape, architecture, design, urban, parks, gardens, EEG, experiment, cognitive, neuroscience, mental, health, attention restoration.

Resumo

Esta tese apresenta uma pesquisa sobre os valores contemplativos da paisagem que podem ser encontrados e projetados nas cidades contemporâneas. A pesquisa concentra-se em como esses valores contemplativos podem influenciar a atividade cerebral humana, o que pode contribuir para a melhoria da saúde mental e bem-estar, e qualidade de vida em áreas urbanizadas. A investigação consiste em dois estudos complementares, cada um com métodos e abordagens próprios.

O primeiro estudo identificou as características contemplativas da paisagem, ou seja, todos os fatores que tornam uma dada paisagem contemplativa. A identificação desses fatores assentou em revisão bibliográfica e num método de avaliação da paisagem realizado por especialistas, focada em imagens de parques e jardins urbanos (Questionário sobre paisagens contemplativas (CLQ)). Este resultou num conjunto de imagens de paisagem hierarquizadas de acordo com o seu maior ou menor grau de *contemplatividade*. A fiabilidade e validade do questionário foram entretanto testadas obtendo-se resultados satisfatórios.

O segundo estudo consistiu numa experiência realizada num laboratório de neurociências, tentando demonstrar que o padrão de atividade cerebral suscitado pela observação de paisagens de elevado valor contemplativo é semelhante aos padrões de atividade cerebral associados ao estado de atenção plena (mindfulness, por sua vez associada com atividade frontal esquerda alfa e theta). O estudo teve a forma de uma experiência de laboratório, baseado no método de electroencefalografia (EEG), em que as seis paisagens mais contemplativas e as seis paisagens menos contemplativas (apresentado em vídeos 3D) foram exibidas em dois blocos de estímulos a 32 sujeitos, enquanto era feita gravação simultânea do sinal EEG

A experiência mostrou que o padrão de ondas cerebrais que ocorreu durante a visualização das paisagens mais contemplativas não pode ser associado com os padrões de “mindfulness” atualmente estabelecidos, o que comprova a hipótese falsa. No entanto, várias análises complementares foram realizadas, e mostraram que as imagens de paisagem mais contemplativas induzem ativação mais forte do cérebro em regiões temporal direita, em comparação com as não-contemplativas. Isto sugere alternâncias nos mecanismos de atenção que as paisagens contemplativas podem ter induzido. Além disso, observou-se maior ativação no lobo frontal esquerdo, enquanto observação os dois tipos de paisagens (que está associada com os estados emocionais positivos), com as paisagens contemplativas mostrando um aumento desta tendência para induzir este fenómeno.

A pesquisa apresentada confirma que a criação de paisagens contemplativas pode influenciar os padrões de atividade cerebral das pessoas que as vivenciam. É uma abordagem inovadora de aplicação de métodos das neurociências para a arquitetura paisagista, a fim de criar princípios de ordenamento e desenho da paisagem baseada em evidências que podem contribuir para o esforço contínuo de melhoria da qualidade de vida nas zonas urbanizadas.

Palavras-chave: paisagem contemplativa, arquitetura paisagista, contemplação, mindfulness, parques e jardins urbanos, design paisagístico, perceção EEG, neurociências, bem estar,

Streszczenie

W niniejszej pracy przedstawiono badania na temat kontemplacyjnych wartości krajobrazów, które można spotkać lub zaprojektować we współczesnych miastach. Starano się opisać sposób, w jaki kontemplacyjne wartości krajobrazowe mogą wpływać na aktywność ludzkiego mózgu, co może przyczynić się do poprawy samopoczucia, zdrowia psychicznego, jak i ogólnej jakości życia w obszarach zurbanizowanych. Niniejsza praca składa się z dwóch uzupełniających się opracowań, w których zastosowano metody odpowiadające tematyce każdego z nich.

Celem pierwszej części badań (*Study I*) było zidentyfikowanie kontemplacyjnych cech krajobrazu, czyli tych atrybutów przestrzeni i strategii projektowych, które miałyby stymulować obserwatora do kontemplacji. Narzędziem zastosowanym do ustalenia tych atrybutów była ocena krajobrazów za pomocą Kwestionariusza Kontemplacyjności Krajobrazu (*CLQ*) przez grupę ekspertów.

Ta część badań doprowadziła do powstania rankingu wybranych zdjęć krajobrazów uszeregowanych według ich kontemplacyjnego potencjału. W tej części weryfikowano również wskaźniki trafności i rzetelności kwestionariusza CLQ, które wykazały zadowalające wyniki.

Druga część badań *(Study II)* miała charakter eksperymentu. W ramach tego badania próbowano udowodnić, że model aktywności mózgu podczas obserwacji krajobrazów ocenionych przez ekspertów, jako najbardziej kontemplacyjne, jest podobny do modelu aktywności mózgu, typowego dla stanu uważności (ang. *mindflness*), który przez neurologów określany jest jako wzmożona lewostronna aktywność *Alfa* i *Theta* płatu czołowego. Badanie miało formę eksperymentu laboratoryjnego przy użyciu metody elektroencefalografu (EEG), w którym sześć najbardziej kontemplacyjnych i sześć nie-kontemplacyjnych widoków krajobrazu (w formie filmów 3D) było wyświetlonych w dwóch zestawach, trzydziestu-dwóm uczestnikom, podczas symultanicznej rejestracji sygnału elektrycznego z ich kory mózgowej.

Eksperyment pokazał, że model fal mózgowych, który wystąpił podczas oglądania najbardziej kontemplacyjnych krajobrazów nie może być porównany ze wzorem aktywności typowym dla stanu uważności, co dowodzi fałszywości postawionej hipotezy. Niemniej, dodatkowe analizy pokazały, że najbardziej kontemplacyjne widoki wywołały znacznie silniejszą aktywację mózgu w prawym płacie skroniowym, w porównaniu z widokami nie-kontemplacyjnymi. To sugeruje zmiany w mechanizmach

uwagi, indukowanych przez kontemplacyjne krajobrazy. Ponadto zauważono trend wzmożonej aktywności lewostronnej płatu czołowego podczas obserwacji wszystkich krajobrazów, lecz to zjawisko było silniejsze w przypadku krajobrazów kontemplacyjnych. Ten typ aktywacji można odnieść do pozytywnych stanów emocjonalnych.

Niniejsze badania potwierdzają, że kontemplacyjne krajobrazy mogą wpływać na wzorce aktywności mózgu wśród osób je oglądających. Innowacyjność w prezentowanej pracy polega na zastosowaniu metody z dziedziny neurobiologii w architekturze krajobrazu, w celu stworzenia zasad projektowania opartych na empirycznych dowodach, które w efekcie mogą korzystnie wpłynąć na poprawę jakości życia w obszarach zurbanizowanych.

Słowa kluczowe: krajobraz kontemplacyjny, uważność, mindfulness, architektura krajobrazu, projektowanie, design, miejskie, parki, ogrody, EEG, neurologia, neurobiologia.

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Abbreviations

2D – Two Dimensional

3D – Three Dimensional

AITW – Awake in the Wild

ANOVA – Analysis of Variance

ART – Attention Restoration Theory

CA - California

CCD – Charge-Coupled Device

CL– Contemplative

CLM – Contemplative Landscapes Model

CLQ – Contemplative Landscapes Questionnaire

CMS - common mode sensing electrode

DC – District of Columbia

DRL - drive circuit electrode

E-B – Environment-Behavior

ECG - Electrocardiogram

EEG – Electroencephalography

EMG - Electromyography

F - Fisher's F ratio

IBMT – Integrative Body-Mind Training

IR – Infrared

GSH – Gutmann´s Split-Half

H0 – Null hypothesis

HD – High Definition

Hz – Hertz

M – Mean

MA – Massachusetts

MBSR – Mindfulness-Based Stress Reduction

MS - Mean Square

MSE - Mean Square Error

n - Number in subsample

N - Total sample size

NCL– Non-contemplative

p – Probability

PIC – Porto Interactive Center

PPS – Project for Public Space

r – Pearson's correlation coefficient

SD - Standard Deviation

SE - Standard Error

SS - Sum of Squares

t - t-statistic

TBRT – Triarchic Body-Pathway

USA – United States of America

VRM – Visual Resources Management

WHO – World Health Organization

INTRODUCTION

Introduction

If we allow discoveries in neuroscience and cognitive science to butt up against old philosophical problems, something very remarkable happens… We will see intuitions surprised and dogma routed (Churchland, 2002, p.32).

This thesis is an explorative elaboration on a topic as old as philosophy itself – the relationship between man and nature, between what is in and what is out. This relationship with nature changed across the centuries and included various shifts from fascination to exploitation to even fear and disgust. Today it seems clearer than ever that nature is our domain, and the quality of our life depends heavily on the environment we live in, thus we observe humanity re-connecting with nature. Contemporary science has enabled us to see this topic from a multidisciplinary perspective. Bearing this in mind, different scopes shall be introduced in the following pages.

The relationship between man and nature reflects on all the design disciplines which have dictated the principles of organizing the living space of people. Since ancient times we have been seeking for the best methods of space organization, shifting from human-centered to nature-centered approaches across the centuries. Already over 6 000 years ago numerous principles of *feng-shui* philosophy were created to bring well-being and happiness into people´s lives through balance and harmony of space. There is also a long tradition of meditation in nature. The majority of Buddha´s spiritual search took place outdoors in the plains and forests of northern India, the culmination point of his enlightenement under a grove of Bodhi trees. Buddha´s later years of teaching meditation took place in the wild and he also taught his students to meditate at the foot of trees (Coleman, 2006). Thousands of years later ancient Europe went further with the Platonian concept of *Mimesis* (good, beauty, truth) (Tatarkiewicz, 1973, pp. 225-230) and the *Vitruvian Triad (firmitas, utilitas, venustas*[1]) (Liukkonen, 2005), which were sets of requirements for any creation, space, or structure. When the first medieval monasteries were built, religious meditation moved indoors, together with the social processes of removing oneself from nature, which was perceived as dreadful and unfriendly. The exception to this was the philosophy of Saint Francis of Assisi, who preached that the world was created good and beautiful by God

[1] *firmitas, utilitas, venustas* – (Latin) solid, useful, beautiful

but suffers a need for redemption because of the primordial sin of man. He is considered to have had a great love for animals and the environment (Bonaventure, 1867, pp. 78-85). During the Renaissance, the attitudes of Europeans eased. Perhaps under the influence of great geographical discoveries or due to the development of science, the medieval horror of nature began to be replaced by fascination, which soon turned into a desire for conquest and exploitation. Man wanted to conquer nature. He explored the world to learn its secrets, mapping and constructing models of reality.

The development of Newtonian physics led to the widespread image of the world as a great machine, whose activity could be calculated and tested. This concept led to the creation of the technological and industrial reality of Western Civilization, where the living space of people was supposed to serve production and consumption purposes, the modern urban landscapes were built within this paradigm. However, the model of the world as a great machinery failed in regard to the shaping of space for social and cultural processes (Krolikowski, 2010). In response, the relationship between man and nature shifted again. In the late nineteenth century, the convergence between the Romanticists' respect for nature and a new awareness that man is an integral part of the environment emerged concurrently with the discoveries on the origins of the species (Darwin, 1885). People began to be aware of the limitations of natural resources and the fact that our planet is facing environmental crisis. The current attitude of man towards nature evolved with the ideas of resourcism, preservationism and ecocentrism. This multidimensional tendency to unite with nature results, for example, in the cultural elites moving from the cities to the countryside or in the general disapproval of loud, crowded cities. It seems that we have re-discovered what was already known thousands of years ago—and more recently confirmed scientifically—that contact with natural landscapes has a regenerating, soothing effect on us (Ulrich & Parsons, 1991).

For the past several decades in spatial design, there has been a return to natural values due to increasing political and social awareness about the importance of environmental protection. Reconnecting with nature presents itself as a remedy to the chaos and coldness of the metropolis—the most common living space in the twenty-first century.

Together with environmental awareness, there has been a growing interest among researchers, decision makers as well as the general public, in the investigation of the health benefits of the natural environment. Evidently, new scientific approaches (this thesis among them) are being based on old concepts that emerged centuries ago. The knowledge that contact with nature has a positive effect on us is nothing new, what

has changed are the tools, resources, and points of views that we can use in order to better understand the interrelations between man and his environment.

The concept of *romantic garden* should be recognized as the beginning of the re-discovery of how beneficial the natural setting can be for our mind. This concept emerged during the early eighteenth century in England and quickly spread across all Europe. It was based on an opposition to the French formal, symmetrical gardens and, even though the view of nature presented in English gardens was idealized, it still underlined the role of the natural "untouched" landscape for the romanticist´s spirit, contemplation, and commemoration of idyllic times. The writings of English garden theorists were an inspiration for further exploration of the psychological effects of the landscape, including the sanitary-reform movement.

This nineteenth century movement (generally recognized between 1830 and 1860) was initiated by the widespread debate about three major issues that gripped British city dwellers: dirt, pollution and disease. Americans had also encountered the problems of urban life, including violence, crime, "loose morals, bad habits, intemperance and idleness" (Boyer, 1983, p. 17). The sanitary solutions introduced to the cities at these times were improvements in sewer drainage, water supply, and garbage removal, better ventilation in buildings and also major changes in the planning of urban neighborhoods (Peterson, 1979). Planners in this era sought to alleviate the overwhelming crowdedness by constructing so-called "breathing spaces" such as parks and outdoor recreation areas (Corburn, 2007).

The pioneer of landscape architecture, the gentleman farmer Frederick Law Olmsted, created a comprehensive body of theory about landscape design, which did not focus on aesthetic theory, but rather on the very health of the human organism. He was the first to describe the potential mental health disadvantages of living in urbanized areas, and suggested immersion in natural landscapes as a solution (see more details in the literature review). Urban green spaces were given a new role as soothing and healing refuges, where one can restore energy by engaging in entirely different activities than those related to the urban context. Afterwards, urban green spaces had a whole new function: they were no longer only decoration for buildings or an expression of aesthetic taste of an author, but also carried "sanative" and "restoring" capacities.

The restorative potential of the environment was more profoundly explored in the 1990s by environmental psychologists. They empirically proved that contact with the natural environment has a positive influence on people's health, i.e., reducing stress and diminishing mental fatigue.

Indeed, one of the biggest challenges facing developed countries is mental health. At the European Ministerial Conference in Helsinki in 2005, the World Health Organization stated that Europe's biggest problem today is the effects of mental disorders of the European population. A quarter of the population suffers from these issues at some point in their lives (including psychoses, depression, anxiety and eating disorders). "Of the 870 million people living in the European Region, at any one time about 100 million people are estimated to suffer from anxiety and depression…, 4 million from schizophrenia, 4 million from bipolar affective disorder, and 4 million from panic disorders". The greatest cause of the burden of disease on the European Region is cardiovascular disease. The second is neuropsychiatric disease (19.5% of all disability-adjusted life-years, and 40% of all chronic diseases), closely followed by depression, which is mainly caused by mental disorders (6.2% of all disability-adjusted life-years) (WHO, 2005).

Mental health disorders lead to many negative effects: alcohol abuse, depression and (most tragically) – suicides. It is sad to discover that nine of the ten countries in the world with the biggest rate of suicides are located in Europe. On the other hand, globally, in high-income countries, suicides are the second leading cause of death in the age group 15-29, just after road traffic accidents (WHO, 2014).

Popular conditions to develop mental disorders include fatigue reactions—or in popular speech, burnout—which includes psychophysical incoordination, mood swings, irritability, easy fatigue, and nervous system disorders. These might not seem so severe but, when present in everyday life throughout years, can lead to serious mental and personality disorders as well as a whole host of cardiovascular system diseases. Aches and pain include backache, neck pain and diffusive pain such as in fibromyalgia. These are so-called lifestyle diseases or diseases of affluenza and have been present in developed societies since the Industrial Revolution (Hansson, 2004; Qvarsell & Torell, 2001; Sedlak, 1980; Toffler, 1970, 2006). The loss in quality of life caused by mental diseases is obvious and the sheer scale of it is even more worrisome (Konkolewsky, 2004).

Moreover, according to the World Health Organization (2005), "There is no health without mental health. Mental health is central to the human, social and economic capital of nations and should therefore be considered as an integral and essential part of public policy". The call for establishing national systems to promote and help evolve the policies and strategies for mental health has been addressed to governments internationally. The aim is to improve the mental well-being of people by fostering awareness of its importance and by designing and implementing new systems based on multidisciplinary research.

It seems reasonable enough to compare the sanitary crisis in cities of the nineteenth century to the current mental health crisis. As much then as now, there is a dire to establish new solutions for improving, not only the sanitary conditions, but also the psychological effects of living an urban life.

It is absolutely vital to focus on the urban context. According to the United Nations' *World Urbanization Prospects,* in the More Developed World the level of urbanization, classified by the percent of the population living in urbanized areas, will reach 83.7% by 2030. From 1950 to 2001, it had grown from 54.9% to 78.7% (Champion, 2001). Fast urbanization, coupled with the Industrial Revolution, initiated problems of crowdedness and segregation, leading to social issues such as alienation, aggression, affluenza and mental diseases. The source of these problems could be connected to the overly fast-paced civilization development, increase in the speed of life, increase of extrinsic development with simultaneous decrease of intrinsic psychological development (Sedlak, 1980), an overwhelming amount of information, and exposure to vast amounts of sensory stimuli (Toffler, 1970), and the loss of biological, energetic balance between the inner and outer sphere of human beings (Skolimowski, 1992, 1981). Other possibilities include mass production of nutrition (bad quality of food and water) and pollution of the air and soil, which significantly decrease the life satisfaction and well-being of city inhabitants. Finally, the origins of these problems could also be connected to the bad spatial design of the living space, because the quality of the living space in our cities significantly affects our well-being, while metropolitan areas are highly transformed environments where the natural function of the ecosystem is highly disturbed.

Multiple disciplines, including environmental psychology, urban studies, as well as landscape architecture, have been seeking for new solutions to these problems. The presented thesis is one attempt to find out what landscape architects can do to improve the well-being of city inhabitants. One key-guideline for this thesis is that the new understanding of urban green space should include its psychological values and benefits resulting from the tranquil reconnection with nature.

Bearing this in mind, the concept of contemplation has been incorporated into the conceptual framework of this research. Contemplation can be stimulated by the space that surrounds us, and is a key-component of many types of outdoor recreation, including activities requiring a minimum of facilities and which have minimal environmental impact on the recreational site, i.e. walking, hiking, bird watching and all sorts of sedentary activities. The major motives of urban dwellers for visiting the parks seem to be relaxing and being in nature (Chiesura, 2004). Through the contemplation of natural or created landscapes, mental capacities can be restored. Designing for

contemplation means designing for peace and silence, which, according to biofeedback, is a part of the human psychobiological make-up (Hermann, 2005).

Even though there have been studies on the beneficial influence of natural settings on the human psyche, exactly which attributes of space can induce such states has not been established. This thesis, presents an attempt to show that it happens not only because of presence of nature *per se*, but also because of the contemplative states that the environment can induce in us. Also to be shown is that not every natural setting has the same power of contemplativeness, i.e., the wilderness, an urban park, and just a single plant would each affect us differently. Furthermore, the specific design of the urban park could induce different effects.

Urban parks and gardens have to meet some specific criteria of design and maintenance in order to prove beneficial for the community. But how can we judge if a park or garden is well designed or not? The development of empirical studies gave researchers a wide palette of methods for landscape quality evaluation, mainly focused on asking people what they think about the specific design. However, there has been a rivarly between two evaluation approaches: (1) expert based—where the evaluation of the visual quality is performed by an expert, usually working alone, with scores based on the expert´s knowledge and experience, as well as the assumption that the expert would "perceive more" because he had been trained to detect more details about the landscape; (2) perception-based—where the quality of the visual landscape is assessed by a group of independent subjects, or in other words, the general public.

In this research, both mentioned models have been merged. As a perception-based approach, the brain responses of the general public were addressed (n = 32). In the expert-based part, I addressed responses to the questionnaire collected from a group of experts (n = 10). Both paradigms within the presented framework complement each other in an endeavor to find the most contemplative green landscapes, which can be implemented in the city environment and improve the well-being of the city dwellers.

The perception-based approach that focuses on the unconscious brain response to landscape images seems to correspond with the trend in landscape architecture for evidence-based design. Clients of landscape architecture professionals, including the general public and government agencies, are increasingly putting pressure on designers to demonstrate that their projects will achieve both the environmental and social benefits proposed (Chiesura, 2004; Eberhard, 2009; Windhager, 2009). The research and professional-designer disciplines are then joining their insights, building bridges between seemingly distant disciplines. As the brain is the organ that is ultimately responsible for processing our sensory stimuli, then seeking for the mechanisms of visual perception in the neuropsychophysiological response of

the brain seems to be yet another step towards better understanding the interrelationship between man and nature. This approach can also be directly translated to the design principles for creating the spaces that may be called contemplative.

Keeping in mind the changing attitude of man towards the environment, there has recently been a turn toward a more holistic regard to nature. People, as an integral part of the ecosystem, seem to feel an urge to restore their psychological capacities through reconnection with nature. The current mental health crisis can be compared to the nineteenth century sanitary crisis. Both the sanitary benefits back then and the psychological benefits nowadays can be obtained through better urban space management and better urban design, which include the design of green spaces. Recently, the development of science and technology has provided a wide spectrum of research tools and methodologies for better understanding how humans react to different environmental stimuli. In this thesis the insights of green space design theory is linked with neuroscience in a relatively simple experiment.

The innovative part is that instead of asking people about their preferences towards different landscapes, their brains were “asked” directly by observing which brainwave patterns were active while viewing different types of landscape settings. This new approach is expected to highlight the most important contemplative features of designed green spaces for future designers. Identifying the contemplative values of urban landscapes can also play an important role in international mental health policies, by promoting the idea of recreation in contemplative urban green spaces to help alleviate the effects of mental health disorders. Eventually, this research will open a door for further investigation efforts in the area.

CHAPTER I

CONCEPTUAL FRAME

Conceptual Frame

True discovery is not strictly logical performance, and accordingly, we may describe the obstacle to be overcome in solving a problem as a "logical gap", and speak of the width of the logical gap as the measure of the ingenuity required for solving the problem

(Polanyi, 1958, p. 130)

Design and Research Process

The following elaboration consists of empirical studies that are connected to design theory, but does not include a design. In this chapter, the differences between the design and research approaches are described, in order to provide a clear frame for where this elaboration belongs from the designer's, as well as the researcher's, perspective.

The design process starts when the first conceptual effort is undertaken by an individual or team, but the exact moment when it ends is not clear. The design process formally ends when the construction is completed (Zeisel, 2006); however, occasionally, even after a considerable time, some adjustments might be added and implemented on the site. Also, there are many designs that were never constructed and designs that needed adjustments after construction. Therefore, it could be said to end when the final proposal is prepared. The design process is a complex activity that includes multiple intangible elements, such as intuition, creativity, and imagination.

Professional design includes three elementary activities: imaging, presenting, and testing (Korobkin, 1976). Imaging is the ability of the designer of "going beyond the information given… seeing something where nothing seems to have been before" (Zeisel, 2006, p. 19). It can be one of the first steps of the process, but not necessarily. This activity is connected with creativity and the ability to visualize, providing a larger framework for the problem that needs to be resolved, which is based not only on personal internalized images, but also on the whole body of knowledge and experience that the professional has acquired. Presenting is an important stage of the design process that enables communication of the design images to others and includes sketching, drawing, modeling, etc. Lastly, the testing stage includes receiving

feedback, judgments, comparisons with others or self-criticism. Each design professional has to be able to step back and examine their creations.

During the design process, a designer or a team of designers deal with various problems that they need to solve. There are various origins for the problems that the landscape architect has to face: climatic, ecological, economic, social, technological, cultural, psychological, aesthetic, ethical, and political, among many others. Therefore, designers are usually dealing with a large amount of information, which should be well recognized and organized. At this point, each landscape architect becomes a researcher and can use various available methodological frameworks or develop a new one adjusted to the specific problem. The following research, as an example, is generating answers for design questions connected with psychology, sociology, perception and aesthetics, which a designer may encounter at this point of his work.

Another element of the design process is shifting visions of the final project. “Designers continually modify predictions about their final result in response to new information and insight. The design process is thus a series of conceptual shifts or creative leaps” (Zeisel, 2006, p. 22). This process in design theory can be given different names, including: variety reduction (Hiller & Leaman, 1974), restoring the balance (Sanoff, 1977), reworking sub-objectives (Archer, 1969), hypothesis refinement (O’Doherty, 1963) and transformation (Schon, 1974).

The next step in the design process would be an evaluation of how the proposal reached the required outcome and how the final solution is acceptable within a range of variants. There is never one single best scenario for the project, but an infinite number of alternatives with an infinite number of ideal scenrios (Archer, 1969, p. 83; Zeisel, 2006, p. 27). Therefore, it is theoretically unreasonable to look for the one best design, but rather to evaluate the level of acceptability of a design in terms of identified problems: “we must consider whether differences do not represent highly desirable variants in the design process rather than alternatives to be evaluated as “better” or “worse” (Simon, 1969, p. 75).

Conducting research, on the other hand, is based on: developing concepts, formulating hypotheses and empirical testing (observing and sampling processes). A researcher can build hypotheses by simply answering the questions “How or why did something occur?” according to the data that they may gather on the way. The hypotheses are tested by comparing them with empirical data acquired through a scientific experiment, for example. Testing the hypotheses can lead to its confirmation or rejection, but also to its replacement, refinement, and improvement for further testing. Empirical testing includes: observation (e.g., in *Study I* the responses of experts on the composition of the landscape settings were observed), sampling (e.g.,

finding the right number of participants for the EEG experiment in *Study II*), and analyzing the output results with the statistical methods, in order to find out if the acquired differences are due to co-incidence or not.

There is also a place for creativity in research – in the development of original concepts or use of innovative methodologies. For example, in this thesis the development of the concept of "contemplative space" plays a vital role and emerged through long-time observations and studies, which initiated a simple reflection on why some spaces make us feel good while others do not.

There is much in common between design and research practice. For example, both researcher and designer do not approach the task without some preconceptions in their minds, which is a sum of their individual learning experience across the years. That means they both approach their tasks with some creative vision, rooted in individual experiences and observed phenomenon. Also, a proposed solution in the case of design and a hypothesis in the case of research are going to be tested in both cases. However, testing one hypothesis may lead to an improved hypothesis, another to further data collection or the replication of studies process. In the case of design, there is a moment when testing and improvement of the design will stop, for example, when there is no more time to continue and the project needs to be implemented. In experimental research, concepts tend to be holistic, meaning that they only make sense if analyzed in a sum of samples, not as a single case. Unlike in design, where the applied solutions (concepts) should work in only one, particular case.

All in all, both design and research practice are creative endeavors, however scientific research is based on a specific structure, set of rules, and a strict order. In the design process, there is no need for such a precise order of actions, which can be decided individually by a designer. Also, designers do not seek after the one best solution (which could be considered as "truth"), but various solutions that are acceptable enough for one single case. In scientific research, on the other hand, there is a tendency to seek for general, universal rules without a variety of alternatives.

Currently, there is an observable change in the principles of the design and research communities. There are new challenges for designers emerging from the general public, as well as decision makers. New designs are required to meet not only aesthetical and functional expectations, but also social and health-based needs (Eberhard, 2009; Windhager, 2009). Therefore, the application of the research approach in design practice becomes very important. As a result, the concept of "evidence-based design" has been receiving more and more attention. This elaboration consists of a research approach that seeks for improvement of the design process. It is a search for the scientific evidence which could support the design.

A landscape architect, whose design practices across the years were interwoven with her research, conducts both empirical studies presented here. The developed concepts were inspired by design practice, but can only serve a part of the whole process. The evidence-based design approach cannot replace the designer's contribution and the design process cannot be automatized, due to its creativity bases and lack of one "best" design. This investigation is only a tool that some designers might want to use for improving their projects.

In the end, merging scientific research and design, just like developing a link between disciplines, seems beneficial for the evolution of each of the elements involved—it is a challenge that contributes to opening people´s minds to new concepts and new problems, which may emerge as new paradigms in the fields of neuroscience, landscape architecture, and urban planning.

Previous Studies

This thesis presents an interdisciplinary research focus—it joins insights of landscape architecture and neuroscience in an attempt to explore the relationship between designed urban green spaces and the reaction of the human brain towards it. In the thesis, each of these areas was represented by a separate study, each of which includes a detailed literature review of the topic and the state of the art.

The following chapter describes the previous publications and research initiatives on the design issues merged with the neuroscientific methods. This approach emerged recently, therefore there is not much literature developed on it yet. However, there have been some similar research attempts and topics that were still found to contribute to the following elaboration.

One research initiative that should be mentioned is the Scottish research project "The Urban Brain" initiated in 2013 by Richard Coyne, a professor of architecture at the University of Edinburgh. He and his team ran the experiment with the mobile neuroheadset Emotiv, in which they asked participants (n = 12) to have a 25-minute walk through the outdoor spaces of the city, which included three zones: urban shopping street, path through green space, street in a busy commercial district (Figure 1).

Figure 1. Participant of the 'Urban Brain' experiment, with installed 14-channel Emotiv-EPOC® headset (recordings saved from 5 channels).

The experiment showed "lower frustration, engagement and arousal, and higher meditation when moving into the green space zone; and higher engagement when moving out of it" (Aspinall, et al., 2013). The results were described in a paper and published in The British Journal of Sports Medicine. Although *"The Urban Brain"*

experiment was not an inspiration, it shows the most similarities to the scope of this thesis: evaluating the brain response of people engaged in the experience of designed urban outdoor spaces. However, there were some limitations that this elaboration will attempt to avoid, including: too small number of participants (for this experimental design, the sample size should be approximately twenty participants at least[2]); using the Emotiv equipment, which is very noise-sensitive, and its reliability has recently been undermined (e.g., Duvinage, et al., 2012; Harrison, 2013). Moreover, the results might have been affected by the "order effect" which occurs when all participants are exposed to the stimuli in the same order of appearance, while tiredness mechanisms are naturally present.

The experiment undertaken in Edinburgh is an example of evaluation of one specific location, within the reach of vision of one walk. It also included all types of sensory stimuli and random events that one could encounter on the way. On the other hand, the elaboration in this thesis focuses on the designed scenes (settings), and only concerns the visual stimuli. This is a different approach and will provide different contributions.

Another example of the link between the neuroscience and design disciplines is the Academy of Neuroscience for Architecture (ANFA), established in 2003 at the Salk Institute in La Jolla, California (USA). The Academy's motto is to "promote and advance knowledge that links neuroscience research to a growing understanding of human responses to the built environment" (ANFA, n.d.). There are a number of international publications and events organized by ANFA. However, as the name suggests, The Academy´s research focus is based on the architectural elements of the built environment, stressing the interior design of public places (schools, retreats, hospitals, etc.). Scientists at ANFA developed multiple interior design strategies, which include light intensity, color of the walls, size of study space, etc. The design of the landscape and green spaces has remained outside the focus of ANFA's researchers, at least so far. Also, the experimental approach that ANFA promotes is usually based on functional Magnetic Resonance Imaging (fMRI), which is a typically costly method, very reliable, but difficult, and nearly impossible to use in exterior environments outside of the lab or hospital. What is more, it is based on the activation of the structures deep inside of the brain, which are not accessible for EEG-based experiments (as presented in this thesis).

[2] Estimated sample size (n = 20) computed with G-Power® software (Mayr et al., 2007), for F-tests ANOVA Repeated-measures, within factors, with following input parameters: effect size=0.3; α = .05; Power =.80; Number of groups=1; Number of measurements=3, Corr among rep measures= 0.5.

ANFA´s leading publication is John Paul Eberhard´s *Brain Landscape,* in which he evaluates existing methods of merging neuroscience with architecture and models possible areas of interest for future researchers (2009). In this book, there is a broad description of the brain structure and which parts are supposedly responsible for the perception of space (according to previous clinical fMRI studies). He also provides some guidelines for designing buildings for education, work and memorial. The most interesting part of this book for my study is the broad explanation of why it is worth developing interdisciplinary dialogue between neuroscience and design disciplines, and what has to be done so that the output of the collaboration is satisfactory.

Another book by an author associated with ANFA is *Inquiry by Design (*Zeisel, 2006), where the author describes the environment-behavior (E-B) methods, and introduces a new one—connected with neuroscience. This approach would, as the ANFA researchers claim, build a basis for evidence-based design of the physical environment and show the tendency of basing design decisions on scientific evidence developed organically with the development of science and technology, and demand for multi-purpose solutions.

There were also some scientific papers concerning topics similar to the topic of this thesis. One of these papers titled, *Human Response to Window Views and Indoor Plants in the Workspace* (Chang, et al., 2005), used the EEG methods, among others, to evaluate the level of stress and anxiety in participants, measured in six conditions: (1) window with a view of a city, (2) window with a view of a city and indoor plants, (3) window with a view of nature, (4) window with a view of nature and indoor plants, (5) office without a window view, and (6) office without a window view and indoor plants. According to this study, the least amount of stress and anxiety was associated with the views of nature. Another example of an EEG experiment, by the same author, evaluating different types of landscapes was *Psychophysiological responses to different landscape settings and a comparison of cultural differences* (Chang, 2002) where he exposed two groups of subjects (Taiwanese and Americans) to five photo slides (forest, park, water, city and mountain) while simultaneously recording electroencephalography (EEG), electromyography (EMG), and heart rate (HR) data. The results focused on showing the cultural differences between the groups of participants.

The two aforementioned papers did not focus on the design of the urban green spaces, and no design or compositional factors were considered during the sampling process, meaning that the choice of the window views for the first study, as well as the park photograph in the second study, was rather random. From the designer's perspective, it would be difficult to establish one view that would represent all views of

parks. There is an abundance of park views, and depending on style, depth, utilized plants, etc., a park‘s views may differ tremendously.

The following thesis reflects the growing interest in development of evidence-based design, particularly by introducing experimental and neuroscience methods for the designed landscape evaluation. Recently, there has been some research initiatives undertaken in this field, however the topic is in the initial stage of exploration. This thesis is one more attempt with a similar scope that attempts to produce reliable scientific data.

Definitions and Central Concepts of the Thesis

Developing concepts is an integral part of any research. In this inter-disciplinary investigation, it is especially important to support the bridging of gaps between disciplines, therefore all central concepts are described in depth. The concepts developed for the purpose of the following research are: *contemplative landscape, contemplativeness of landscape, landscape setting* and *contemplative landscape features, urban parks and gardens*. These introduced concepts are defined in the following paragraphs.

Contemplative landscape.

The concept of contemplative landscape, introduced for the purpose of this thesis, shall be understood as a landscape setting (view/scene), with some particular contemplative features, which triggers a sense of contemplation in the observer.

Contemplation comes from the Latin word *contemplatio*, which shares its roots with the Latin word *templum,* a place consecrated for the taking of auspices, or a building for worship. In a religious sense, contemplation is usually a type of prayer or meditation. According to Platonic philosophy, contemplation is a critical component in reaching a state of *henosis* (Ancient Greek ἕνωσις), which means *oneness, unity, union*. Contemplation could lead the soul's ascent to knowledge of the form of the *good* and other divine forms. The concept of contemplation appears in various religious and philosophical systems such as Judaism, Islam, Christianity, Hinduism, and Buddhism where it has always been referred to as something that brings one close to god and divine forms.

The meaning of contemplation has evolved across the centuries, from very spiritual and mystical activities connected with faith to the state of being while attentively experiencing some stimuli (visual, auditory, etc.). According to contemporary dictionaries, *contemplatio*n has at least three meanings. Besides religious contemplation and contemplation as an act of intention, it signifies an attentive watching, a perceiving of something, or thoughtful observation (Contemplation, 2003, 2010, 2011). According to psychologists and specialists in meditative techniques, everyone is involved in contemplation on a daily basis without even noticing it. This state could be compared to a trance or hypnosis, although not every type of trance provides contemplation (Thurman, 1994).

The meaning of contemplation followed in this research is a state of mind, associated with a certain pattern of brain activity, which can be induced by viewing a landscape setting (e.g., Figure 2). This thesis aims to prove that the landscapes high in contemplativeness are able to influence brainwave patterns, bringing beneficial effects to the mental health and well-being of the observer.

Figure 2. A woman contemplating the landscape of Porto City Park, autumn view (Pardal, 2006, p. 26)

Figure 3. Hiking trails down the Lagoa do Fogo, São Miguel, Azores. Natural stunning landscapes are landscapes of contemplation. Can we re-create this effect in our cities? (phot. by Author)

According to previous research, contemplation of nature benefits body and mind, gives a sense of well-being, contributes to psychological, intellectual and spiritual development, and stimulates creativity and stress reduction mechanisms (Kaplan & Kaplan, 1989). The landscape (either natural or designed) that induces such a response shall then be referred to as a contemplative landscape (Figure 3).

Contemplativeness of the landscape. Each space including the natural or designed landscape has some level of contemplativeness, which depends on the aggregation of certain physical attributes (contemplative landscape features). If we are able to identify which physical attributes of the landscape settings influence their contemplativeness, then we should also be able to measure the contribution of those attributes to overall setting experience, and express the contemplativeness of the setting by a given value. In this thesis contemplativeness of a landscape setting is expressed on a 1 to 6 point scale, where 6 is the highest score.

Landscape setting. Landscape setting in this thesis can also be named a landscape view, scene, picture, or can be expressed by a photograph, painting or still video. The landscape itself is a complex structure that is rather difficult to define. The variety of definitions of the landscape shows how complex this concept is and how many disciplines can be involved in the research, evaluation, and description of the landscape.

While following the general tendency of change in defining the landscape from the beginning of twentieth century, it can be seen that the landscape was described as basically a synthesis of biological aspects such as flora and fauna (Nałkowski, 1920). There was also an attempt to distinguish a new specific sphere of our planet—the landscape sphere (Nowakowski, 1938). Then, landscape was frequently associated with the geographic, physical and environmental aspects of our planet (Armand, 1980). Later on, it became useful to find the borders/edges of different landscapes, so it started to have the same meaning as an ecotop (Lautensach & Troll, 1959) or as a complex of geo-components, which could appear as a matrix, patches or corridors (Forman & Godron, 1986). Only after, with the development of environmental psychology and cultural landscape protection, the cultural and social aspect of landscape began to play a greater role (Nowak, 1970). Most recently, scientists have begun to notice the visual aspects of the landscape and its abstractive character as a formation perceived by a human through senses, as particular views, that can be rated and evaluated (Bogdanowski, 1981; Schmollgruber, 1994). Evaluation of the landscape brought researchers to a new dimension of its meaning, and new methods. From the phenomenological point of view, the landscape is perceived as a scene or view (often represented by a photograph) and, from this point, it can begin to be evaluated. This

definition brings the observer closer to the landscape, as its quality depends on the sensory stimuli and mechanisms of perception. Studies on the meaning of the landscape (Francis & Hester, 1992; Olin, 1998, p.149; Treib, 2011) showed that landscape can transfer a particular significance from the designer to the viewer.

For the purpose of this study the definition of the landscape, established by the European Landscape Convention from 2000, seems the most adequate. According to the preamble of this document the landscape is "…an important part of the quality of life for people everywhere… contributing to human well-being… is a key element of individual and social well-being and its protection, management and planning entail rights and responsibilities for everyone…" (T. Series, 2012, p. 3)

In the following work, the visual aspect based on perception is central. The targets of this research are landscape settings, represented by the landscape photographs and still 2D and 3D videos. Supposedly, these can be received by the eyes, processed by the brain, and, in effect, induce a contemplative response in the mind.

Contemplative landscape features. Contemplative landscape features may also be described as contemplative values of the landscapes. They are all the attributes of the landscape setting that are present within some particular view and that trigger the state of contemplation in the observer. Each landscape setting contains an infinite number of characteristics, which are not only objects, colors and textures present within the particular view, but also inter-relations between those objects, and even the individual observer's interpretations of those relations.

One of main goals of this elaboration is to identify a set of contemplative landscape features (physical attributes of space) that, when present in the setting in some particular way (e.g., level of importance in the overall perception), can induce the contemplative state in the observer. In this thesis, only the visual aspects of the landscape setting that were designed and built by people have been considered. For example, a large mountain as a feature *per se* would not be a focus, but the opening of the view for a mountain, as a design decision. Contemplative landscape features are then those characteristics visible on the landscape image (here, the photograph) that contribute to induce the contemplative state in the observer.

Urban parks and gardens. The main focus of this research lies in the attempt to make cities more livable through all available means, to improve the quality of public spaces by giving them new functions, and to contribute with evidence-based ideas for decision making in urban planning. That is why the main target of investigation are urban parks and gardens—city parks, or the parks of highly-populated areas, which are not part of a wild, rural, or cultural landscape.

Urbanized areas seem to be the most fragile in terms of natural functioning, as the challenge of making cities livable had already been noticed during the era of the industrial revolution: “A man’s eyes cannot be as much occupied as they are in large cities by artificial things…without harmful effect, first on his mental and nervous system and ultimately on his entire constitutional organization” (cit. in Beveridge, 1995, p. 36).

This is when parks as “sanitary institutions” started to be introduced in the cities. Recently, there has been a continuous endeavor to make cities healthier and greener by introducing more public green areas. These spaces join together natural elements and explicit design interventions, which have the highest potential to be contemplative landscapes inside the urban fabric.

Mindfulness. The description of contemplation presented above requires it to be addressed in a more systematic way in order to formulate the hypothesis and perform a scientific experiment (namely using scientific measures such as the ones resulting from the previous EEG experiment). This led to the seeking of further definitions in other disciplines that have developed proper terminology and evidence.

Mindfulness is a very popular concept in the world of science recently: between 1980 and 2013 the number of mindfulness research publications grew almost exponentially from 0 to over 500 per year (Black, 2014). It also seems very similar to what we understand as contemplation, because it is often described as the non-judgmental attention to the experience at the present moment (Ivanovski et al., 2007). Equating the contemplation of something (e.g., a landscape) and mindfulness was the first vital research assumption for developing the hypotheses of this investigation. A scheme of such attribution is presented by Figure 4.

The concept of mindfulness has been well studied by psychology. Also, the neuroscience of mindfulness has been investigated in multiple experiments. The most recognized definition of mindfulness is the one established by Jon Kabat-Zinn, the creator of this concept. He described mindfulness as “the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, p. 145).

Nevertheless, the concept of mindfulness goes far back into ancient times, originating from Buddhist philosophy and tradition where, it was considered as an initial step towards enlightment through transcendent meditation, by “noticing the sensations of walking when we walk, the taste of our food when we eat, and the appearance of our surroundings as we pass through them” (Siegel et al., 2009 p. 23) (see Figure 5). Inherited from Eastern traditions, mindfulness is based on the awareness of the “observer-self”, which is about observation from the third-person (soul or counsciousness) perspective instead of the first-person (ego) side. Mindfulness helps

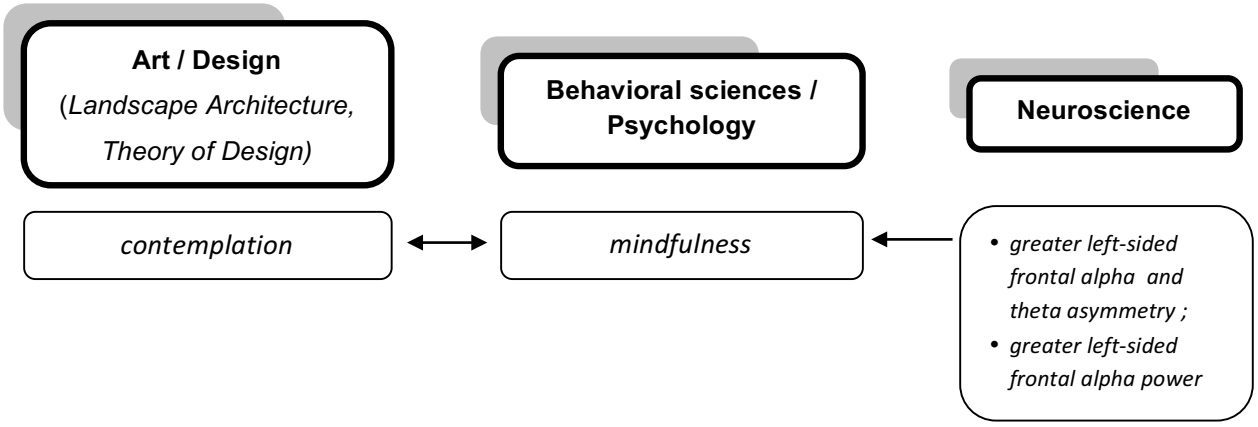


Figure 4. Relations between different disciplines that contributed to creation of the conceptual model of this investigation.

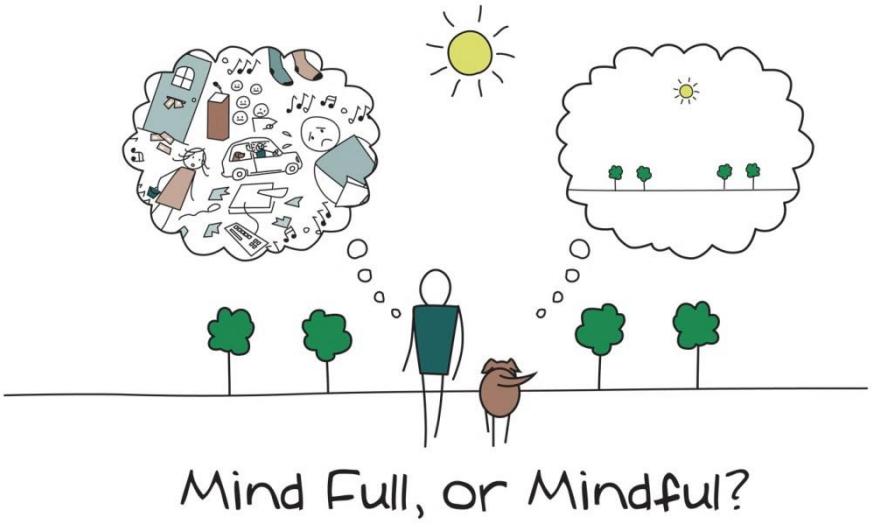


Figure 5. What is mindfulness? (University of Michigan, n.d.)

to transcend the limited perspective of the direct experience and perceive the world more objectively, without judgements, accepting everything as it is.

Mindfulness became an important part of so-called positive psychology as an effortless, simple process that consists of drawing novel distinctions, that is, noticing new things. The more we notice, the more we become aware of how things change depending on the context and perspective from which they are viewed. Mindfulness requires, however, that we give up the fixed ways in which we've learned to look at the world (Langer, 2007) and draw our attention on the here and now.

There are several mindfulness training techniques in contemporary schools of meditation, including: Integrative Body-Mind Training (IBMT), described as open-monitoring mindfulness practices (Hölzel, 2011), Mindfulness-Based Stress Reduction (MBSR), which includes open monitoring and focused-attention; Triarchic Body-Pathway (TBRT), a Chinese relaxation technique; among other more or less recent techniques (Chan, et al., 2008). All the techniques to reach mindfulness are based on mechanisms of intention, attention control and attitude of acceptance and friendliness towards the experience (Shapiro, 2006) and consist of three stages of practice: early (involving an active effort from participant), middle (with an effort to reduce mind wandering) and advanced (no effort nor activity whatsoever, only being) (Tang et al., 2015).

The common ground of all these techniques is a practice of noticing and observing everything taking place around in the present moment. Therefore, going outdoors and experiencing nature seems to be an important part of any mindfulness training. From the report of the mindfulness teachers and programs of multiple mindfulness retreats around the world, the trainings include: hiking or kayaking trips, meditation in the wild, and actually living in the wild throughout the time of the course. One example is the *Awake in the Wild* (AITW) mindfulness retreat based on the insights of the book *Awake in the Wild* (Coleman, 2006), which is one of many mindfulness retreats located far away from the cities, in the wild, using the proximity of wilderness to enhance meditation practices. The mindfulness teacher and practitioner, author of aforementioned book writes:

"Practicing the art of mindfulness outdoors is a profound way to deepen our receptivity to the natural world. Using these ancient ways of training, the mind is able to quiet the inner noise in our heads so we can be present to the jewels of the earth…A depth of meditative awareness, where the mind is calm, concentrated, and completely present, is a key for awakening. Being in nature can effortlessly bring forth this quality….When we are stressed, going outside for some fresh air, taking a walk in the park, or wandering deep in the woods quickens our attention, brings us instantly to the

present. Being outdoors provides metal space and clarity, allowing our bodies to relax and our hearts to feel more at ease" (Coleman, 2006, p. xix).

The findings have shown a strong relationship between mindfulness practice and mental health improvement, stress defense anxiety, depressive states reduction (Kabat-Zinn, 1982; Shapiro, Schwartz & Bonner, 1998) as well as learning and memory processes, emotion regulation, self-referential processing, and perspective taking (Baer, 2003).

The benefits of mindfulness are well described by psychology, thanks to developed scales and indicators. However, the neuro-psychophysiological mechanisms that accompany mindfulness still remain unclear, despite the numerous experiments undertaken. This is mainly due to small sample-size experiments, or drawing interpretations from post-hoc analysis. Another issue is different experimental designs that do not always control for all subtle variables. For example, the early cross-sectional experiments were performed on groups of Buddhist monks compared with control groups of non-practitioners, ignoring the fact that a number of variables such as cultural origins, interest in meditation or temperament may cause different brain activity across groups.

In order to uncover different neural mechanisms of mindfulness, scientists used methods of fMRI or EEG in laboratory-based experiments. Twenty-one of the most reliable fMRI experiments on the neuroscientific basis of mindfulness were described in the review paper published in *Nature Reviews Neuroscience* by Tang et al. (2015). Effects reported by each of these experiments have been found in multiple brain regions, including the cerebral cortex, subcortical grey and white matter, brain stem and cerebellum, suggesting that the effects of mindfulness might involve large-scale brain networks (e.g., Lazar, et al., 2005; Pagnoni, 2007, Vestergaard-Poulsen et al., 2009).

The performed EEG experiments characterized mindfulness by increased left-sided alpha and theta asymmetry—a pattern associated with positive emotions (Keune et al., 2013; Barhhofer et al., 2007) and greater frontal alpha power—a pattern associated with relaxation (Banquet, 1973; Lagopoulus e al., 2009). Additionally, practices that emphasize more intense concentration would likely induce higher beta activity, and mindfulness involves concentration and attention to outer stimuli. Nevertheless, these speculations have yet to be confirmed by neuroscience, but only mentioned in the literature (Treadway & Lazar, 2009).

Despite the many gaps in knowledge about the *mindful brain*, more and more studies on different techniques of mindfulness are being conducted, uncovering (yet

not very consistently) regions and complex interactive networks that can be correlated with mindfulness meditation.

Thus, taking all the risk connected with the misinterpretation of concepts, it has been decided to associate the concept of mindfulness with the state of contemplation that appears in the art disciplines.

While discussing the concept of mindfulness, it is necessary to acknowledge that some people are naturally more mindful than others, by being more sensitive to the sensory stimuli occurring on their way. For example, most children are considered more mindful than their parents as they are more likely to notice and non-judgmentally focus on the present moment. Also, the ability to direct our attention towards the here and now experience is possible to achieve consciously by most people, and some specific conditions (such as the type of surrounding space) might play an important role in achieving this state. It is then important to notice the variety of possible mindfulness interpretations. From the psychological perspective, it is a tool for treatment of various mental health disorders. The mindfulness that we know from the neuroscientific lab is a specific pattern of brain activity that occurs during a lab experiment under provided conditions. However, mindfulness can also be viewed as a shifting of one´s attention to the here and now, while, for example, walking in the woods.

This research was thus organized around the concept of mindfulness that was associated with the contemplation of landscapes, because of all the similarities between them. The presented studies shall test if the brainwaves patterns associated with mindfulness can be similar to what we understand as contemplation of the landscapes.

CHAPTER II

RESEARCH SCOPE

Research Scope

This research attempts to produce a *positive scientific knowledge*, according to Karl Popper's theory. The principles of Popper's philosophy are that in order to produce scientific knowledge the researcher must first identify a problem and research questions, state the hypothesis, and then test whether this hypothesis is true or false (Popper, 2005). On the contrary, Kuhn, his major opponent, stated that it is possible to produce scientific knowledge even when the problem or hypothesis is not stated in advance (Kuhn, 1962).

In the case of this thesis, the problem that was chosen for observation was clearly stated in the beginning, which enabled easier navigation across the thesis chapters and ensured confidence for professionals from both scientific and design disciplines around the explored topic.

Research questions

There are at least five sets of questions that this study attempts to answer. Firstly, what is a contemplative space? Or, what are the physical attributes of the space that make it contemplative? What are the most contemplative spaces like?

Secondly, is it possible to operationalize the concept of contemplative space to know exactly how contemplative a particular space is? In experimental science, this usually involves measuring the concept, according to some developed criteria, a tool, in order to express it with numbers. Is it possible to create this tool to measure the contemplativeness of designed green spaces?

After the questions about the feasibility of operationalizing the concept of contemplative space, there is a set of questions concerning the actual meaning of this concept. In these reflections, the psychological and neuro-psychophysiological disciplines offer guidance. These are the areas that provide the evidence about functional mechanisms of the brain and the possible effects on people's responses to certain environment factors. Can the state induced by contemplative landscapes be compared to the mindfulness meditation measured with neuroscientific tools?

The follow-up questions would be: is there a difference in brain functioning of a person exposed to a contemplative landscape and a person exposed to a non-contemplative landscape? Are there ways to generalize findings to a whole

population, regardless of the level of sensitivity, individual preference, region of origin and many other factors? If so, then what kind of brain functioning is associated with contemplative landscapes? Is there any pattern of brain activity that can be associated with the experience of contemplative space?

Lastly, what are the benefits of contemplative spaces? What impact can they have on our mental health and general well-being? Can the experience of contemplative landscape be associated with restoration, as a sort of treatment for mental fatigue and/or a reduction of stress?

In order to answer those questions we formulated the hypotheses as follows

:

Hypotheses

We began by hypothesizing that (H1) it is possible to identify contemplative landscape features and organize them in a questionnaire that is reliable and valid, according to the following parameters: (H1.1.) shows a good internal consistency; (H1.2.) good (split-half) reliability; (H1.3.) strong inter-rater agreement; and (H1.4.) good validity.

Using such a questionnaire with the above mentioned properties, it would be possible to select the most contemplative landscape settings out of a database of photographs. We then hypothesized that (H2) the most contemplative landscape settings can induce in the observer a pattern of brain activity that can be associated with a state of mindfulness, namely: (H2.1.) left sided frontal alpha asymmetry; (H2.2) left sided frontal theta asymmetry; and (H2.3.) increased left frontal alpha power.

CHAPTER III

EMPIRICAL STUDIES

Empirical Studies

In order to test hypotheses H2.1, H2.2, and H2.3, which are connected with the EEG experiment (see *Study II* below), it was necessary to first deliver the proper visual stimuli for this experiment. This led to conducting *Study I* (see below), which aimed to develop a tool that could help with distinguishing the most contemplative landscapes from others. The feasibility of this study constitutes a test on hypotheses H1.1, H1.2, H1.3, and H1.4, through use of the Contemplative Landscape Questionnaire. These two interdependent studies are parts of the complex methodology design that is presented in Figure 6.

The two studies refer to different areas of knowledge (landscape architecture and cognitive neuroscience) and likewise apply methods originating from these specific disciplines. In *Study I* we used methods related to the discipline of landscape architecture were used, such as:

1) *Delphi method*, based on the evaluation of a panel of experts, who work out a consensus about a problem with multiple possible scenarios (Figure 6. step 3.0);
2) *Visual Resources Management* model of evaluating the scenic quality of the natural landscape settings (Figure 6. Step 2.0);
3) Literature review, on contemplative landscape features (Figure 6. Step 1.0);
4) On-site *Photographic Documentation and Analysis* (Markwell, 2000);
5) Sampling method according to principles of environmental photograph-based research (Kaplan et al., 1972; Kaplan & Kaplan, 1989) (Figure 6. Steps 4.0 – 4.3).

Methods from psychology were also used, in order to examine the psychometric characteristics of the developed questionnaire.

Study II is a laboratory-based EEG experiment; therefore, it was organized according to the practice of neuro-psychophysiological experimental design. Specifically, a transversal observational study, according to a within subjects design was organized.

The two studies complement each other and were described in separate parts of the thesis. Both parts of the research used the appropriate statistical measures for testing the obtained results, either in terms of reliability and validity, or statistical significance of the effects.

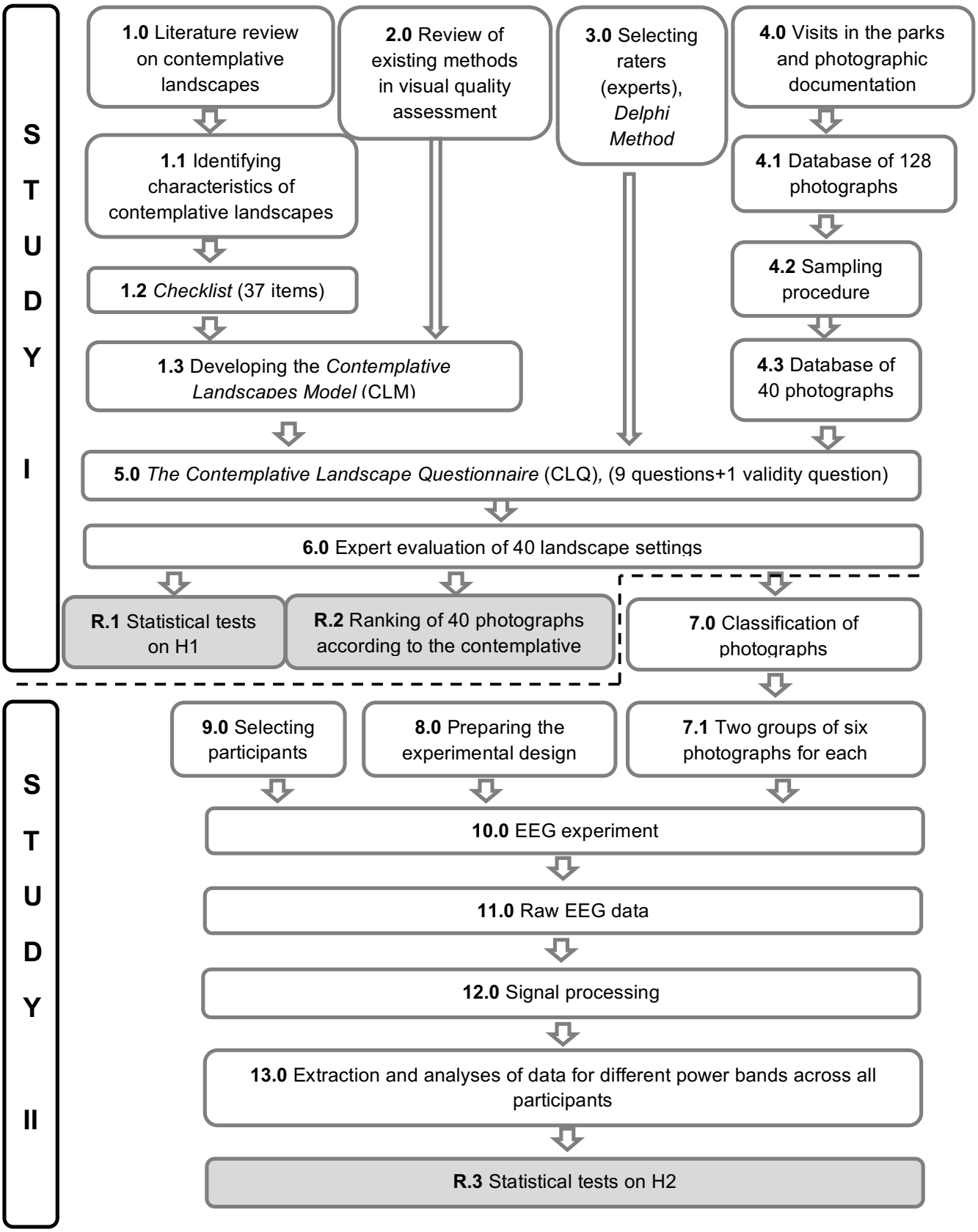


Figure 6. Methodology scheme, including all steps undertaken across the research (1.0 to 13.0) that lead to the results (R.1 to R.3)

CHAPTER IV

STUDY I

DEVELOPMENT AND ANALYSIS OF A CONTEMPLATIVE LANDSCAPE QUESTIONNAIRE

Development and Analysis of a Contemplative Landscape Questionnaire

"– I wish Mr. Black would put his place into my hands, and let me show these people a satisfactory result …;

– Why, what would you do?

– I would not attempt to change the very pleasing natural character, I would take this present character and work it up"

—dialog between F.L. Olmsted and R. S. Peabody

Introduction and the State of the Art

Most invented green spaces are considered places for calm relaxation, re-connecting with nature, and contemplation. Landscape architecture, as an art discipline, understands contemplation as a state of mind, where we direct our attention towards a piece of art (in this case, the designed landscape). This contemplation can be induced by some beautiful setting, which stimulates the healing power of nature (i.e., stress reduction and relaxation) and as already mentioned, it focuses on the elimination of thought, while giving a sense of well-being (Kaplan & Kaplan, 1989).

Professionals responsible for the creation and evaluation of urban outdoor spaces, mainly parks and gardens, often use words such as contemplation, serenity, tranquility and so forth, to describe a desired output or function of these spaces.

In fact, reflection on any invented landscape, in terms of the psychological or mental states they induce, ultimately leads to the concept of contemplation. Contemplation is a key-component of recreation, including activities requiring a minimum of facilities and which have minimal environmental impact on the recreational site, i.e. walking, hiking, bird watching, and all sorts of sedentary activities. The major motives for urban dwellers to visit parks seem to be relaxing and being in nature (Chiesura, 2004). Achieving these objectives has been a continuous challenge for landscape architects, and stimulates them to create contemplative spaces.

As previously mentioned, the design process is difficult to evaluate and make uniform, because each design professional will have their own ways of achieving the

final proposal. Therefore, the continuous endeavor of looking for "good design" cannot rely solely on the applied design process. Also, judging the design by the qualifications or portfolio of the author can be misleading. Due to these facts, various methods have been developed to evaluate the existing designed spaces. Here, another issue arises: what is there to evaluate? Most of the evaluation techniques are based on the evaluation of the landscape settings represented by photographs. Even though there is a strong positive correlation between the ratings of the photographs versus real landscape settings (Pitt & Zube, 1987; Stamps, 1990), the landscape setting is not the same as the entire designed space, which is composed of an infinite number of possible views (settings).

It is more complicated to evaluate the whole space within some borders. This requires an entirely different approach, as the experience of the space in its entirety is much more than just a sum of images perceived by us. Moreover, each of these images would fail to represent the infinite number of views in real space. An example of the method of evaluation of whole space is the expert-based "Impression Curve" (Wejchert, 1984), where the expert is walking along some established path and evaluates each spot according to some criteria. The output is a curve illustrating the relation between the places along the walk to the visual attractiveness scores (Figure 7).

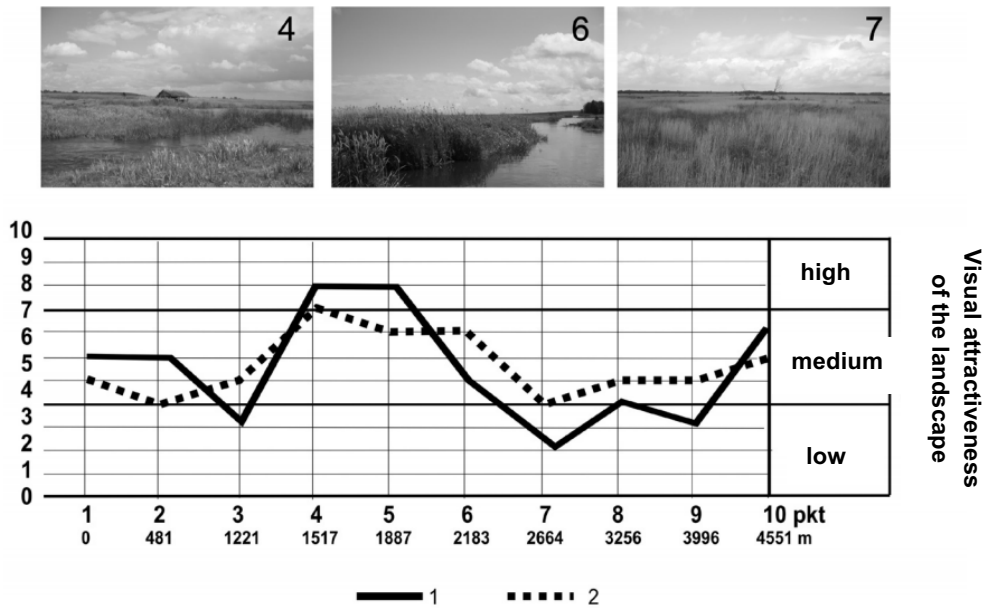


Figure 7. The Impression Curve for the hiking path Waniewo-Sliwno, (1- right side view, 2- left side view) Selected photographs of views: 4. anthropogenic landscape, 6. border of national park, 7. reed thickets (adapted from Malinowska, 2010)

Another question in the landscape assessment is where to look for valid and reliable responses. Until now, it could only be achieved by asking people, but who

should be asked? As previously mentioned in the *Introduction*, there are two competing approaches in landscape evaluation: an expert-based and a public-based approach. The advantage of the expert-based model is that it attempts to objectively evaluate the landscapes, using the generally-approved formal design parameters (e.g., the physical attributes of the landscape such as: mountains, lakes, and trees are translated into formal features such as form, line, texture, etc.). However, one major limitation of this approach is a low level of *precision* and *reliability,* meaning that the differences between the responses of different raters about the same landscape are sometimes as big as the differences between two different landscape settings (Daniel & Vining, 1983), even if it is assumed that expert responses are valid, i.e. they are measuring what is intended.

On the other hand, the perceptional-based model, where data is collected from multiple raters (usually from the general public) shows higher levels of reliability (achieved mainly because of a larger group of raters) (e.g., Brown & Daniel, 1987; Gobster & Chenoweth, 1989; Hetherington et al., 1993; Herzog, 1987; Hull & Buhyoff, 1984; Hull & Stewart, 1992; Palmer, 1997; Ribe, 1994; Schroeder, 1986) and (Zube et al., 1974). This approach emphasizes sensory, emotional, cognitive and personal relationship factors, which is not the case in the expert-based approach. However, with the perceptional-based approach, there is a validity problem (Daniel, 2001). Researchers never know what is really being assessed (whether they assess the "true" factor of interest or something else, such as personal tastes of groups, recent social trends, etc.).

Twenty-first century philosophies started to question the need for visual quality assessment, public or expert-based, and suggested new solutions. These solutions include basing on intrinsic ecological values, communal decision making, negotiation, and consensus building. It is believed that the best environmental management decisions can be reached by the balanced merging of two of the mentioned paradigms. In other words, the final value of the landscape results from interaction between biophysical landscape features and human perceptual and judgmental processes (Daniel, 2001).

Finally, there is the factor of interest to be evaluated in some designed landscape, which can vary. There are methods of assessing the aesthetic values (e.g., Zube et al., 1982), ecological functioning (e.g., Blair, 1999; Cook, 2002) or the "success" of a designed space (e.g., Phillimore, 1999), among many other factors. In the presented investigation, evaluation of the visual aspects of the urban parks and gardens, which have an unconscious, psychological influence on people´s brains, seem to be the most relevant.

This psychological influence of environment has been previously observed by many philosophers, landscape architects and researchers. For example, F.L. Olmsted developed innovative concepts about the relation between the visual scenery and well-being of the whole person. According to him, the natural landscape provided a relief from “rigidity and confinement and protrusion of art of the ordinary conditions of the city” (cit. in Beveridge, 1995, p. 37). It was able “to refresh and delight the eye and through the eye, the mind and the spirit”. The subsequent studies showed that urban lifestyle can cause multiple strains on people´s well-being, including not only visual discomfort, but also the necessity for a constant high level of concentration, which leads to mental fatigue.

In opposition to urban landscapes, researchers developed the concept of “natural environments”, which became the focus of various research scopes in environmental psychology. Several recent studies suggested that preferences for natural scenes with greenery and water may be universal (Herzog, 1989, 1992; Herzog & Bosley, 1992; Hull & Reveli, 1989; Schroeder, 1991; Yang & Brown, 1992; Zube, 1991). Sebba (1991) suggested that most adults identify the outdoors as being the most significant places in their childhood. Adding vegetation to built environments enhanced aesthetic value in some, but not all, settings (Hull & Harvey, 1989; Joardar, 1989; Orland, et al., 1992; Sheets & Manzer, 1991). One study found that joint experiences in natural settings benefited human groups (Ewert & Heywood, 1991). Why are natural environments so highly valued? Recent research suggests that viewing natural scenery stimulates the parasympathetic nervous system and has a calming effect on people under stress (Hartig, et al., 1991; Ulrich et al., 1991). Ulrich (1993) theorized that such effects may even have an evolutionary basis in that natural selection may have favored those who can relax in a natural setting—the *biophilia hypothesis*. Kaplan and colleagues (1993) noted that a visit to a museum or similar setting can also have restorative effects on stressed individuals. Kaplans (1989) proposed that prolonged attention to a task leads to directed attention fatigue, which can be relieved in natural environments.

Summing up, there is a wide body of literature including empirical studies in the area of environmental psychology and landscape design assessment. Also, contemplation as an artistic concept has been present for centuries in the fine arts, as well as in design theory. Nevertheless, the body of knowledge about the psychological benefits of contemplation and/or the neuro-psychophysiological response to it, as well as the physical attributes of space that might stimulate different brain responses, has not yet been explored by science. However, some attempts have already been

established to connect architectural neuroscience disciplines, and to build the dialogue between them.

While there is a great deal of technical information in the design professions for recreation and park facilities (Harris & Dines, 1988; Neufert et al., 2012), there is very little on the physical attributes that create a contemplative outdoor space.

This study aimed to identify those physical attributes of the contemplative space, based mainly on the literature review. Then, all identified features were incorporated to the evaluation model based on already existing landscape visual quality assessment models. This new evaluation model (CLM) was then applied to the group of photos, carefully preselected, using a group of experts as respondents. The statistical measures of the performed test showed its reliability and validity. With those analyses being satisfactory, the outcome of the study was the ranking of all photographs used for the study, according to their contemplativeness (or a contemplative score). Some of those photos were selected for Study II—the EEG experiment.

Methods

Literature Review on Contemplative Landscapes

The main goal of the literature review is to find which features describe landscapes that are contemplative in contrast to those which are not contemplative. This can create some confusion because, as previously stated, the contemplativeness of the space is not a technical term, and no specific border to distinguish contemplative from non-contemplative landscapes has yet been established.

Contemplation of a beautiful landscape or piece of art has been a staple in fine arts literature as well as landscape architecture and design disciplines across centuries. Nevertheless, the intent of this research was not to review and analyze all the existing literature on contemplative landscapes.

The existing broad body of publications about these topics needed to be filtered according to certain criteria because of several occurring limitations. The first criterion applied was to limit the research of contemplative landscapes to only contemporary publications, i.e., those published after 1950. The reasons for this decision were:

- The limited amount of research time – reviewing the history of design itself could take years while this study, is just a part of a complex methodology.
- The assumption that authors write about contemporary contemplative landscapes always has its origins in the historical heritage.
- The output of this research will serve as a tool for contemporary designs adjusted to existing urban environments. There is no need of addressing those results to the past.

The second criterion applied was for the quality of the considered literature. Only analyzed pieces created by recognized, important authors were analyzed, i.e., V.I.P's of contemporary landscape architecture and design practices, in order to avoid false statements or conceptual missteps concerning the contemplative values of the landscapes.

The final literature review criterion concerned the types of landscapes described as contemplative. As the elaboration deals with urban parks and gardens, the environments considered were only those that could potentially be replicated within the urban context.

In the existing literature about contemplative landscapes, authors mostly refer to contemplation as an effect that some particular (selected) designed space has on them

as visitors. This type of literature does not have the form of scientific elaboration and is mostly based on subjective descriptions, reports, or summaries about the designed areas from the expert's point of view. This suggests that the described attributes of such spaces are potentially contemplative.

For example, in Heinrich Hermann's essay *On the transcendent in landscapes of contemplation* (Hermann, 2005), two case studies of contemplative outdoor places are described: The Salk Institute in California and the Woodland Cemetery in Stockholm. He pursues deep analyses of design attributes of each of these spaces in association with reflections and other psychological effects that he experienced during his visits and assumingly can be experienced by anybody visiting those places. According to Hermann, contemplation is an inner silence "understood not only in the acoustic sense, but as the absence of distracting sensual stimuli". What is more, he suggests which physical attributes of the designed space can be associated with the psychological response labeled as contemplation (e.g., visibility of shade movements along the daily cycle as a means of transcending time by "making one acutely aware of the passage of time and its cyclical nature" (Hermann, 2005, p. 46). Similar approaches were made by Krinke (2005) and Treib (2005) who described how particular case examples from the existing world can create a certain feeling in the observer, which can be called contemplation. Their essays were gathered in a book "Contemporary landscapes of contemplation", which became a vital source of reference for this study (Krinke, 2005). Contributors to this book conceive contemplation consistently as fixed attention, elimination of thought, inner-orientation of oneself, and reaching an inner silence. While seeking after the set of physical attributes of contemplative spaces, they present different case examples of spaces that, according to them, are the most-contemplative (e.g., Bloedal Reserve in Washington, National Library in Paris, Thermal Baths in Vals, Lightning Field in New Mexico, among others).

Contemplation vs Restoration.

The literature review, including the above-mentioned publications, led to the concept of restorative environment, which potentially shares similar values with contemplative landscapes. The concept of restorative environment was introduced in the 1980s by environmental psychologists Stephen and Rachel Kaplan, Ulrich and others (Herzog & Barnes, 1999; Kaplan & Kaplan, 1989; Ulrich & Parsons, 1992). It refers to contact with natural vegetation as the main contributing factor of the restorative experience, that is, improving people's health and well-being by eliminating mental fatigue, recovery of directed attention, and enhanced ability to reflect on issues of importance (Herzog et al., 2003). Even though environmental psychologists did not

address contemplation in their study, their theory can provide a useful tool for examining contemplative landscapes. In their book *The Experience of Nature: A Psychological Perspective*, the Kaplans (1989) describe four attributes of the restorative experience—fascination, being away, extent, and compatibility. However, these are only partly formalized in the physical space (e.g., wilderness experience as part of being away, densely vegetated landscapes with natural character, etc.) (Kaplan & Kaplan, 1989).

Publications such as *Landscape Architecture and Health, Evidence-based health-promoting design and planning* by Stiggsdotter (2005) use the restoration theory to more precisely establish the physical features of the space that could improve visitors health and well-being. She describes seven characteristics of a healthy (restorative) public garden, which are: *serene, wild, rich in species, spacious, common, pleasurable, festive* and *cultural*. Description of these characteristics provides some technical design guidelines (e.g., biodiversity, character of peace and silence, or sense of wilderness achieved by low maintenance of some parts of the garden).

The Kaplans' Attention Restoration Theory (ART) became a basis for some further study. An interesting example is the Herzog and Barnes study on the landscape's tranquility (Herzog & Barnes, 1999). According to this study, tranquility—understood as calmness, serenity, peacefulness—is one of the major components of attention restoration and the restorative experience. After collecting data through questionnaires addressed to the public, researchers found that the highest in tranquility are the landscapes of forest, field, and broad waterscapes. On the other hand, the tranquility results did not significantly correlate with the preference results. This example shows a different approach and a different conceptual model and vocabulary applied with the same outcome expectations as this research is attempting to discover, namely the physical attributes of the *contemplative* or *restorative* or *peaceful* spaces. Tranquility ("character of peace and silence") is one of the key-components of the contemplative experience.

The literature review was completed with academic publications about specific design strategies for achieving particular effects in space. For example, Skalski (2005), whose research interest focuses on the values of long vistas in urbanized landscapes, pointed out many benefits of creating long distance views in cities that can be associated with the contemplative experience of the space leading to stress reduction.

A topic involving deep literature study was the use of symbols and archetypes in the designed space. As a matter of fact, these seem to have a strong influence on people's psychological response. Some publications (e.g., Hermann, 2005; Tuan, 1974) refer to the archetypal elements as space elements that induce contemplative

responses, triggering some particular emotions and reflections. However, they do not list all possible archetypes that one can encounter in parks. Instead, as previously mentioned, they point out an archetype existing in a described space and describe its importance. Due to this, additional research on the symbols and archetypal elements had to be undertaken in order to find which could appear in the designed urban landscapes and their significance. One important reference for establishing a list of "landscapish" archetypal elements is Jung's publication on dream analyses and symbols (Jung, 1955, 1964). Symbols are important elements of the collective unconscious, for they were present in our civilization since prehistoric times. For example, the large stone boulder has always been associated with the grave and, due to this, has a potential to induce contemplative, commemorative experiences. This is just one of many possible symbols that could have an interesting impact on our perception of space.

In summary, not all authors use the word "contemplation" to describe the possible psychological positive influence on visitors induced by a particular landscape. This may cause some confusion in realizing which publication refers to contemplative landscapes and which are addressing some other concept.

Furthermore, the literature about contemplative spaces refers to different psychological benefits that may be achieved by visiting and emerging in such spaces, but there is not one established list of physical attributes that would designate it contemplative.

Due to the fact that the significance-capacity of contemplative spaces is so broad, it was associated with all psychological benefits that green designed space can offer in terms of passive park recreation (i.e., sense of well-being, inner silence, relaxation, focused attention, attention restoration, stress reduction, recovering of mental fatigue). By looking at how professional landscape architects, namely experts, describe the physical attributes of a contemplative space, a common understanding of such a construct was pursued and a framework to operationalize its evaluation in a designed setting was developed.

Identifying Attributes of Contemplative Landscapes

All features recognized as contributing to the contemplative character of the landscape through the literature review were listed out and segregated into four major categories depending on the specificity of the item.

The first category contains the *Physical Attributes* of such spaces, which were easy to recognize in the descriptions of the existing contemplative landscapes. These descriptions were mainly subjective points of view of an expert visitor to this space (see previous chapter). A part of these descriptions concerned the highly individual, emotional experiences of the visitors. This leads into the second category of contemplative features, which consists of the *Psychological Attributes* (such as sense of solitude and character of peace and silence). To a certain extent, the psychological attributes can be expressed by the physical ones. For example, creating some kind of screening or divisions can reinforce the feeling of peace and silence. However, the psychological attributes were considered important to list and test separately, because they could potentially cover other, difficult to expect features of design.

The third category of contemplative landscape features was a set of *Archetypal Elements*. This category is inspired with the psychodynamic approach and is based on the theory of *collective unconscious* (a concept introduced by Carl Gustav Jung). According to this theory, there are some elements of our living environment which are universally present in the psyche of each individual, inducing the same type of psychological response simply because we belong to the same species, which since archaic times has been passing the symbolic meaning to subsequent generations. Some of these powerful elements are components of the natural landscape, thus identifying them was an important part of identifying the contemplative attributes of space.

The final category that helped to define the contemplative landscapes was their composition types. According to the classic distinction established by Smardon (Smardon et al., 1986), there are six major composition types*: Canopied, Enclosed, Panoramic, Focal, Feature,* and *Ephemeral*. The last category of contemplative landscape attributes is based on that division almost exactly, excluding the *Ephemeral* type of landscape composition, which only occurs under some special, temporary conditions (for example, during a sunset or a storm). All the categories mentioned above are described below, respectively, together with the literature references.

Physical attributes. The physical attributes of the space are identified as all the landscape setting features that may be measured, quantified, or designed by the landscape architect in the physical space. The contemplative physical attributes, described in the following pages, are those which induced some type of contemplative experiences in the visitors who visited them and described in the reviewed publications.

The first important physical attribute of contemplative space, present in numerous publications, is a long distance view. The three distance zones related to human vision capabilities (or in other words, *Layers of the Landscape*, see Figure 8.), are precisely defined in the book *Foundations for Visual Project and Analysis* (Smardon et al., 1986).

The first distance zone is *Foreground,* between 0 to 0.25–0.5 miles (~400 - 800 meters)*,* where "the observer is a direct participant [and] can have impression on the immediate details (bark, pattern, boulder forms or degraded parts) … Intensity of color and its value will be at maximum level" (Smardon et al., 1986, p. 319).

The *Midground* (or *Middleground*), on the other hand, is where the less and more distant landscape elements meet together. It reaches the distance of ¼-½ to 3-5

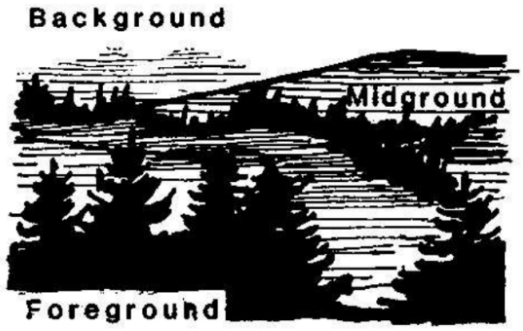


Figure 8. Distance zones. Adapted from Yeomans (1983).

miles (~400 - 800m to ~4.8 - 8.0 km) from the observer. In the Middleground "conflicts of form, color, shape or scale show up. Colors… will be more blue, softer than those of the foreground. Some of the sharpness of value contrast will be reduced".

The final, furthest layer of the landscape is the *Background,* which reaches from 3-5 miles to the limits of sight (~4.8 - 8.0km and more). Due to the aerial perspective, the background surfaces and forms lose detail distinction, emphasizing the outline of the shapes; "Silhouettes and ridges of one land mass against another are the conspicuous visual parts of the background with skyline, the strongest line of all" (Smardon et al., 1986, p. 320).

The distinction of three distance-zones—fore-, middle- and back-ground—applies more accurately to the natural or rural landscapes where we have to deal with

large territories. It is difficult to achieve the visibility of three landscape layers in complex, dense or built environments such as urban landscapes. For example, the visual axis of the Royal Gardens of Versailles (from in front of the palace to the end of the garden) is 3.4 km, and this garden complex is considered as providing one of the farthest views in garden history. On the other hand, Central Park of New York is 4.7 km long, but the furthest possible view there would be is only around 800m. The human eye cannot reach Smardon´s *Middleground* in other big parks such as Prospect Park in Brooklyn (New York), where the longest vista is only 780m, or Porto City Park (Portugal) where the longest view would be approximately 650m. In dealing with this scale-related issue, fo the purposes of this research, a view of 400 and more meters into the landscape was considered to be a long-distance view. Strictly following the theory of distance zones, it is where the *Foreground* turns into the *Middleground.*

Long distance views in the theory of design are directly connected with the comfort of long distance views. According to many authors, being able to see far away is a feature that significantly improves the quality of landscape through the visitor's perception capability. The long distance views stimulate in the observer a sense of personal freedom, mental pleasure, stress reduction, an improvement of the quality of life in the city (Skalski, 2005; Tuan, 1974). Skalski explains that the proper functioning of human perception formed itself during the long process of environmental adaptation and the development of certain perceptional capabilities. If we are unable to utilize our natural perceptional skills (here, the sense of vision) because we are surrounded by different kinds of visual barriers, then we can experience and accumulate a certain type of discomfort, or even a lack of freedom. "Urban landscape tightly filled with architectonic objects significantly limits liberty of sight use. Such spatial environment provokes a natural need of a distant view, up to horizon or at least at the sky. The need of distant view or in many cases it can be a desire, results from a human nature of a hunter, consolidated in our genes. Fulfilling this desire can be done beyond our will or completely consciously" (Skalski, 2005, p. 44). According to Skalski, opening the views in the cities (especially those located on flat terrains) is very important for improving the well-being of people inhabiting those cities. He mentions multiple psychological benefits of such actions, however contemplation is not listed among them. Another benefit of long distance views is described in a broad study by Bates (2004), an author of alternative therapy aimed at improving eyesight without the use of glasses or lenses. He suggested that nearly all eye problems are caused by the habitual strain of the eyes, so switching the visual attention between the close, middle and far distance, repeatedly and continuously, blinking and relaxing from time to time, may significantly improve one's eyesight quality. Even though his findings were never fully approved by

academic medicine, the mechanism of switching between the distance zones seem to stress the importance of far vistas, especially for people who spend time mostly indoors and focus their eyes on close objects.

The importance of long distance views in its more psychological aspect was confirmed by environmental psychology. Kaplan in his paper *Meditation, Restoration and Management of Mental Fatigue*, points out four properties of the restorative experience, which occur while visiting a restorative landscape (2001). One of those properties is *being away*, which he defines as "being distinct, either physically or conceptually, from the everyday environment" (Kaplan, 2001, p. 2). Long distance views can stimulate the away feeling and a reorientation from every-day life (especially life within an urban context), because *being away* goes beyond simple "getting away from it all", and means switching between various activities and changing the perspective of viewing things and everyday activities. The "being away" is directly linked with the psychological attribute of space, namely reorientation, which is more broadly described in the next section about the *Psychological Attributes*. One spatial design that seems to confirm that physical distance can stimulate psychological distance (to the banality of everyday life) is a multi-award winning, pedestrian, S-shaped bridge project in Castleford in United Kingdom (Authors: McDowell and Benedetti Architects, see Figure 9). The main design principle was to join two sides of the river (each with its own social problems), and create the possibility of long distance views into the river-scape from unprecedented perspectives. The success of this project was proved after a few years with improved public enjoyment and space identification, and with a decreased scale of social problems (Castleford Bridge, 2008).

Another literature reference concerning long distance views is the theory of *Savannah Preference*. According to which, our preference—shaped across thousands of years of evolution—is generally concentrated around large, open spaces with scattered trees and water, and covered with uniform grassiness. These savannah-like landscapes differ from other types of simple, open landscapes such as deserts, dense areas (i.e., jungle) or complex spaces (i.e., mountains). In the savannah type of environment early humans were most likely to survive, because of their physical adaptation to its conditions (Balling & Falk, 1982). The savannah landscape type provides a far view, shaded areas under trees, sources of water, and the possibility to hide among the grasses. Therefore, all the space-oriented needs of early humans were met in the savanna environment. The savanna preference is visible in popular landscape design – parks, gardens and resorts usually possess all of the savannah-like landscape attributes (Kellert, 1993). The component of the savannah-like landscape

that is also connected with long distance views is a large space of absence or a clearing, which also has an archetypal meaning (see the section *Archetypal Elements*).

Figure 9. The Castleford pedestrian bridge, on the Ayre river, (Yorkshire, UK). The physical distance with the long distance views can stimulate the psychological distance towards one´s life banality (Castleford Bridge, 2008).

Figure 10. Central Park and Manhattan (A split of two worlds between the architecture of the city and the green of Central Park, New York, n.d.)

As there are no sharp edges or geometric figures in the natural world, smooth shapes remind us of the structures created by nature. Not only is mimicking nature in designed landscapes satisfying our need to re-connect with nature, but it is also considered the highest masterpiece of design: "… growth of the vision and contemplation of nature enables him [a designer] to rise towards a metaphysical view of the world and to form free abstract structures which surpass schematic intention and achieve a new naturalness of the work. Then he creates a work … that is the image of God's work" (Klee, 1923, p. 17).

Forms inspired by nature are very familiar to us psychologically as we all come from nature, and are marked with bio-preference, namely biophilia. In other words we all love nature on a deep psychological level. The environments rich in natural views and imagery reduce our stress, enhance focus and concentration, and have restorative benefits. In the past few decades, this claim was tested by the previously mentioned environmental psychologists and proved that contact with nature confers emotional, cognitive, and physical benefits (James, 1892, 1984; Kaplan & Kaplan, 1982). Not only does actual contact with nature count, but also contact with all types of representations of it, such as posters, window views or nature-like sculptures, are sufficient to induce the biophilia effect (Kaplan & Kaplan, 1995). At the same time "too much of nature" is not preferred. Places that are too wild or without identity will not make us feel safe. We have evolved in such a way that we don't feel comfortable in wilderness untouched by human hands. Our evolution made us adapt to spaces where the wilderness is under control, moderated and maintained, similar to natural reserves, parks, and urban gardens. Research on landscape preference has shown that people prefer scenes with 'tamed nature' over 'wild nature'', where human intervention such as mown grass, boardwalks, and bridges were present (Kaplan et al., 1998). The same study reveals a preference for "smooth ground" with an undulating, moundy form. Hermann, in his description of the Woodland Cemetery in Stockholm as the example of the most contemplative landscape design, seems to confirm this statement. He describes the soothing and peaceful character provided by levelling and smoothing over the ground, creating a large clearing with an elevated heart of the cemetery called Meditation Grove: "The ground here is a continuous blanket of surprisingly lush green lawn" (Figure 11) (Hermann, 2005, p. 56).

Figure 11. Smooth landform enhances the contemplative character of Woodland Cemetery in Stockholm (Landscape Architecture Works | Landezine, n.d.).

Figure 12. Pocket Park (Paley Park, New York City, USA) (De grootste domeinnaam- en hostingprovider van Nederland, n.d.)

What is more, Hermann shows in his description of the Cemetery how smoothing of the landform is directly connected with enhancing the natural asymmetry of the place, which is "suitable for achieving an almost natural sanctuary [and] creates the continuous surprise from changing vistas and the constant subtle reorientation of visitors as they move through the cemetery" (Hermann, 2005, p. 60).

In the reviewed literature, there are many references to contemplative spaces as enclosed areas. Cloister gardens from the Middle Ages are an example of such spaces, serving as the monastery's central open space and as a symbolic area for contemplation. Also, Japanese 'Zen' Gardens have a similar composition to garden rooms, where in peace and intimacy one could give him or herself over to meditation. More contemporary examples include so called pocket parks or pocket gardens (see Figure 12), especially popular in densely urbanized areas, where space for a green refuge is limited.

Enclosed gardens or garden rooms have been created for thousands of years in both the East and West for the same basic reasons—protection, intimacy and contemplation (Krinke, 2005, p. 129). Besides the borders of this space, one frequent characteristic of the enclosed garden is inward space composition, although it can be applied regardless of the scale. Inward orientation of the space composition manifests the central and peripheral components in a hierarchical way. According to the literature, this leads to the character of a "created sanctuary" or "silent oasis", and induces contemplation, beyond any religious program (Hermann, 2005, p. 39). This inward composition of space can also present itself through the clear signage system, which is very important for avoiding the feeling of being lost in space. "Being lost can be terrifying. Fears of getting lost can contribute to people's decisions to avoid unfamiliar natural settings. By contrast, feeling reassured that one will be able to find one's way can increase the quality and potential benefits of nature experiences" (Kaplan et al., 1998, p. 49). According to Kaplan, feeling familiar with a space is a part of Compatibility (one of four components of the Restorative experience). In fact, it is hard to imagine anyone contemplating nature while being stressed about finding a way back home. Hermann, on the other hand, presents the signage and symbolic elements located in the hierarchical relation to each other as one of the design strategies for evoking memories, eliciting recognition, and inducing contemplation (Hermann, 2005, p. 61).

Another group of physical attributes of contemplative space are those related to the harmony and balance of the design. Even though it seems like the rule of any successful design, in a contemplative landscape those values have special meaning,

such as distinguishing the horizontal and vertical balance. The horizontal balance is about the distribution of the apparent weight of the elements, so that the view does not appear to be heavier on one part and lighter on another. The easiest way to achieve this in the spatial design is to try to make both sides of the view mirror images of each other. In other words, there should be a symmetrical balance. An asymmetrical balance appears when it is not possible to have the mirror effect on each side of the view. In this case, careful rearrangement of the visual weight of the designed objects is necessary. They are tweaked and adjusted until the whole view is balanced (Zelanski & Fisher, 1996). The vertical balance is also important in terms of balancing the upper and lower parts of the design structure. Here, the absolute symmetry can be confusing to the viewers, and the rule of mirror no longer applies. Considering the benefits of looking up towards the sky and knowing that a contemplative space should stimulate it, the vertical balance should also contribute to creating such effect. In drawing and architecture, it is used to represent the regular view of a standing person with the horizon at one-third the height of our view. When we sit on the ground, it changes to two-thirds the height of view. Therefore, while sitting, the design should guide our gaze upwards and, while standing, the natural proportions should be maintained.

According to the authors, spatial order, harmony and an absence of distracting stimuli is vital for creating "inner silence" and redirecting one's thoughts from the surrounding stimuli inwards (Hermann, 2005; Kaplan et al., 1998; Krinke, 2005; Tuan, 1974). Everyday life provides us with more and more information to perceive and process every day. There is no time to "digest" all that information, thus the experience of "information overload" becomes more commonplace (Toffler, 1970). One of the main purposes of contemplation is to rest and alleviate the mental fatigue stimulated by this overload of information.

Therefore, the design of contemplative landscapes will always lead to a reduction of distracting stimuli and/or information provided by the space. As mentioned before, smoothing out the landform and making it look the most natural possible is one tip suggested by the authors concerning the forms in the landscapes of contemplation.

Another strategy to limit the stimuli is to simplify forms and shapes. "It gives a respite from 'visual clutter' with a limited color / material palette and a reductive design vocabulary" (Treib, 2005, p. 22). Simplification also known as "economy of the design" is a rule according to which there is only what is needed without anything that could potentially distract attention from the essence of an idea. Sometimes, simplification can lead to abstractive or semi-abstractive design (as for example in Picasso's "Bull" where the eleven drawings lead towards the simplification of the animal, Figure 13).

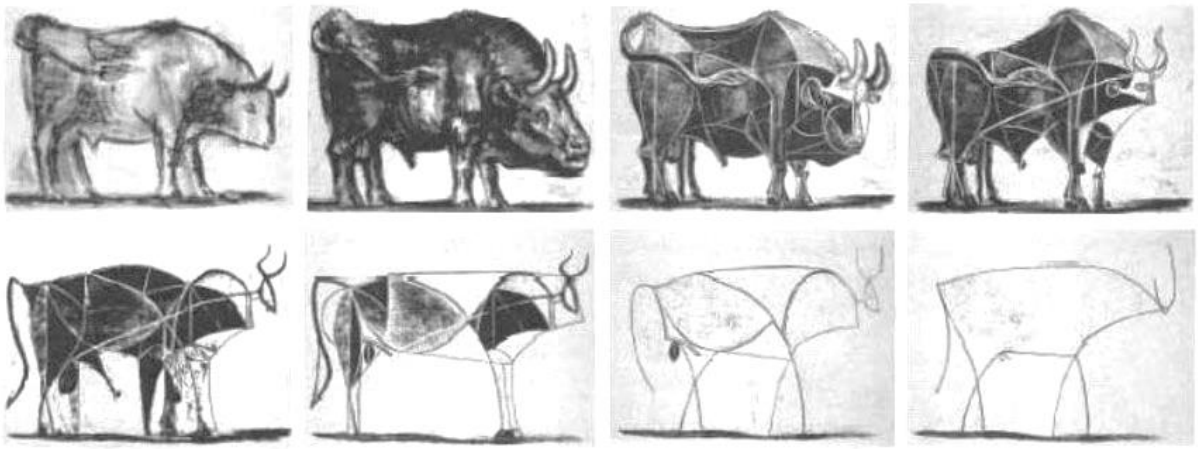


Figure 13. Simplification of the form on the Pablo Picasso´s *The Bull* lithograph, 8 of 11 progressive states of the same lithograph – 1945-1946 (ArtDuh.com, n.d.)

As a space design strategy, simplification does not simply mean introducing abstraction, even though multiple gardens, such as French formal gardens, were designed using geometrized forms, as in flower-quarters. Shapes such as circles, squares, rectangles and triangles are those most familiar to us, and those which we respond most easily to. Geometry is an abstractive concept and does not exist in nature, but still our perception recognizes and operates with those shapes very easily, leading to archetypal meaning and further interpretation. For example, "If the base of the triangle is parallel to the bottom of the picture [landscape view] plane of the design, it appears reassuringly solid. However if it is anything but parallel to the bottom of the design, the triangle may be interpreted as tipping unless it is somehow held in visual balance" (Zelanski & Fisher, 1996, p. 88). The interesting output of the elaborated framework will be testing if the high simplification of forms and/or abstraction as an artistic expression is contributing to the contemplative experience of the space. In the case of natural simplification, it means a lack of disturbing objects of a space, a lack of overwhelming information and stimuli, and a feeling of order and balance. In simple spaces we tend to feel good as they provoke creative thought by reducing the impact of external stimuli. This demands compensation by the individual seeking knowledge, tranquility and lightening of mood: "Simplification signals contemplation because the story is rendered less obvious" (Treib, 2005, p. 22). The less there is to catch our attention, the more of ourselves we have to bring to the space to give it a meaning—the meaning depends on us. For contemplation then the best spaces would be those simple ones, where our thoughts can fly freely without focusing on a certain element and without having to wonder about what the artist meant.

According to the reviewed literature, the colors (or rather the way the light induces the colors) of the landscapes can be an important component of the space's contemplativeness. Obviously, landscape colors depend on multiple factors such as geographical location, meteorological conditions, season, time of day and so forth. Aware of those factors, landscape architects can still manipulate the design with a utilized color pallete.

In regard to planting, natural planting has—by nature and unlike horticultural planting—a more harmonious and limited palette. According to Olmsted, the restorative power of landscape design cannot be achieved by neither specimen planting nor spots of brightly colored flowers (cit. in Beveridge, 1995, p. 36). Attractive and *catchy* flower colors and shapes, when dominating the setting, trigger our attention towards them and disable the possibility of contemplation. This is how Krinke described this effect during her visit in the Bloedal Reserve: "Japanese Garden, and the Rhododendron Glen … these two spaces contained many different plants, textures and colors, and I found it myself more distracted than relaxed" (Krinke, 2005, p. 122). The mid-nineteenth century's horticultural revolution brought to designed parks and gardens thousands of new species of exotic, attractive plants, which formed decorative, but not always coherent, displays. A horticultural planting and flower-bedding, despite catching attention, is against the spirit of place and against good taste and balance (Beveridge, 1995, p. 36).

Warm, non-contrasting colors, often called broken colors, of used materials and plants can create the feeling of intimacy and solitude (Hermann, 2005). What is more, the soothing and calming green color, as the primary color of nature with all its shades, should be a base of contemplative design. An example of the green-color contemplative design is presented by Krinke (2005) in her Reflection Garden description, and on Figure 14:

"The Reflection Garden provides a potent meditation on the color green. The pool is the darkest of greens, almost black, from the vantage point of the bench. As you move closer to the pool edge, the sky and its colors begin to vividly tint the color of the pool. …Being surrounded by a vivid chartreuse lawn, juxtaposed with a green-black pool, and enveloped by every other shade of green in the hedge and forest was a very unusual and memorable experience" (p. 123).

Figure 14. Contemplation of different shades of green at the Reflection Garden (Bloedal Reserve, Oregon, USA) (Bliss, 2014)

The point of view of the observer of the landscape should preferably be located in a shaded area, where colors are naturally less contrasting**,** and where the observer is not exposed to direct sunshine, for shade invites rest and relaxation while also creating a character of intimacy (Hermann, 2005). Introducing an intense shade-cover area in the landscape setting reduces stimuli by "dampening" the senses (Treib, 2005, p. 28). The visibility of shade movements along the daily cycle, or the passage of the sun and moon over the horizon, stimulate the contemplative experiences connected with the transcendence of time: "a subtle mechanism for registering the passage of time via constantly moving shadows …receiving, reflecting, registering it and casting shadows—making one acutely aware of the passage of time and its cyclical nature" (Hermann, 2005, p. 46). A continuous game of light and shade enlivens the landscape through its constant changing. Seasonal and daily cycles overlap with the cycles of generations and eras, which can be called the *time arresting effect*. The seasonal cycles in space design can be manifested with the seasonality of vegetation and its naturally changing colors. Most of the early-Japanese 'Zen' gardens adopted this rule "manifesting the passing of the seasons of which Japanese are so culturally aware" (Treib, 2005, p. 22).

Stigsdotter, in her work titled *Landscape Architecture and Health, evidence-based health-promoting design and planning*, suggests that the character of vegetation of such healthy space should be wild, meaning "Plants seem self-sown, (presence of) lichen and moss-grown rocks, old paths" (Stiggsdotter, 2005, p. 17). Also, she underlines the importance of bio-diversity, namely "variety of species of animals and

plants". These planting-strategies again reflect the work of the Kaplans, who first established the concept of "wilderness experience" and "nearby nature", which are vital for the restorative effect on us and help alleviate mental fatigue (Kaplan & Kaplan, 1989). However, their body of work also confirms that settings that are too wild cause stress and anxiety rather than restoration, thus we feel unsafe, lost and out of control. Testing the wilderness and various species planted will indeed be a very interesting strategy to test in our research.

Another interesting design strategy that purportedly triggers the contemplative response is connected with looking at the sky and its vastness, due to its "coolness and distant serenity" (Zelanski & Fisher, 1996, p. 236). In every outdoor space, the sky is the ceiling and the atmosphere of Earth is the huge dome of every landscape. Looking towards the sky delivers the longest view and a feeling of vastness. This is why looking up to the sky, watching the sunset or moving clouds, and observation of stars at night has been connected to contemplation. The sky itself is not an element that can be designed, but the designer can certainly use some particular tricks to stimulate the visitor to look up at the skyline (Hermann, 2005). The viewer can be stimulated to look up at the sky by managing the level of the point of view. If focal-designed elements are located above the head of the viewer, they will usually look up automatically. The easiest way to change the point of view is to sit down, then while looking around we see much less sky, and much more ground, and if the designed elements and structure is leading our attention up, we will then look up (see Figure 15). Also, manipulating the skyline by inserting towering elements as opposed to the flat skyline is one strategy to make us look up. The design does not have to necessarily make us raise our heads in a large or small motion, what matters is managing the attention. It can be achieved by designing a mirror of still water in which the sky reflects (see example on Figure 16) (Hermann, 2005; Hou, 2015). This strategy is connected to a strong archetype of water (see below *Archetypal Elements*), and can be achieved in the designed landscape by implementing equipment that makes us sit back or lay with our eyes up towards the sky. Another trick is introducing hills, mounds and a viewpoint to achieve this particular effect.

Figure 15. Park seats that stimulate sitting back and thus looking up. Parque da Cidade, Porto, Portugal (photo by author).

Figure 16. Reflection Garden, Bloedal Reserve, Oregon, USA, design based on creating the water-mirror reflecting the sky and forest (Yelp, n.d.)

Figure 17. Repeating masts on *The Lightening Field*,Walter De Maria (New Mexico, USA) (4-bp, n.d.).

One important design strategy mentioned as a trigger for contemplation is repetition. Repeating objects and elements induce feelings of continuity and endlessness, such as on the New Mexico Lightening Field (Figure 17), described by Trieb (2005) as a highly contemplative landscape. Repetition is one of the basic design strategies, used by repeating identical lines, shapes, forms, and textures of colors to create a predictable pattern, which consists of a coherent visual structure (Zelanski & Fisher, 1996, p. 36). The fact that we perceive the objects as having constant properties eliminates the need of reinterpreting them. This potentially gives us the feeling of perceiving/seeing the landscape as a whole. Repetition of the designed elements constitutes a visual rhythm that is a kind of a beat—marking the viewer's eye movement so it depends on the intervals between repeating objects. For contemplative purposes the rhythm should be constant and regular, with relatively large gaps between the objects.

Psychological attributes. Psychological attributes of the space design are connected to the emotional, psychological effect that some spaces induce in us. These characteristics are hard to describe by a set of physical space attributes or design strategies, as they depend on many factors, including the individual sensitivity of the visitor, and have to be re-considered by a designer each time.

The first important psychological attribute of the contemplative space is a sense of solitude. For one to contemplate, one must be alone, or at least feel so: "Places should be deserted and solitary, individual, and distinct, neither too bright nor too dark, and placed apart from one another with moderate intervals between each. … the hillside was a place of self-imposed solitude" (Leatherbarrow, 2004, p. 215).

This passage refers to both architecture and landscape architecture, to places, like chapels, and to landscapes, such as hills. Other people or companions might disturb pondering and reflecting. As much as silence is necessary, being alone and free from other people´s influences is also an important factor. Hermann, in the description of the Stockholm Woodland Cemetery, writes about solitude: "One can experience solitude walking through the grounds as a silent observer, able to stop anywhere, any time. Even when surrounded by others, one may still feel free to follow one´s own thoughts and feelings as if alone" (Hermann, 2005, p. 63).

Spaces of silence and a respectful character, such as cemeteries, are clearly places where one can sense solitude, but how to create this character in a public park or garden? The most likely method would be by special zoning and programming the areas of intervention and dividing spaces of entertainment from those of passive activity and contemplation. These places should not be completely isolated from people, but designed in a way so one can feel distance from others without feeling

anxious or worried. A sense of solitude is directly related to tranquility. The phenomenon of a landscape's tranquility was studied and described by Herzog and Barnes (Herzog & Barnes, 1999). They established that the level of tranquility (calmness, serenity, peacefulness)—one of the major components of the attention restoration theory of the Kaplans—is correlated with the types of spatial composition. Solitude as a psychological attribute of designed landscapes seems to be specifically important in the case of urban environments, where crowdedness and a high level of population density is one of the major problems. Therefore, urban parks and gardens seem to play the role of refuge from the crowd.

Another psychological attribute that seems to contribute to the contemplative experience of the landscape is a design that invites rest and relaxation. This is also not easy to specify and describe, however some hints were found in the literature that may be helpful for designers. For example, something very obvious would be introducing comfortable seating areas or benches that are well maintained and where one can feel welcome to sit and relax for as much time as he/she wants. Comfort is probably one of the features most connected to this aspect, thus contemplative spaces cannot occur without us feeling comfortable and welcome there. Apparently, not every seating area invites rest and relaxation. The artist Banksy made an interesting comment on that. Through his art he pointed out several disasters of our civilization (2015). One of the comments concerns the seating areas in public places, which are recently appearing in urban parks and gardens as well. The self-explanatory critique is presented on the poster *Anti-Sitting Bench* (Figure 18).

Figure 18. Anti-Sitting Bench by Banksy (Dismaland, exhibition, Weston Super-Mare, UK, 2015) The sarcastic comment over the types of seating areas that are being installed in our public spaces nowadays, which do not provide a sense of comfort, even though they are supposed to invite rest and relaxation. Anti-sitting benches: "(1) Have narrow and slopey seats – bodyweight remains on feet discouraging long seating, prevents from leaning back, stops objects resting on it; some feature a pivot, tipping users to ground if relaxing too heavily (2) Are made of steel – cold in winter, hot in summer, slippery and buttock-numbing, discourages long sitting (3) Armrest dividers- blocks lying across bench by homeless or tired people. Meet front of bench to block skateboarders."

The final identified psychological attribute of the contemplative landscape is the sense of reorientation that it provides to the visitor. This means that it stands in contrast to the surrounding urban landscape, but also to the banality of everyday life. Reorientation through the landscape, in a psychological sense, can be described as "orienting the individual within a bigger order" or "generating narrative (that is) a reference to fundamental human life situations that resonate universally …offering silence and a feeling of being removed from the world …, eventually eliciting empathy for others and reflection on one's own" (Hermann, 2005, p. 59).

The reorienting space would then be any space that is different from the everyday-life context of the region/city in which it is located, providing visitors with different views, activities, pace, and overall perception from what they are used to experiencing every day. This has already been mentioned previously with the concept of "being away" introduced by the Kaplans in relation to long vistas. Contemplation

induced reorientation can be achieved in the physical space, for example, by introducing an enclosure or visual distinction from the city. This would be, among other design strategies, one of the most basic ways to reorient one from the city**.**

Archetypal elements. Archetypal elements can be powerful and meaningful elements of any space composition. The concept of an archetype (Ancient Greek: ˈɑrkɪtaɪp) originates from the behavioral, psychological studies and is also present in literature and the humanities. It signifies a pattern, prototype, object or behavior that is present in our world and is being copied, reproduced or emulated across centuries. The fact that archetypes are ancient suggests they carry powerful meanings and mythical energy.

For the purpose of this research, we understand archetypal elements as the visual elements present in the invented landscapes, with symbolic meaning, imprinted in the collective psyche. Symbols, like those related to life and death or the collective human family (such as graves at the cemetery), induce strong commemorative and contemplative experiences. In other words, "the symbolically charged elements … evoke memories (both personal and more general), elicit recognition, and induce contemplation" (Hermann, 2005 p. 61).

Although, contemplation might be associated with faith and religious spirituality, many authors underline the importance of a historic and ideological universalism, as an important point in contemplative landscape design. It means that the designer operates with symbols that are not particularly connected with religion (like the cross or star of David) (Hermann, 2005, p. 60). Archetypal elements, as strong symbolic elements, have the power to trigger contemplative experiences, without dividing people according to their religion or ethnicity. In the words of Krippendorff, "finally, a science for design cannot but respect the cultural differences of users, specifically in support of cultural diversities. Rather than standardizing people under the guise of universalistic ideologies, it has to respect different rationalities" (1995, p. 11). All of the archetypal elements described in this study are inspired by Jungian dream analysis and based on the theory of collective unconscious. Nevertheless, Carl Gustav Jung distinguished archetypes from symbols.

According to the Jungian theory, an archetype is some image or pattern that is a part of the collective-unconscious a heritage of the cultural development for centuries. The archetypes exhibit "a kind of readiness to produce over and over again the same or similar mythical ideas" (Jung, 1955, p. 69). The idea of Jungian archetypes is based on the analysis of multiple reports from his patients' dream experiences. Jung found that a number of them related their dreams to powerful images and ideas that were not part of their individual past, but corresponded to the mythical and religious

themes found within the heritage of cultures scattered around the globe. Archetypal situations include the *hero's quest*, the *night-sea journey*, and the b*attle for deliverance from the mother*. Jungian archetypal figures include the *divine child, the double, the old sage*, and the *primordial mother* (Jung, 1955).

Jungian symbols, on the other hand, are the form in which the unconsciousness manifests itself to the individual. He states: "The history of symbolism shows that everything can assume symbolic significance: natural objects (like stones, plants, animals, men, mountains and valleys, sun and moon, wind, water, and fire), or man-made things (like houses, boats, or cars), or even abstract forms (like numbers, or the triangle, the square, and the circle). In fact, even the entire cosmos is a potential symbol." (Jung, 1955, p. 232). Any symbol can be as powerful as an archetype, but it conforms to the unconscious content around the specific archetype, evoking a strong, emotionally charged response. Jungian symbols are not fully defined by the past, but are also connected to the future and one's own life experiences, hopes, and dreams. That is why they are more difficult to interpret and fully comprehend. Still, Jung distinguishes individual and collective types of symbols. The collective are those rooted in religions and myths, such as the tree representing a dynamic, living thing.

The name "Archetypal Elements" was used for this category (which consists of actual Jungian collective symbols, yet is strongly related to archetypes) for two main reasons: (1) In the visual arts, symbols may be confused with signs, pictograms and signage marks, and that would be confusing for the participants involved in the following parts of the study as well as by peers; (2) To underline that the elements included in this category have a strong unconscious influence on our perception, according to our assumption that contemplative space design is one including these sorts of elements—watching them triggers the sense of contemplation. The following pages will explain the meaning and possible effect of the most important archetypal elements that can be introduced in the designed space.

Tree. A tree is one of most obvious designed elements present in green areas, parks, gardens, ecological corridors, etc. However, not all trees will create a psychologically meaningful archetypal element. The symbolic tree will grow as a solitaire (or small group), and will have a significant remarkable shape. An old single majestic oak tree would be the perfect example. The general meaning of the tree is connected to its regenerative powers of nature and stands for the inexhaustibleness of life. The tree is therefore a symbol of life and immortality. But, in fact, it can have many more meanings: "It might symbolize evolution, physical growth, or psychological maturation; it might symbolize sacrifice or death (Christ's crucifixion on the tree); it might be a phallic symbol; it might be a great deal more. And such other common

dream motifs as the cross or the lingam can also have a vast array of symbolic meanings" (Jung, 1964, p. 90).

In ancient traditions, the tree symbolized physical growth and development in opposition to instinctual growth (connected mainly with animalistic symbols) (Jung, 1964, p. 153). Physical growth comes involuntary and naturally, slowly but powerfully, which fulfills the pattern of a tree (Jung, 1964, p. 161). In the Christian tradition, the tree symbolizes that always alive mystery, the birth of our Lord, the newly-born light and hope (Jung, 1964, p. 81). This is where the Christmas tree comes from. Another example is in West Africa where the tribesmen have a "u ju", or spirit tree, to which they ascribe magical power (Jung, 1964, p. 43).

The tree is a powerful symbol as a design element introduced to the space. It can stimulate reflection on self-growth, life persistence and strength. We argue that a well-maintained and well-designed solitaire tree is one of the most powerful archetypal elements in the landscape.

Forest, Path, Clearing. The symbols of the forest, path and clearing can work separately or together, creating a narrative of journey to enlightenment. The symbolic meaning of the forest reaches far back in the history of our civilization "predating any language, symbol, icon or deity" (Saunders et al., 1998, p. 53). Throughout human history, it has been both terrifying (a dark, unfamiliar place where one can get lost) and uplifting (calm, serene, providing shelter). For example, as far as the history of Poland goes, it was completely forested by dense virginal seasonal forests. The first people settling in these areas were building their shelters in the deep forest, cutting down the trees, looking for water, and maintaining the first agricultural plots (Figure 19). According to the Jungian perspective, the forest has a material significance. It can represent everything composing our everyday life. Today, forests—besides wood production and sanitation—have recreational functions. Introduction to the urban landscapes can create a special feeling of re-connection with nature. The forest is "a contemplative space, conjuring daydreams about nature and time …provid[ing] the materialization of a dream" (Krinke, 2005, p. 123).

One good example of introducing the forest in a highly-urbanized environment is the National Library in Paris, France, where the library building surrounds an inner courtyard of mature forest (Figure 20). The author of the design, Dominique Perrault, wanted to "make the library a place outside time, whose references are universal" (Perrault, 1995, p. 75). He was perfectly aware of the symbolic meaning of the forest reaching into prehistoric times, thus his creation was supposed to make everyone believe that "the formations of the landscape and its vegetation have always been there" (Perrault, 1995, p. 76). In effect the National Library of France, and especially its

inner courtyard, has a highly contemplative character—achieved by implementation of the ancient forest with its ancient meaning (Krinke, 2005, p. 123).

Space design including a forested, shaded zone with dense planting or shrubbery, with the walking path leading to a bright opening or clearing, has an explicitly contemplative meaning. Walking along the path symbolizes life's journey. Man travelling through the forest by a path toward a clearing is actually travelling towards psychological wholeness and enlightenment (Jung, 1964, p. 219).

Also, the path has a connotation to one's course through life as in the expression that he is following the "straight and narrow path." It also has religious symbolism and has been used in linguistic terms such as he is "on the path to enlightenment". According to psychoanalysis, the opening or clearing is a symbol of self-awareness, enlightenment, and wholeness, which leads to healing of the mind and self-restoration. Openness and clearness of the view signifies better control and clarification of problems encountered on one's way. The clearing is in fact a "space of absence [that is] a free offering to the human spirit that is not utilitarian in economy-driven functional terms, but highly important, and indeed unforgettable in psychological-experiential terms" (Hermann, 2005, p. 60). Thus, reaching the clearing offers an important and unforgettable experience to the human spirit. The power of the clearing seems even stronger if we consider that clearings were the first contemplative gardens designed by nature. "No doubt about it. The first gardens were not made, but discovered. [They were] a natural spot [such as] a clearing in the forest … In the oldest accounts, such spots are the gardens of the gods, or those favoured by the gods" (Thacker, 1985, p. 9). Today, clearings are one of the main designed elements of urban parks (see example, Figure 21).

Water. One of the most important archetypal elements is water. Utilizing water in landscape design is an important and, ofttimes, meaningful decision. Different water-features were parts of garden programs since the ancient Persian gardens, symbolizing life, dynamism, prosperity and wealth of the landowner.

Figure 19. Reconstruction of the settlement in deep forest from 4000 years ago Krzemionki, Poland (Ruszaj w droge! – Podroze I ciekawe miejsca, n.d.).

Figure 20. National Library of France, Paris, central forest courtyard (Quora – The best answer to any question, n.d.)

Figure 21. Today the clearing is an important component of the urban green areas Alexandra Park, London UK (photo by author).

Because water is such an important part of our life, and the life of our planet, it cannot be left unnoticed by our unconscious. That is why water is the most common symbol for the unconscious in Jungian dream analysis. It symbolizes the mystery of creation, birth-death-resurrection, purification and redemption, fertility and growth. Every form of presence of water in the natural world has an important meaning. For example, the sea symbolizes the mother of all life, spiritual mystery and infinity, death and rebirth, timelessness and eternity, and the unconscious. Rivers are the symbol of death and rebirth (baptism), the flowing of time into eternity, transitional phases of the life cycle, and incarnations of deities. The waterfall represents the dualistic structure of the psyche, because the body of falling water connects the above with the below. Water unifies the two polar extremes. A unity of our psychic nature also lies in the middle (Jung, 1955, p. 269). According to Jung (1964), "Water is the commonest symbol for the unconscious. The lake in the valley is the unconscious, which lies, as it were, underneath consciousness, so that it is often referred to as the 'subconscious', usually with the pejorative connotation of an inferior consciousness. Water is the 'valley spirit' … psychologically, therefore, water means spirit that has become unconscious" (p. 19).

As previously mentioned, the water mirror, according to Jungian theory, has a significant meaning: "True, whoever looks into the mirror of the water will see first of all his own face. Whoever goes to himself risks a confrontation with himself. The mirror does not flatter, it faithfully shows whatever looks into it; namely, the face we never show to the world because we cover it with the persona, the mask of the actor. But the mirror lies behind the mask and shows the true face" *(*Jung, 1964, p. 20).

This suggests that reflection in the water mirror brings one closer to one's true self, provoking psychological introversion and strongly underlining water's significance as a component of the contemplative landscape.

Mountain. An archetypal element of mountain can be physically expressed by any type of above-ground level elevation: hill, mound, or even a view tower. A diverse landform connected with the presence of that elevation in the landscape was mentioned before as important for inducing long-distance views or stimulation to look up to the sky. Besides these, the presence of a hill in the landscape invites us to climb it. It seems that the will of climbing the mountain/hill is connected to its archetypal meaning, thus the top of the hill represents a goal to accomplish and the promise of glory. According to Jungian theory, the act of climbing the mountain suggests a trial of strength and maturing. "It is the will to achieve ego-consciousness in the heroic phase of adolescent development" (Jung, 1955, p. 132). The mountain is a linkage between the heaven and Earth. Frye in *Anatomy of Criticism* calls it the 'point of epiphany' and

supplies multiple examples of the mountain-tops, towers, and staircases of the Bible, Dante, Yeats and T.S. Eliot (1957). In connecting places on different levels, stairs symbolically afford a passage from one mode of existence to another.

Stone. Rough, natural stones were often believed to be the dwelling places of spirits or gods, and were used in primitive cultures as graves (Jung, 1964, p. 232). Also, in many primitive stone-sanctuaries, the deity is represented not by a single stone but by many great unhewn stones, arranged in distinct patterns (the geometrical stone alignments in Brittany and the stone circle at Stonehenge are famous examples). Arrangements of rough natural stones also play a considerable role in the highly civilized rock gardens of Zen Buddhism. The Old Testament (Torah) speaks of stones in many verses, often as sacred stones or sacred places. Stones were placed on peoples' graves (tombstones) across cultures for centuries, which could spring from the symbolic idea that something eternal of the dead person remains, which can be most fittingly represented by a stone. However, neither the body nor a human soul ever resembled a stone, yet it symbolizes "mere existence at the farthest removes from the emotions, feelings, fantasies, and discursive thinking *of ego – consciousness"* (Jung, 1964, p. 209).

Circle. The circle as a geometric figure does not exist in nature, but as an idea and shape, it possesses a strong symbolic meaning. Circle (or sphere) signifies wholeness and unity. The *Mandala*, which signifies the desire for spiritual unity and psychic integration, is a geometric figure based on the squaring of a circle around a unifying center. The circle also symbolizes an egg (oval) which represents "the mystery of life and the forces of generation". In the Yin-Yang, the circle is a symbol representing the union of opposite forces of the Yang (masculine principle: light, activity) and the Yin (the feminine principle: darkness, passivity).

Doctor von Franz has explained the circle (or sphere) as a symbol of the *Self*. It expresses the totality of the psyche in all its aspects, including the relationship between man and the whole of nature. Whether the symbol of the circle appears in primitive sun worship or modern religion, in myths or dreams, in the mandalas drawn by Tibetan monks, in the ground plans of cities, or in the spherical concepts of early astronomers, it always points to the single most vital aspect of life—its ultimate wholeness (von Franz, 1986, p. 11).

Landscape composition types. Providing information of which category of composition each landscape belongs to may give some interesting conclusions on which composition type induces the most contemplative response in the observer. In order to cover all possible landscape types that one can encounter in the parks and

gardens, as well as any other landscapes, an already existing, recognized categorization tool was applied, which is presented in Figure 22.

There are other systems of categorization of landscapes, such as urban vs rural, mountain, forest, water-scape, or by the historic style or artistic values. However, for this investigation, the most reasonable categorization was by composition of the setting (scene), because the research is testing values of the landscapes within a particular setting.

The types of landscape composition used in this investigation are established by the classic division first established by the U.S. Forest Services in 1973, then extended and described in the book *Foundations for Visual Project Analysis* (Smardon et al., 1986) in the Illustrated Glossary. According to this system, the arrangement of objects and voids in each landscape scene can be categorized into six types of landscape composition: Canopied, Enclosed, Feature, Focal and Panoramic and Ephemeral, where:

a) Canopy, Canopied: Covered or bridged by the uppermost spreading branchy layer of a forest (U.S. For. Serv., 1973)
b) Enclosed: Enveloped or surrounded; bounded or encompassed. (U.S. For. Serv., 1973)
c) Feature: A distinct or outstanding part, quality, or characteristic of something. (Webster, 1960)
d) Focal: Of or places at a focus ; as a focal point (Webster, 1960)
e) Panoramic: A continuous series of scenes or events constantly changing scene.
f) Ephemeral: Anything lasting but a brief time. (U.S. For. Serv., 1973)

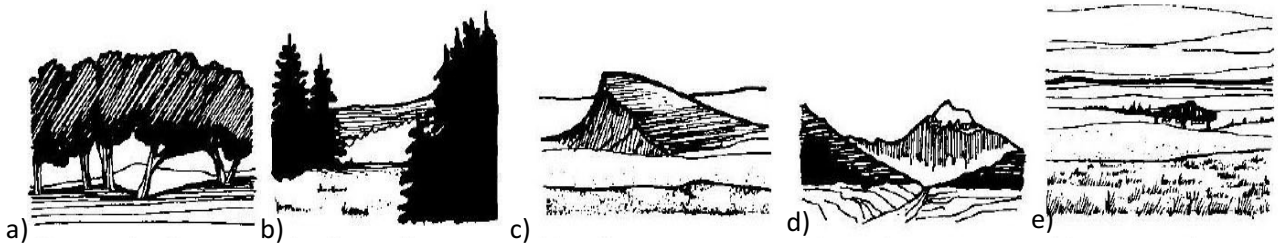


Figure 22. Five landscape composition types, utilized in the study, based on the classical distinction: (a) Canopied, (b) Enclosed, (c) Feature, (d) Focal, (e) Panoramic (illustrations adapted from Yeomans W.C. 1983)

Of the six landscape types above, there were only five introduced to the research. The ephemeral landscape type, due to its unclear description and, supposedly, little contribution to urban parks and gardens, as well design practice, was rejected. The ephemeral landscape type is most probably related to the temporary states of the landscapes such as meteorological phenomena, or by looking at it for only a brief amount of time, e.g., while driving a car. If that is a correct interpretation of this landscape type, it would not be possible to achieve this composition type through landscape design or by any activity that the designer would undertake.

The design strategies described above, which after application in the physical space became designed landscape features, were organized into a 37-item checklist (Table 1). Twenty-four identified items were physical attributes of the space; nine constituted archetypal elements originating from nature; three items focused on the psychological effects on the visitor; and a final item served to identify the spatial composition type.

Table 1.
The list of design strategies found in the literature, with potential to be a contemplative landscape features (Checklist) – with the source references from the literature review.

Feature #	Design Strategy	Source
	PHYSICAL ELEMENTS	
1	long distance view (≥400 m)	1, 6, 8, 10
2	historic and ideological universalism	7
3	inward orientation of the spatial composition	2, 4
4	large space of absence (clearing)	3, 2
5	smooth land form (mounds)	2, 8
6	signage elements in the hierarchical relation to each other (central/peripheral)	2, 8
7	natural asymmetry (organic forms)	2, 10
8	contrast with surrounding urban landscape (enclosure or visual distinction)	3, 2
9	openings and closings of views	2, 8, 10
10	spatial order, harmony, absence of disturbing stimuli	3, 2, 8, 10
11	physical and visual relations are worked out	2, 8
12	lack of direct exposition to the sun (point of view in shaded area)	2, 4
13	warm, broken colors	2
14	stimulation to look up to the sky (e.g., optical manipulation of the skyline, water mirror)	2, 11, 12
15	simplification of forms	3, 2, 4
16	repetition	4, 12
17	visibility of shade movements along the daily cycle; sun/moon passage	2, 4, 10
18	seasonally changing vegetation	2, 10
19	character of peace and silence	2, 5, 13
20	high degree of wilderness	5, 9, 10
21	biodiversity (rich in species)	5, 9
22	large-scaled elements in relation to human body	2, 14, 10
23	signage or symbolic elements with strong connotation to life and death	2, 10
24	signage or symbolic elements with strong connotation to continuity of life, collective human family	2, 10
	ARCHETYPAL ELEMENTS	
25	path	3, 20
26	still water	15, 16
27	waterfall	15
28	single old tree	16
29	big stone	15
30	clearing	3, 17, 20
31	forest	3, 16, 19
32	grave	16,
33	circle	16, 21

	PSYCHOLOGICAL ELEMENTS	
34	gives sense of solitude	2, 5, 13,17
35	invites to rest and relaxation	2, 5, 19
36	gives reorientation (from everyday routine, banality of life)	2, 5, 13, 10
	LANDSCAPE COMPOSITION TYPES	
37	canopied, enclosed, focal, feature, panoramic	1, 22, 23

Notes: (1) Smardon et al., 1986; (2) Hermann, 2005; (3) Krinke, 2005; (4) Treib, 2005; (5) Stigsdotter, 2005; (6) Skalski, 2005; (7) Krippendorff, 1995; (8) Kaplan et al, 1998; (9) Kaplan and Kaplan, 1989; (10) Tuan, 1974; (11) Hou, 2015; (12) Zelanski and Fisher, 1996; (13) Herzog and Barnes, 1999; (14) Bell, 1998; (15) Jung, 1955; (16) Jung, 1964; (17) Leatherbarrow, 2004; (18) Banksy, 2015; (19) Saunders et al., 1998; (20) Thacker, 1985; (21) von Franz, 2008; (22) US. For. Serv., 1973; (23) Webster, 1960.

Developing the Contemplative Landscape Questionnaire.

Modeling the Questionnaire. Building the *Questionnaire* as a "rater-friendly", clear and consistent evaluation tool was the final step before it was applied. All items presented in the *Checklist* were transformed into an online-based Contemplative Landscapes Questionnaire using some already existing methods for visual landscape evaluation. Incorporating pre-existing and reliable models ensured adequate coverage of all important aspects of visual features of the landscape scenes.

The most prominent existing model utilized at this stage was the Visual Resource Management model, developed by the US Bureau of Land Management. It is based on early-twentieth century visual studies conducted for the construction of utilities and other infrastructure throughout the western United States on public lands (U.S. Dept. of the Interior, 1992). The VRM model is based on the assumption that all landscapes have some level of scenic value that can be assessed. It serves as the basis for numerous landscape-visual quality studies, even though it is mostly prepared for natural landscapes (with some level of "cultural modifications") and is not so sensitive to rural or urban landscapes.

The decision to use the VRM model was motivated by a similar base-assumption: each given outdoor space has some level of contemplativeness that can be evaluated. It was necessary to transform the VRM model in order to adjust the tool's sensitivity to designed landscapes (urban parks and gardens) and their contemplative features, which have been listed and analyzed beforehand through the literature review. The scheme below (Figure 23) presents this transformation process of the VRM model, which led to creating a new Contemplative Landscape Model (CLM). The scheme also incorporates an example of the Boston model, which is an adaptation of the VRM model used to evaluate the visual impact of wind energy turbines and other new development in the Boston Harbor Islands National Recreational Area (Burney et al., 2007).

Some categories of our contemplative model remained the same as in the VRM and Boston models: *Landform*, *Vegetation*, and *Adjacent Scenery* (equivalent to *Compatibility*). However, one very important key-element of the contemplative landscape that the VRM model does not consider is *Layers of the Landscape*.

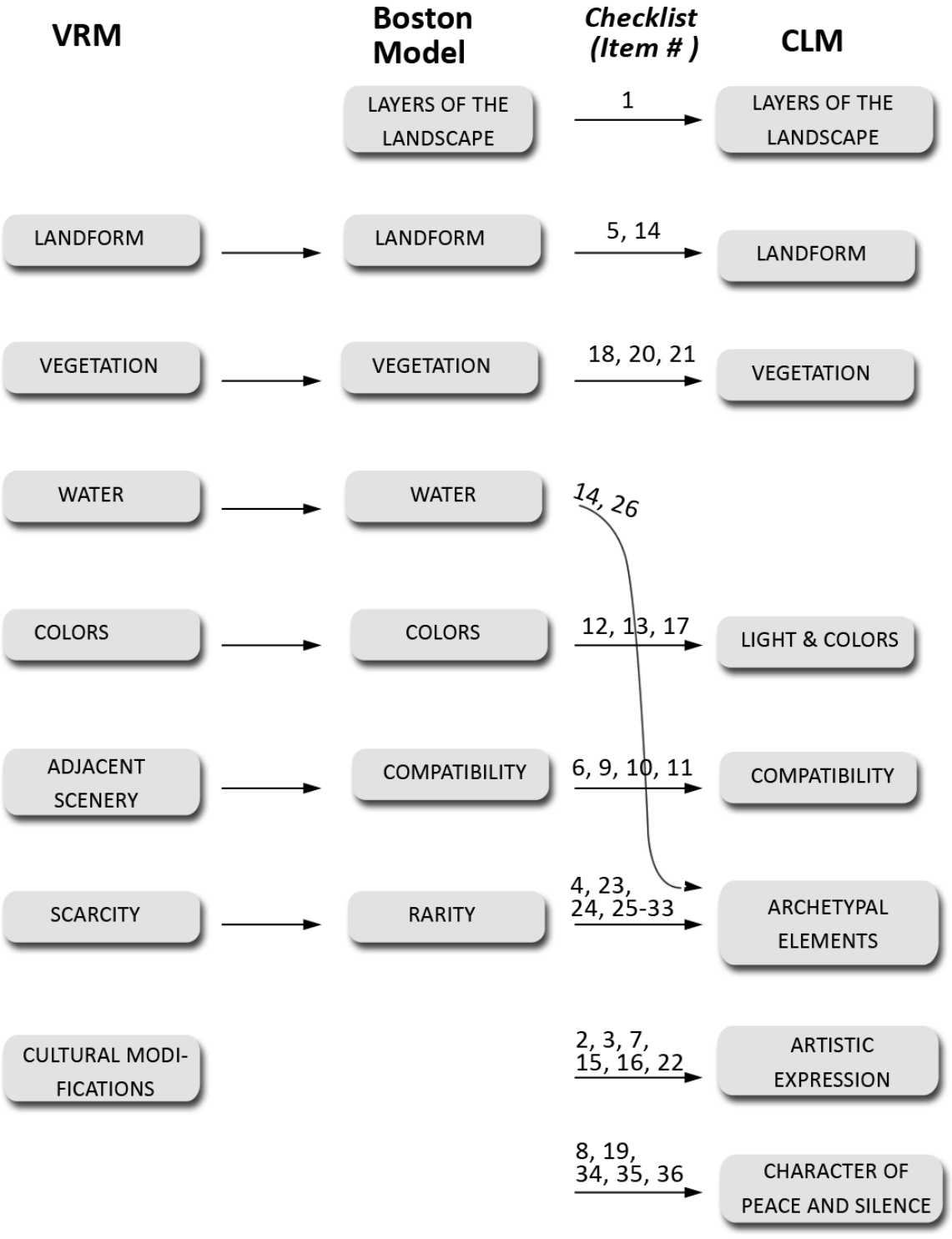


Figure 23. Scheme illustrating how VRM, Boston Model and the items of the *Checklist* were incorporated in the creation of CLM.

Layers of the landscape. This category includes contemplative features such as the depth of the view, which is connected directly to the visibility of three planes and the comfort of long distance views. Only this component of the contemplative landscapes constituted an all new key-category, which wasn't expected to be challenging for any expert to assess.

Landform. The landform category was based on contemplative features such as smoothness of the ground and manipulation of the skyline (through opening and closings of views, as well as through introducing some specific elements of the skyline) to stimulate looking up to the sky. This suggests that the subtle hills and mounds and diversified skyline would be the most desired for contemplation, thus the flat or rugged landforms are expected to be weaker in the classification.

Vegetation. This category proves the need of experts for this study, because raters have to prove knowledge about the plant species and types of habitats. It includes such characteristics as seasonal changes of vegetation form (e.g., whether the trees are of a species that turns orange in the autumn, or whether they drop their leaves or remain the same throughout the year. Also, another factor improving the contemplative score of the setting is a high degree of wilderness. If the vegetation looks wild (or natural/ native), the picture should score more points. Biodiversity, should also not be overlooked when considering the contemplativeness of a setting. As the literature shows, large monocultures will not score high. In this part of the Questionnaire, experts are especially challenged, because they need to balance between those three characteristics of the vegetation and choose the most appropriate score (in their opinion). The seasonality of changes, wilderness character, and biodiversity could also be named for (or correspond to) the level of naturalness of the vegetation of the scene. However, it was deemed appropriate to ensure the final score given by an expert refers to each of those three important contemplative features.

Compatibility. This category is identical to the Adjacent Scenery category of the VRM model. In short, it is about the quality of the design in terms of balance and harmony. It includes features such as: spatial order, absence of disturbing elements, working out the openings and closings of views, as well as the physical and visual relations between the elements, and the hierarchical relation between signage or communication system elements. In other words, experts here are asked to evaluate if the design is clear, balanced, well-composed and not overwhelming or confusing.

The VRM and Boston models incorporated *Water* as a key element in the visual quality of landscape evaluation. However, each of these models has slightly different reasons for addressing this element. In the VRM model, it is present because water is an important factor of any natural landscape and generally increases the attractiveness of

this landscape. On the other hand, the Boston model is prepared for evaluating harbor landscapes, where water is present in every evaluated case. In the CLM, water may be considered an archetypal landscape element. Bearing this in mind, the *Water* element was fully transferred to the new category *Archetypal Elements*, which replaces the *Scarcity/Rarity* categories (see Figure 23). The scarcest elements of landscapes according to the VRM model are, in fact, archetypal elements, with features such as stones, waterfalls, and dense forests as strong archetypes. Thus, we decided to create the all new category of *Archetypal Elements*, which joins both water and scarcity elements from the VRM model.

Archetypal elements. This category includes the evaluation of how strong the archetypal elements influence the overall perception of the setting. The fact that some archetypal element is present does not guarantee that it will be acknowledged by the viewer, therefore the experts here were asked not to only identify archetypal elements, but to, more importantly, evaluate how strongly they influence the overall perception of the observer. Archetypal elements to consider included: path, clearing, single old tree, forest, still water (water mirror), waterfall, circle, grave, and boulder.

The VRM category *Colors* seemed incomplete for use in the contemplative model, because most perceived colors depend on the light conditions of the site. Also, many contemplative attributes of the space dealt with light and shade. Therefore, the *Color* category was extended to the *Color and Light* category.

Color and Light. Within this category, experts had to give a balanced evaluation of how colors and light/shade influence the quality of the setting. An important factor was broken, natural colors in opposition to vivid, contrasting colors, and visibility of the shade and sunlight, or shade movements, with an assumption that the places where the observer is not directly exposed to the sun are the best for contemplation.

Finally, we created two all new categories that did not exist in either the VRM or the Boston model, because these models dealt with more or less natural scenery. These new categories are *Artistic Expression* and *Character of Peace and Silence*. Implementing these elements was necessary in order to make the CLM sensitive to the designed landscapes in urban areas. These were designed with artistic concern, mostly on a completely modified environment, using some artistic expression strategies. Also, the character of peace and silence is very important for urban contemplative spaces, as it is a contrast to the noise and crowdedness of the typical urban environment, whereas in natural landscapes, this factor is usually assumed to be the case.

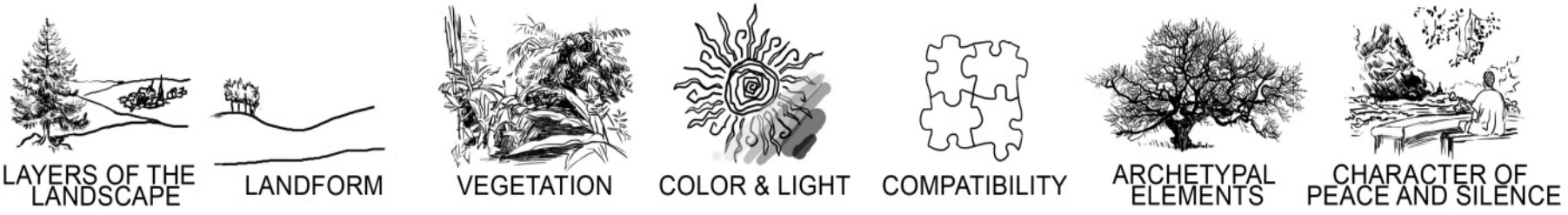
Artistic expression. This category served as a container to which all the artistic strategies collected from the literature were placed and listed: large-scaled elements in

relation to the human body; repetition; natural asymmetry; simplification of forms (abstraction); architectural/geometrical use of plants. In this case, experts were to decide how strong these strategies influenced the overall perception of the setting.

Character of Peace and Silence. This category is difficult to evaluate by only looking at the photographs, therefore the help of experts was essential, because they know that a character of peace and silence can be achieved by using the right visual strategies, such as inviting rest and relaxation, giving a sense of solitude to the observer, creating the appropriate distance, visual enclosure, and an environment contrasting with the urban chaos. In short, experts were asked to evaluate the tranquility and serenity of the presented setting in this category.

After incorporating the *Checklist* items within the VRM structure, the scoring system was applied in order to create a scoring-chart that could be used directly by experts (Figure 24).

The research version of the Contemplative Landscape Questionnaire is presented in Appendix 1, and its final version (with the adjustments applied after evaluation of the statistical results) in Appendix 2.



	LAYERS OF THE LANDSCAPE	LANDFORM	VEGETATION	COLOR & LIGHT	COMPATIBILITY	ARCHETYPAL ELEMENTS	CHARACTER OF PEACE AND SILENCE
6 5	far distance view (400m or more), layers greatly enhance the visual quality	undulating lanform, natural lines	high diversity of species, plants seem native; seasonally changing vegetation	natural, broken or warm colors AND visibility of light and shade	physical and visual relations are worked out AND explicit spatial order, harmony, balance between *natural* and *created*	strongly influence the overall perception	explicit, in contrast to the urban environment; invites to rest and relax AND gives sense of solitude
4 3	layers moderately enhance the overall visual quality	landform is not very significant to the setting OR hard to say	moderate diversity of vegetation, moderate changes across the seasons	moderate amount of contrasting colors, moderate amount of light and shade	physical and visual relations are not clear OR some elements disturbing the harmony and balance	are present but not important for the overall perception	moderate, AND/OR moderate sense of solitude AND/OR less contrast with urban environment
2 1	layers do not enhance the overall visual quality OR no layers	flat or rugged landform	low diversity of vegetation, minority of native species; no seasonal changes	lots of vivid, contrasting colors, light and shade are not visible	physical and visual relations are not worked out well or not at all OR chaos / lack of harmony	no archetypal elements	no character of peace and silence, busy, no conrast with the urban environment

Figure 24. Scoring chart with a 1-6 Likert scale, which was used by experts to evaluate the landscape settings and gave basis for creating the *Contemplative Landscapes Questionnaire (CLQ)*

Selecting target settings.

In psychology and social science research, sampling issues involve the selection of adequate participants and adequate stimuli. In environmental research, selection of adequate environments is of equal importance. Thus, an important step in preparation for the lab experiment was to create a database of photographs and then choose the most and least contemplative ones from this database. It is important that the data collection ensures several instances for each identified contemplative landscape characteristic.

With accordance to the first hypothesis (H1), it is assumed that some landscape settings induce a more contemplative experience than others. So, in order to observe that difference, it must be ensured that those very contemplative landscapes are in the database of photographs. The following chapter describes all steps that were undertaken in order to select photos for further testing. The output of this search, forty photographs of landscape settings, is presented in Appendix 3.

Site selection. Finding the most contemplative landscape setting was a major challenge. The settings selected for *Study II* needed to be the best representation of their kind while also providing variety. All specified key-components of CLM should be covered by the set, or at least have stimuli good enough to provide clear results sharply contrasting with the second condition during the lab experiment. This raised some concerns, of course. What if the truly contemplative parks were not found? What if they were too far to travel to, making it impossible to take pictures and videos? What if they were overlooked?

These worries surfaced often, especially since this was an attempt to find answers in an unexplored area. Nobody had already stated: *"this park is highly contemplative, and this is not"*. But, fortunately, this research is not about finding the most contemplative places on Earth, but just some particular characteristics that could characterize the landscapes (such as composition and design) in relation to others. So, ideally, the developed tool would, take any two landscape settings and reveal which one is more contemplative than the other. Therefore, the concern about not finding the most contemplative place was present only in the initial stage of this research.

Nevertheless, the will to find very strong, representative examples of landscapes was an imperative throughout the entire research process, for it is the goal of any ambitious researcher to do whatever it takes in order to make their investigation of the best possible quality.

The solid source of support employed for this endeavor was the literature, which—as previously stated in the literature review stage—consisted mostly of more or

less poetic descriptions of parks and gardens where authors experience contemplation (see *section Literature Review on Contemplative Landscapes*). This provided some inspiration about where to go, to collect landscape samples.

It is important to stress here that this research was conducted in terms of the setting and not by park. The results should not be interpreted park-wise, and the selection of those parks should not lead to any conclusions. Thirteen parks and gardens, scattered around Europe and North America, were visited and selected as the most relevant for the collection. From these, 128 landscape settings were acquired in the form of photographs and videos. The visited parks are presented in Table 2. The process was divided into two phases:

1) Phase I – with 87 landscape images in total. The first phase of photographic documentation consisted of multiple visits to the four selected parks: City Park of Porto, Serralves Foundation Park in Porto, Parc André Citroën in Paris, and Parchi di Nervi in Genoa. Each of these parks are located in Europe; therefore, they were easy to access for research purposes. The visits to these parks delivered the majority of the photos that can be found in the final database. The photos here were evaluated by only four experts, which allowed for the consideration of rejection of some items from the checklist. The database of photographs collected in these "nearby" parks served mainly to extend the database with multiple different landscape settings and ensure a source for the non-contemplative condition of subsequent experiments with stimuli.

2) Phase II – with 41 landscape images in total. These were chosen in order to supply the Contemplative condition with the most representative photographs. This phase of data collection took place in parks and gardens that were described as contemplative, or for some other reasons were classified as contemplative. The second phase consisted of visits to parks located in the United States of America in various locations. The USA, as the country where landscape architecture was born, provides plenty of good examples of contemporary landscape design, which are well studied and described by the literature. The visits were possible thanks to my seven-month-long stay as a visiting scholar at the University of Massachusetts. Each of the visits was prepared in terms of the probability of high-contemplativeness in order to find the most contemplative sceneries this time around. The expected output of this phase was finding the most contemplative landscape scenes that would feed the CL condition.

The photographs and videos from Phase I and Phase II were filtered and put as targets in the Contemplative Landscapes Expert evaluation, and then twelve of them served for a laboratory experiment.

Below are descriptions and maps of the parks visited with the location points for the photo and video collection, together with the arguments about the reasons that this particular park was chosen as a representative for this research (either because of such intention of the author or because some of some contemplative landscape features that it had). Together with these descriptions are samples of the settings captured during the visit. Each setting is described by an identification number (Photo #), and brief information about the stage of the research in which it was used, including the testing of the checklist, *Questionnaire* stage (when experts had evaluated it), and/or the final laboratory experiment stage.

The photos of settings presented below are neither a complete database of case studies nor are they the same image quality and resolution used in the experiment. The high-definition images are stored separately and are available upon personal request.

Table 2
List of parks which were included in the Pilot and the full-scale experiment.

		Name of the Park	**Location**	**Designer**
Phase I	1	Parque da Cidade	Porto (Portugal)	Sidónio Pardal
	2	Serralves	Porto (Portugal)	Jacques Greber
	3	Parque Andre Citroën	Paris (France)	G. Clément, P. Berger, J.F. Jodry , J.P. Viguier
	4	Parchi di Nervi	Genoa (Italy)	G. Rovelli or M. and G. Roda[3]
Phase II	5	Central Park	New York (NY, USA)	Frederic Law Olmsted , Calvert Vaux
	6	South Pointe Park	Miami (FL, USA)	Hargreaves Associates
	7	Washington Cathedral	Washington DC (USA)	Frederick Law Olmsted Junior
	8	Chattanooga City Park	Chattanooga (TN, USA)	Hargreaves Associates
	9	Prospect Park	New York (NY, USA)	Frederic Law Olmsted , Calvert Vaux
	10	The National 9/11 Memorial	New York (NY, USA)	Peter Walker
	11	Naumkeag Estate	Stockbridge (MA,USA)	Fletcher Steele
	12	Balboa Park	San Diego (CA, USA)	Kate Sessions, et.al
	13	Salk Institute	La Jolla (CA, USA)	Louis Kahn

3 Authorship not clear (Albericci, 2011)

Parque da Cidade – City Park (Porto, Portugal)

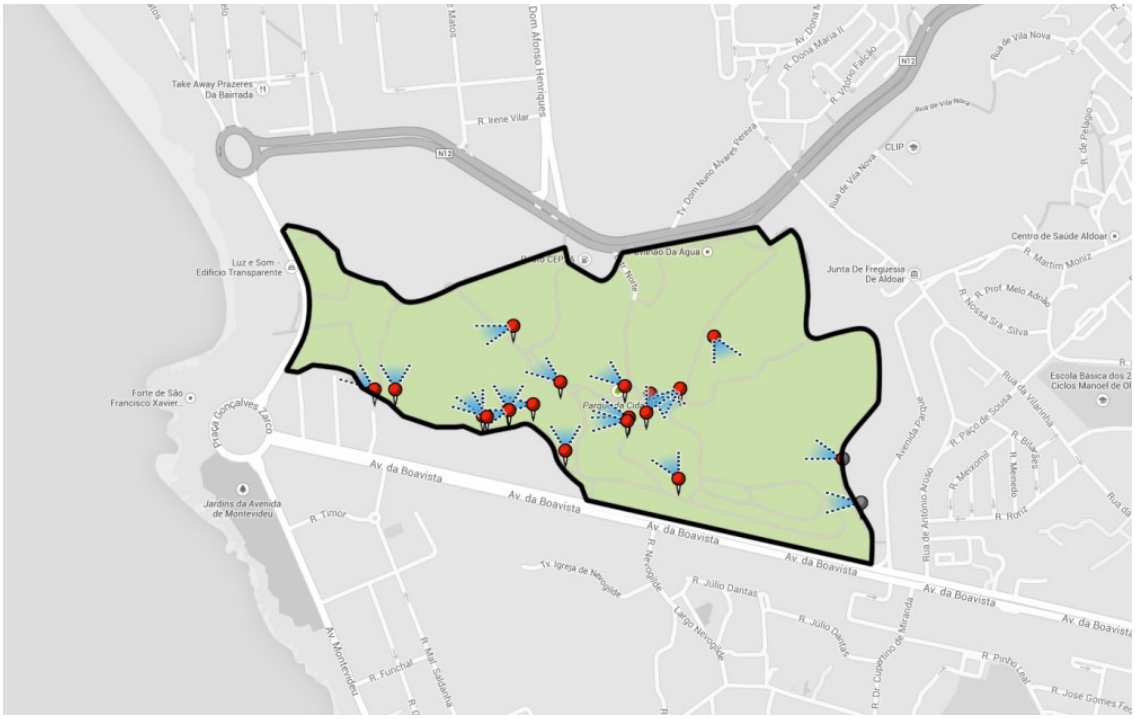


Figure 25. Schematic representation of the site and locations of image capture (*n* = 19) for selected landscape settings in the Parque da Cidade of Porto.

Figure 26. A valley-corridor enables long distance panoramic views, Parque da Cidade, Porto, Portugal. Photo #41, used only for testing of the checklist (by author).

The City Park of Porto in Portugal is an example of a park with one of the main functions stated as contemplation. The 83 hectares of green space facing the Atlantic Ocean was inaugurated in 1993 and serves as the one of the most important green areas of the city and one of its major tourist attractions (Figure 25). The author of the project, Sidónio Pardal, describes his creation as follows: "the Park's landscape is an end in itself and expresses its essence. It doesn't attempt to imitate nature and has no other purpose than direct use as a public urban space for recreation activities and contemplation" (Pardal, 2006, p. 64)

Pardal further elaborates that: "A Park is based on an idea striving to express natural beauty, like substantive content arising from a landscape that it objectively materializes. It is … offering the landscape as a decoded public space contrasting with the surrounding city structure." (Pardal, 2006, p. 5)

The immensity of the park and its excellent location enabled the use of strong contemplative design strategies and the application of primary archetypal elements in the design. Some of the contemplative design strategies present in this park are:

1) Long distance views—the possibility of viewing further than 400 meters away, enabling the view of three planes (Figure 26).
2) The coastline of the Atlantic Ocean and the valley corridor are two structural archetypal elements. According to C.G. Jung's dream analysis, the ocean and valley are existential experiences existing in the collective unconscious and significantly influence mind recovery (Jung, 1964).
3) The water basins with the still water mirror reflecting the sky, which, as in medieval cathedrals, stimulates the viewer to look up to the sky and increases attention to eternal values.
4) The areas in the park with a high density of tall trees that give shade and cool shelter on hot sunny days and shaded narrow, winding paths through the greenery increases a sense of solitude (see Appendix 3, photo #33). These paths lead to radical openings of views and large clearings with long vistas, as a reference to the spiritual voyage through the darkness of the soul towards the light and the open clearing of enlightenment.

Another description of the park is provided by the former mayor of Porto City, Mr. Rui Rio, in the introductory page of the book *Parque da Cidade do Porto — Ideia e Paisagem:*

"...one of those unique moments of absolute meditative pleasure. The park transcends mere utility when we plunge into its tranquility and feel awed in a silent gaze over the landscape. The Park is gratifying reality that brings us hope. It's an example of an enlightened urban development policy put into practice. This was a

demanding task achieved through studies, reflection and an open imagination, a committed effort to build a project that is as difficult as it is demanding. The result is an evident expression of simplicity that transmits a sense of peace and harmony" (cit. in Pardal, 2006, p. 36).

During my numerous visits to the park, I found it to be a very successful design and place that really works well for the city inhabitants. The major assumptions of the designer, entertainment and contemplation, are successfully met there. People work out, meet friends and relax there quite regularly. The park is an ideal place to go to, and its immense scale does not make any of its parts inaccessible or unwelcoming. The simplicity of the design, which addresses the simplest needs without imitating neither nature nor historical models made it a great park to include in my research. Even though it is an extensive area, its proximity to the urban core is significant. The park provides many panoramic settings with very long distance views (including views reaching the ocean horizon line). Through this example, the feasibility of introducing large-scale green areas with panoramic character into the cities just may be confirmed!

Serralves Foundation Park - Serralves (Porto, Portugal)

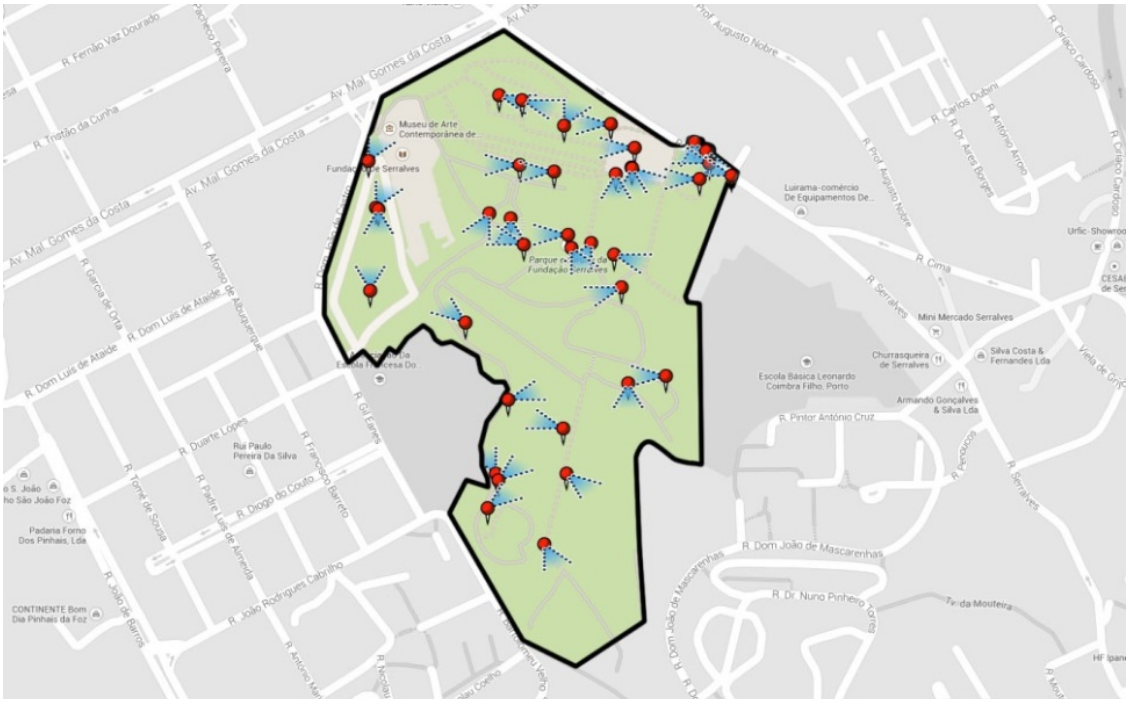


Figure 27. Schematic representation of the site and locations of image capture (*n* = 35) for selected landscape settings in Serralves Park.

Figure 28. Photo #42, used only for the testing of the checklist, formal garden around the central axis of Serralves Park (photo by the author).

The park is located in the city center of Porto, and is owned by the Fundação de Serralves (Serralves Foundation). It includes the Serralves House (an Art Deco building dating back to the 1930s), the Contemporary Art Museum and its Auditorium, as well as other buildings and structures. Originally designed as a space for an exclusive private residence, it is now open to the public as a city park and a place for numerous art and cultural events.

The park was designed by Jacques Gréber in 1932 at the very threshold of modernism, but it also incorporates a number of aesthetic principles from previous periods. It provides a great variety of species and settings. The garden is structured around a 500-meter long central axis, and incorporates sections such as a formal garden (Figure 28) with flower beds and water systems, rose and magnolia gardens, a lake with an isle in the middle, and a less formal part inspired by the English landscape-gardens: a pastoral field with domesticated animals, a densely forested area, an aromatic herbal garden and a typical rural settlement. Over the years, the Serralves landscape has manifested a rich texture of form, light and color in a highly individual manner.

The choice of the park was influenced by the diversity of the settings that can be encountered in a relatively small area. There are contemplative views as well as a number of archetypal elements included in the design, which allowed for the testing of various different design solutions, including:

- geometrical use of the plants (Figure 28)
- pastoral landscapes introduced in the city (Appendix 3, photo #31),
- labyrinth-like passages,
- densely forested areas,
- old trees (incl. solitaires)
- minimalistic (harmonious) design of the architectural elements
- explicit spatial order

Views from Serralves were often present in the first pilot parts of the research and also in the full-scale experiment but, later, they were mostly included in the group of non-contemplative settings.

Parc André Citroën (Paris, France)

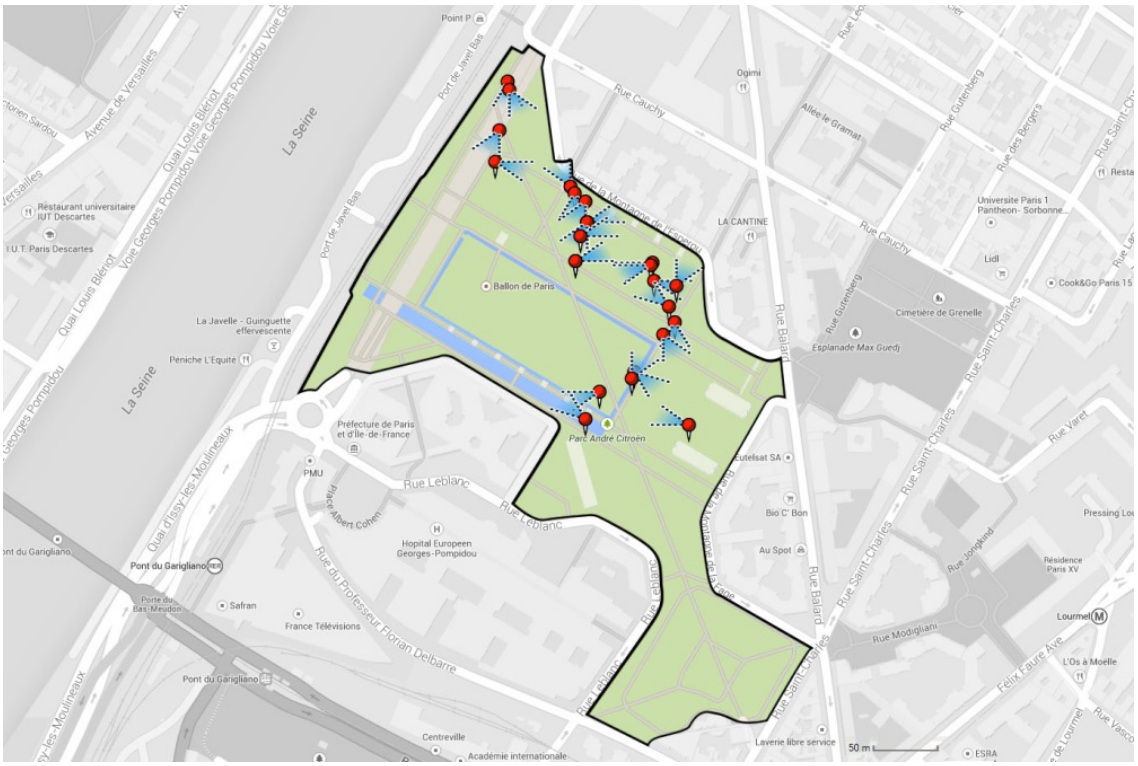


Figure 29. Schematic representation of the site and locations of image capture (*n* = 20) for selected landscape settings in the Parc André Citroën.

Figure 30. Alleys of the Parc André Citroën with geometrical forms of vegetation; photo #43 used only for testing the checklist. *(Photo by the author*).

Parc André Citroën was designed by Gilles Clément, Patrick Berger, Jean-François Jodry and Jean-Paul Viguier as a result of a competition in 1992. According to the Project for Public Space (PPS), this park is not considered a successful project. It is described as *"barely more hospitable than the car factory it replaced"* and is classified as a "hall of shame", second on the list of worst parks on the planet (Project for Public Spaces, n.d.) (Figure 29).

The concept of the park is based on an attempt to provide reorientation from the highly urbanized center of Paris for its visitors and, in fact, the location of the park is in a vital point of the Parisian waterfront. The design is an agglomeration of strong geometric forms juxtaposed to more organic, natural elements (Ellis, 1993). The experts of PPS state that the functionality of the park is strictly limited to only look at objects, without the possibility to actually use the space.

"The entire periphery of the park is a series of fussy little design vignettes that fail to accommodate people's normal uses, such as sitting in groups or even just watching other people. Various theme gardens, follies, and grade-separated paths restrict the user experience to one monotonous act: looking at objects." (Project for Public Space, n.d.)

Nevertheless, this park was included in the research with the notion that the "looking at objects" could be enough for contemplation. What is more, it provided a highly geometrized space (Figure 30), which is another trend in urban landscape design and a strategy of contemplative artistic expression. In the case that the space does not qualify as a contemplative one, it can at least serve as a non-contemplative example. This non-contemplativeness is already suggested by the park's negative reviews.

The visits to the park took place in the early spring. Captured materials were used for the pilot experiment, which was processed with a no-sun assumption. The expert evaluation score was so low for the park in the pilot experiment that it was deemed unnecessary to travel back to the park in order to capture sunny images.

Parchi di Nervi (Genoa, Italy)

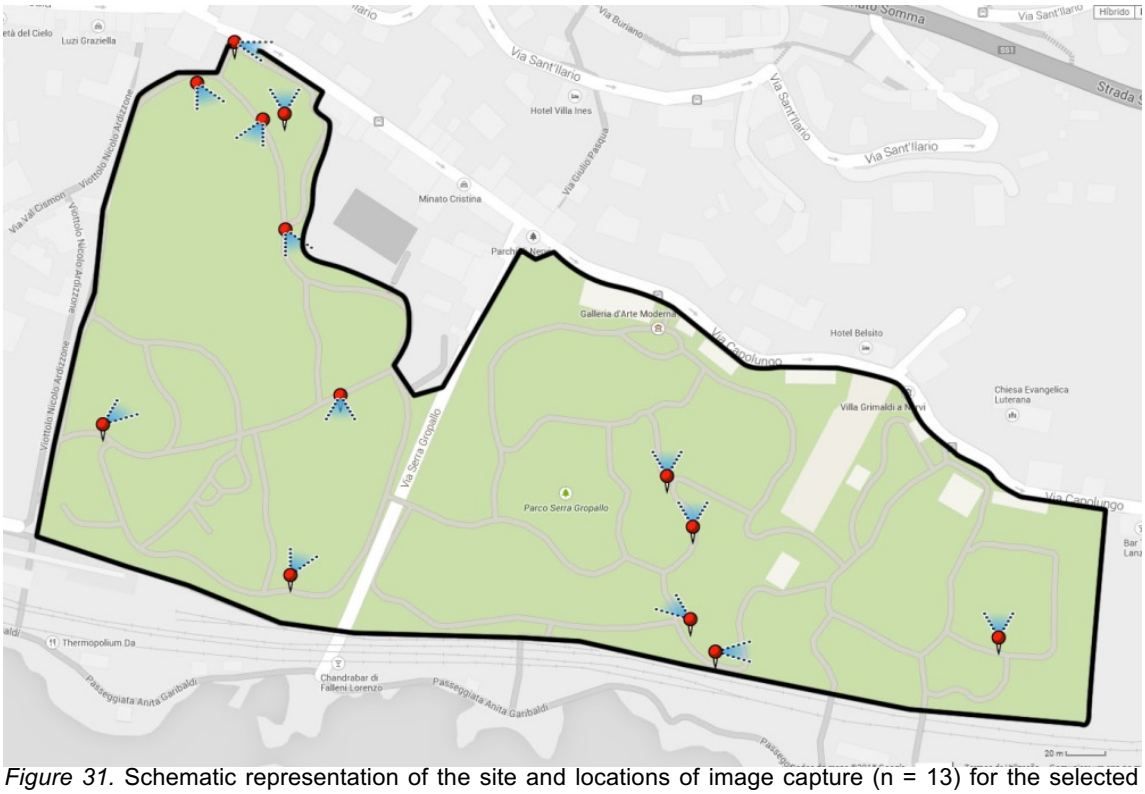


Figure 31. Schematic representation of the site and locations of image capture (n = 13) for the selected landscape settings in the Parchi di Nervi.

Figure 32. The long view framed with the *Palmceae* planting from the part of the park that belonged to Villa Gropallo. Photo #23 used in the checklist testing and expert evaluation, as well as in the Lab experiment in the CL block. (photo by A. Chadala)

Parchi di Nervi is a 92-hectare city park on the outskirts of the northern Italian city of Genova, see Figure 31. Since 1927 it has served as a city park, but it has a much longer history as green surrounding of four private villas, whose construction is dated to the eighteenth century (Villa Gropallo, Villa Saluzzo Serra, Villa Grimaldi Fassio and Villa Luxoro). There is little information about the history of the parks. From the available sources it is known that "The architect Riccardo Haupt wrote in his diaries that Gerolamo Serra intended to let the park be designed by a well-known landscape architect from the region of the Maggiore lake, Giuseppe Rovelli. He, together with his cousin, Luigi, were designers of many romantic parks and gardens in Genóva, and its surroundings" (Italia Nostra, 2003, p. 8). On the other hand, others recognize famous gardeners from the royal Savoy family, Marcellino e Giuseppe Roda as designers of this complex of parks (Albericci et al., 2011, pp. 124-125).

Each of the four properties (villas) that were the basis for Parchi di Nervi is different, however they all represent the character of the Italian Romantic gardens and olive gardens typical for this region. The largest portion of the park belonged to the Villa Gropallo.

Villa Gropallo was described in the historic sources as follows: "The diverse landform and the arrangement of vegetation determine visual varying in width, depth and orientation, enclosed areas and visual barriers shield the borders of the parks. The depressions and reliefs are arranged in such a way that there is a continuous progression of open spaces and that the paths do not interrupt the continuity of the visual fields" (Albericci, et al., 2011, p. 125).

Before World War II, in times of rapid urban growth, the two villas were purchased by the city of Genova (1927, one year after the establishment of the Great Genova with the annexation of the city of Nervi). The city invested in creating a new artistic hub there—an environment of extraordinary prestige acquisitions that allowed the arrangement of the Modern Art Gallery in Villa Serra from 1928 and the preservation of an exceptional piece of landscape. The new green space design was executed according to a precise plan by Orlando Grosso, director of the Fine Arts of the City. The park was supposed to form a "dense and lush flora with a predominance of palms, with the absence of any artifice …physiognomy balanced and harmonious, with a distribution of areas complementary to each other with functions relating to city life and diversified: 'to the west the districts' laborious industry and trade, in the eastern part of the city the seductive smile of nature'" (Italia Nostra, 2003, pp. 9-10).

Parchi di Nervi is a beautiful example of a public city park, whose form is influenced by historic design, but has been redesigned to meet the functions of the contemporary place.

Upon arriving to the park for the first time, its contemplativeness is palpable. The features that make it so are, first of all, harmonious openings and closings of views. Secondly, the physical elements such as large trees, shrubs, and far away landscapes in a balanced relation to one another, which makes the scenery adjacent and interesting (Figure 32).

Furthermore, the park offers long vistas as well as enclosed or canopied spaces. An intriguing feature of the park is that the majority of the trees are from the *Palmaceae* family, which can suggest some compelling questions about whether this specific type of vegetation, characteristic for warm and humid climates, influences the contemplativeness of a design (see Appendix 3 photo #06).

Central Park (New York, USA)

Figure 33. Schematic representation of the site and locations of image capture (*n* = 2) for selected landscape settings in Central Park.

Figure 34. View from the grassy mound over one of the lakes in the south-west part of the Central Park, New York, USA. Photo #16 used for the expert evaluation, presents the sunny May afternoon. It is time where it is very difficult to find the empty spot in the park. Even though the area of the park is so big, there are people everywhere. That prevented us from taking proper pictures. Still, it served for an expert analysis, and scored relatively high in terms of contemplative values (photo by author).

Central Park, as a one of a kind, legendary park that is as successful now as a hundred years ago, could not be left out of this research. It is one of the best parks in the world according to PPS, and this is due to the timelessness of the vision of the designers, Frederic Law Olmsted and Calvert Vaux. They began designing the park in 1858 on an area of 314 hectares (778 acres), which was obtained to satisfy the need for open space for the rapidly growing New York population (Figure 33). Today, the park encompasses 341 hectares (843 acres) and has a collection of over 4 million trees and plants, along with numerous sport fields, playgrounds and water reservoirs.

The communication system and programming of the park has always worked very well, enabling accessibility and communication through different zones without the feeling of confusion or being lost. According to Elizabeth Barlow Rogers[4], "he [Olmsted] arranged sequences of visual events to climax in stunning vistas...Although every inch of Central Park was shaped and molded by machines and men, the hand of man is never obvious" (Project for Public Spaces, n.d.).

The main research obstacle there was to find a place with a relatively small number of people, which should be no surprise considering that it is visited by more than 20 million people per year and is one of the largest attractions of New York and the United States. That is why only two landscape images were captured for this research, but still dominated by crowds of people (Figure 34).

[4] Elizabeth Barlow Rogers (born in 1936) landscape architect, designer and preservationist, writer, author of the *Revitalization of the Central Park*, a first Central Park Administrator and co-founder of the Central Park Conservancy non-profit organization that she helped establish in 1980.

South Pointe Park (Miami, Florida, USA)

Figure 35. Schematic representation of the site and locations of image capture (*n* = 5) for selected landscape settings in South Pointe Park (Miami Beach, Florida, USA)

Figure 36. The overview of the South Pointe Park in the summertime (Hargreaves Associates, n.d.)

South Pointe Park, designed by Hargreaves Associates and opened in 2009, is located in the ecologically sensitive and, at the same time, very animated area of South Beach, Miami (Figure 35). The park positions two corresponding circulation paths: The *Serpentine Walk* and the *Cut Walk* to provide critical regional connections and views out to the Atlantic Ocean. The main path is a promenade built with Dominican Keystone and fossilized coral, which suggests the natural processes of the adjacent sea. The experience of walking along that path "encourages the sense of spectatorship…providing the ideal viewing platform for the massive cruise ships entering and leaving Biscayne Bay" (Hargreaves et al., 2009, p.191).

The *Serpentine Walk* was designed as a counterpoint for the long cut walk. This area is elevated and moundy, paths twist and turn, rising to a spectacular view over the Atlantic Ocean. The park is somehow a gate to nature from the dense urban landscape into the wide panoramic ocean views, leading from the built up area through the long straight promenade until the dune-like elevation with the serpentine paths (Figure 36).

The authors describe their concept as follows "[The park] includes a grand esplanade along *Government Cut*, a beach dune restoration area, children's playground landscape, and a park pavilion, all anchored within a dramatic, serpentine landform that will serve as a place for viewing, a path for walking, and an artful, iconic feature of the park" (Hargreaves et al., 2009, p. 191).

The main reason for introducing this design in the research was the mentioned abstract interpretation of the natural forms of dunes and the tropical bay. Also, it needs to be integrated into the urban fabric, which was interesting. It is impressive to see how an urban park located in a very ecologically sensitive area that still holds elements of the natural native landscape while making visitors associate it with the original place. The design also joins abstraction and symbolism, for example, long distance ocean-view.

Unfortunately, the only possible park visit took place in early March, and the sky was covered with clouds on this day, so when the decision about utilizing only sunny pictures was made, the cloudy photos from South Pointe Park turned out useless. Nevertheless, this site is recommended for introducing in future research.

Bishop´s Garden and Olmsted Woods, National Cathedral (Washington D.C., USA)

Figure 37. Schematic representation of the site visit and locations of image capture (*n* = 4) for selected landscape settings in the area of National Cathedral (Washington, D.C., USA)

Figure 38. Big lawn area in the Bishop´s Garden, space enclosed by the hedge along the stone walls. The space invites rest and relaxation. Photo #39 used in the expert´ evaluation (photo by author).

The Washington Cathedral is a contemporary reinterpretation of European gothic cathedral architecture. The medieval form, however provides all the facilities and accessibility for modern visitors. The outdoor space of the cathedral is an interesting association with the original medieval cathedral, but extended to over 22 hectares (55 acres) (Figure 37).

One intriguing spot is the romanticized *Bishop's Garden*, which is modeled on a medieval walled garden and features herbs, roses beds, and water elements. On the other side, there is a larger lawn area established for recreation of visitors (see Figure 38). Another part of the green area surrounding the Cathedral is the *Olmsted Woods*, located down the slope from the *Bishop's Garden*. It is a densely forested area, whose main element is a stone footpath called the *Pilgrim Way*. This meandering walkway made of irregularly shaped stones leads down to the *Contemplative Circle*. The woods consist of carefully selected and maintained native species of trees, shrubs, and wildflowers and is a host to migratory birds. The author of the design, Frederick Law Olmsted Jr. (the son of the designer of Central Park in New York) writes about this place: "the great sweeping branches of the trees seem to brush off, as it were, the dust of the city, so that one at last reaches the Cathedral cleansed in mind and in spirit" (Conaway, 2008, p. 139).

The Cathedral is welcoming and attracts numerous tourists, regardless of their beliefs and backgrounds, in accordance to the ideas of religious freedom in USA. Washington, D.C. seems to be an appropriate spot for that. The space outside the cathedral inspired me to include it in the research—as religious contemplation in a more secularized way. It was interesting to note how the contemporary cathedral can create a space of contemplation, perhaps Christian contemplation, but not necessarily.

What is more, because this place is not an authentic medieval cathedral, makes it an interesting point for the research. It enables evaluating the space purely for the physical features visible in the landscapes, leaving out the historic authenticity factor (that could be related to genius loci).

The elements of the landscapes that appeared most interesting from this research standpoint were:

1) The pilgrim path as a reference to the archetype of a path, and the forest (see Appendix 3, photo #12).
2) The enclosed garden with a lawn, semi-long vista, giving ample space for an individual, also the archetype of the clearing that invites rest and relaxation,
3) The wilderness character of the *Olmsted Woods* with natural biodiversity of lush forest.

Renaissance Park (Chattanooga, Tennessee, USA)

Figure 39. Schematic representation of the site and locations of image capture (*n* = 6) for selected landscape settings in *Renaissance Park* in Chattanooga.

Figure 40. *Renaissance Park* in the early spring did not look very welcoming. The grass was yellow and poorly maintained; the lack of visitors made it very different than the photos shown on the designer's website.

The 9-hectare (23.5 acre) Renaissance Park on Chattanooga's North Shore was designed by *Hargreaves Associates* and constitutes a good example of transforming a post-industrial wasteland into a park (Figure 39). An important element of the park is a stream leading to the Tennessee River that used to be very contaminated by industrial waste. Buried waste was removed and stabilized chemically and geotechnically on-site rather than being exported to landfills.

"A created wetland system now collects and cleans urban runoff generated on site and runoff brought onto the site via the North Market Street Branch stream, before release into the Tennessee. Finally, unstable and actively erosive stream and river banks have been stabilized with a unique vegetative revetment system and the use of fascines and live-staking, as well as a series of gabion structures and rip-rap armature" (Hargreaves, 2009, p. 206).

The park is a water treatment space, and an ecologically-smart solution for the city. It also incorporates compelling abstract forms, such as a regular hill, a huge ramp, and a sculpture dominant element of the human head. However, upon arriving to the site, the park did not look as great as in the photos published in the literature sources. As it turned out, a good portion of the park´s charm was due to digital image editing. Also, the park's maintenance was not spectacular, which made the park look like a brown desert (Figure 40), and the fancy water stream with barriers—a dirty sewage channel. That is why the park was excluded from the research and experiment. Although, it could be considered as a good example of ecological solutions on post-industrial sites that through application of abstract forms, bring contemplation to the visitors.

Prospect Park (New York City, USA)

Figure 41. Schematic representation of the site and locations of image capture (*n* = 6) for selected landscape settings in the *Prospect Park* (New York, USA).

Figure 42. The long meadow view at the Prospect Park. Photo #35 used in the experts´ evaluation and in the lab experiment in the CL block (photo by author).

Soon after completion of the Central Park design, Frederick Law Olmsted and Calvert Vaux undertook the challenge of turning this 212-hectare (526 acre) section of Brooklyn into a beautiful park (Figure 41). They completed the work in 1877 providing a "peaceful escape from the urban environment, where one could recharge the mind and soul" (Colley, 2013). The main concept of their creation was integrating the inhabitants of Brooklyn and providing a refuge from the urban chaos to those who could not afford travelling outside of the city.

PPS nominated this space as one of the best in the world, describing it as follows: "Sublimely beautiful, Prospect Park is a flexible space which accommodates almost any pastime. Its distinguishing features include woodlands and streams, ponds, picnic areas, playing fields, a children's zoo, a bandshell — and the world-renowned Long Meadow" (see Figure 42) and: "Olmsted and Vaux considered Prospect Park to be a work of art. The vistas, which seem so natural, were in fact painstakingly planned to create smooth, undulating spaces. Hills and vantage points were purposely constructed to look out over the vistas and the people in them. Prospect Park's unbroken expanse accommodates almost any type of user, almost anywhere."

In fact, the visit to Prospect Park was outstanding. Mostly because of the scale of the park and the fact that so many people were spending time there, doing so many various activities, and still the park had a quiet and relaxing ambience. A long walk around the park provided all types of different vistas—water, grassland, forest paths, mounds, permeable and non-permeable groundcover, intimate vine tunnels and open picnic areas, a festival hall with a stage and a fountain-system. The most significant aspect is that the space performs exceedingly well at integrating the people who spend time in the area, from locals of different cultural backgrounds to a tremendous amount of tourists. Everyone coexists and enjoys their time in the park.

Six major settings were captured for further processing. The main factors in the selection of this park are the integration of large water surfaces in the design (see Appendix 3, photo #37) and the far, relatively flat meadows. Also, introducing the best public space according to PPS might bring some interesting insights about how much contemplativeness correlates with the title of a "Great Public Space".

The National 9/11 Memorial (New York City, USA)

Figure 43. Schematic representation of the site and locations of image capture (n = 3) for the selected landscape settings in *The National 9/11 Memorial* in New York.

Figure 44. Massive waterfall in the place of one of the Towers of the World Trade Center. Even though the place is full of visitors it gives a sense of solitude and reorientation from the urban chaos. Photo #02, utilized in the expert´ evaluation as well as the lab experiment in the CL block, National 9/11 Memorial, New York, USA (photo by author).

A memorial is created to be a place of commemorative contemplation. Contemplation about life and death and the transitory nature of human existence are the most obvious themes, but a memorial can also serve as a reminder of the collective human family and the connectivity between every element of the planet.

The 9/11 Memorial fulfills these purposes, regardless of its very up-to-date and contemporary design. The memorial carries heavy symbolism of the tragedy that took place here over a decade ago and, because of that, the impact of the design will always be affected by its association with these events.

It is located at the site of the former World Trade Center complex and occupies approximately half of the 6-hectare (16-acre) site (Figure 43). The Memorial features two enormous waterfalls and reflecting pools, set within the footprints of the original Twin Towers. “Its design conveys a spirit of hope and renewal, and creates a contemplative space separate from the usual sights and sounds of a bustling metropolis. Swamp white oak trees create a rustling canopy of leaves over the plaza. This grove of trees brings green rebirth in the spring, provides cooling shade in the summer and shows seasonal color in fall” (Schechner, 2014, p. 78).

It was intriguing to visit and feel the atmosphere on site, which stimulated my contemplation indeed. Adding the site photographs of the Memorial to the database should show how contemplative it is purely through design, without the spirit of the place, which can only be experienced by the visitor at the site. The contemplative features that the design incorporates are:

1) The archetype of waterfall and grave (names of victims written all around the massive stone structure) (Figure 44);
2) Reflective water ponds;
3) Enclosure of trees that change colors with the changing seasons;
4) Reorientation from the urban landscape, and giving a sense of solitude.

Naumkeag Estate, (Stockbridge, Massachusetts, USA)

Figure 45. Schematic representation of the site and locations of image capture (*n* = 7) for the selected landscape settings in *Naumkeag Estate* (Stockbridge, USA).

Figure 46. Famous art-deco stairs surrounded by white birtches and lines of colorful flowers in front. *Naumkeag Estate*. Photo #09, utilised in the expert´ evaluation (photo by author).

This green space was designed around 1915 by Fletcher Steele (June 1885 – July 1971). He is a legendary American landscape architect, a student of Frederick Law Olmsted. Most of his works (over 700 garden designs) were created during the stylistic transition from Art Deco to Modernism, but in fact his designs are considered one of a kind.

One of his major designs is *Naumkeag*, a landmark featuring stunning views of the Berkshires in Western Massachusetts. The garden surrounds the 44-room summer cottage designed for the Choate Family. It is one of over 100 special places around Massachusetts promoted by the NGO *The Trustees of Reservations*.

Naumkeag is a perfect example of contemporary design that is still challenged by "old guard" influences. In these terms, the garden presents the dialogue between the contemporary contemplativeness and the historical one. It is interesting to investigate how much the decorativeness and historical models can shape the contemplative body of the space.

The garden is full of interesting features—real milestones in the history of landscape design. Steele succeeded in reformulating the function of landscape elements, while experimenting with form and the human-nature relation. The most recognized feature of the garden is a flight of steps with arched blue recesses and a white Art Nouveau handrail that ascends through paper-white birch trees (Figure 46). Another "small architecture" element is a moon gate leading to a walled Chinese garden, rich in Oriental influences.

However, the seven settings captured in photographs and videos did not include all those features. The most important elements from the standpoint of this research, were the calm, peaceful atmosphere of the garden, with long vistas over the Berkshire valley and a chain of hills fading into the horizon, as well as the privacy and intimacy of the resting areas with its large grassy-terrace and seats under the shade of a large, ancient oak (Appendix 3, photo #24). These features are evidence of the appropriation of this space for family relaxation and entertainment. The "Afternoon garden" presents a highly decorative space, where plants are organized in colorful, geometrical forms, and do not correspond to nature, but, according to the artistic vision, should have only an ornamental function (see Appendix 3, photo# 11).

The size of the garden is relatively small and its character is intimate (Figure 45), but there is a true possibility that more personal places are more contemplative. An important issue to notice is that although the garden is not so large, it is also not enclosed, and its design goes far beyond the borders of the lot, thanks to long distance views. This design strategy in private green spaces would perhaps be a significant challenge to introduce in city gardens.

Balboa Park (San Diego, California, USA)

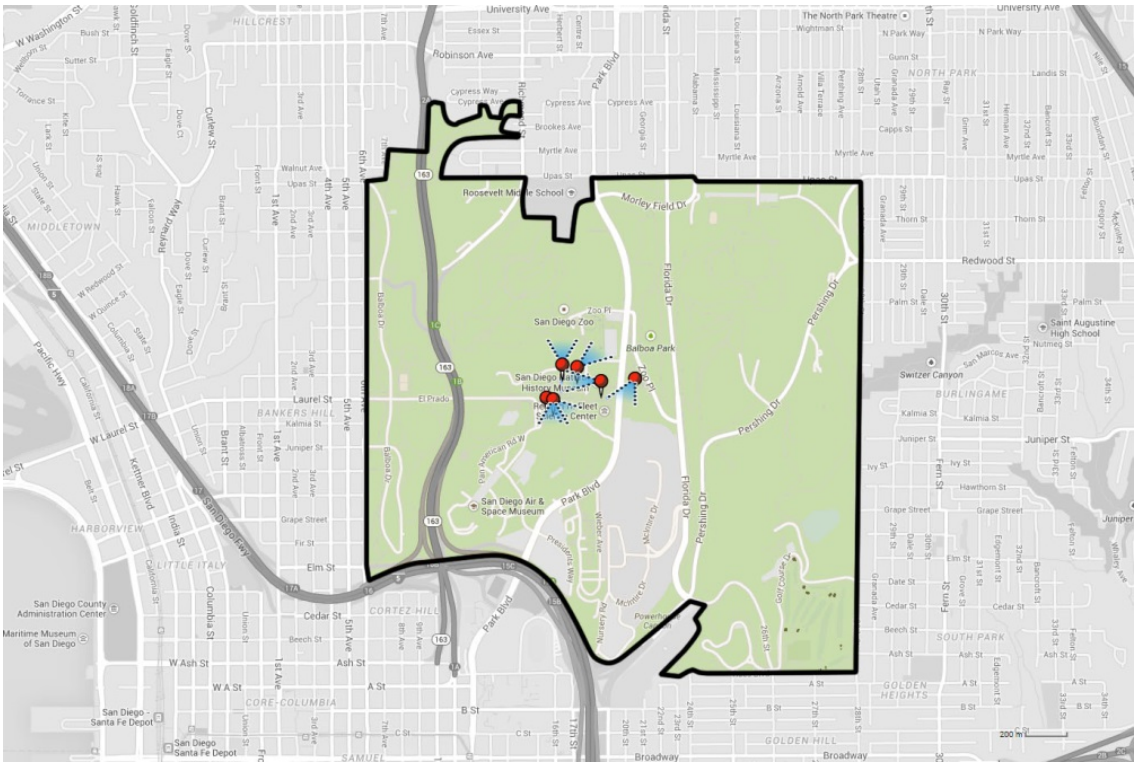


Figure 47. Schematic representation of the site and locations of image capture (*n* = 7) for the selected landscape settings in *Balboa Park* (San Diego, USA).

Figure 48. Botanical Building with the still water pond in front of it, Balboa Park, San Diego, USA. Photo #28 utilized in the expert' evaluation.

The history of Balboa Park started in 1868 when the Board of Trustees of San Diego set aside this wide area of 490 hectares (1,200 acres) for creation of a natural park (Figure 47). One of the most celebrated of the early usages was a 36-acre nursery maintained by local horticulturist and botanist Kate Sessions, who is often referred to as "the mother of Balboa Park". As time passed, the cultural aspect of the park began to evolve, and various different architects and landscape architects were hired to design different parts of the park, as well as temporary Expo Shows. Today, it accommodates much more than the typical park attractions.

According to the *PPS*, it is one of the best parks in the world. It also ranks second in terms of size, after Central Park in New York, as a big city park located in the very central point of the metropolis. Laid out around a series of destinations, or "centers of activity," Balboa Park is organized around a system of internal paths leading to its cultural attractions. The major centers of activity are the El Prado area, which holds the attractions such as museums, theatres, carousel, multiple restaurants and refreshment stands. The largest section of Balboa Park constitutes the famous San Diego Zoo. There are also other numerous parks and gardens, such as the Japanese garden, palm-tree forest, multiple-enclosed gardens, rose garden, desert cactus garden, etc. Balboa Park is full of cultural and entertainment events taking place throughout the year, which makes it one of the most visited public spaces in San Diego.

The park contains a large variety of scenes; therefore, it was interesting to visit the places that contained key-elements of contemplative designs that were still missing from the collected database. The rose garden delivered views over geometric-shaped planters filled with beautifully-growing roses, which on site gave off an intoxicating scent and attracted many butterflies. However, in the photo, only the visual stimuli could be preserved for further testing (see Appendix 3, photo #03).

Another part of the park, El Prado, was interesting in terms of the balance between the natural and built landscapes, which can be seen in the courtyard photo and the *Botanical Building* (Figure 48). The large number of people visiting the park on the day of the visit created some limitations, therefore some photos are not as crowd-free as the others. However, it was possible to acquire images of the enclosed, as well as the open and forested areas of Balboa Park.

Salk Institute (La Jolla, California, USA)

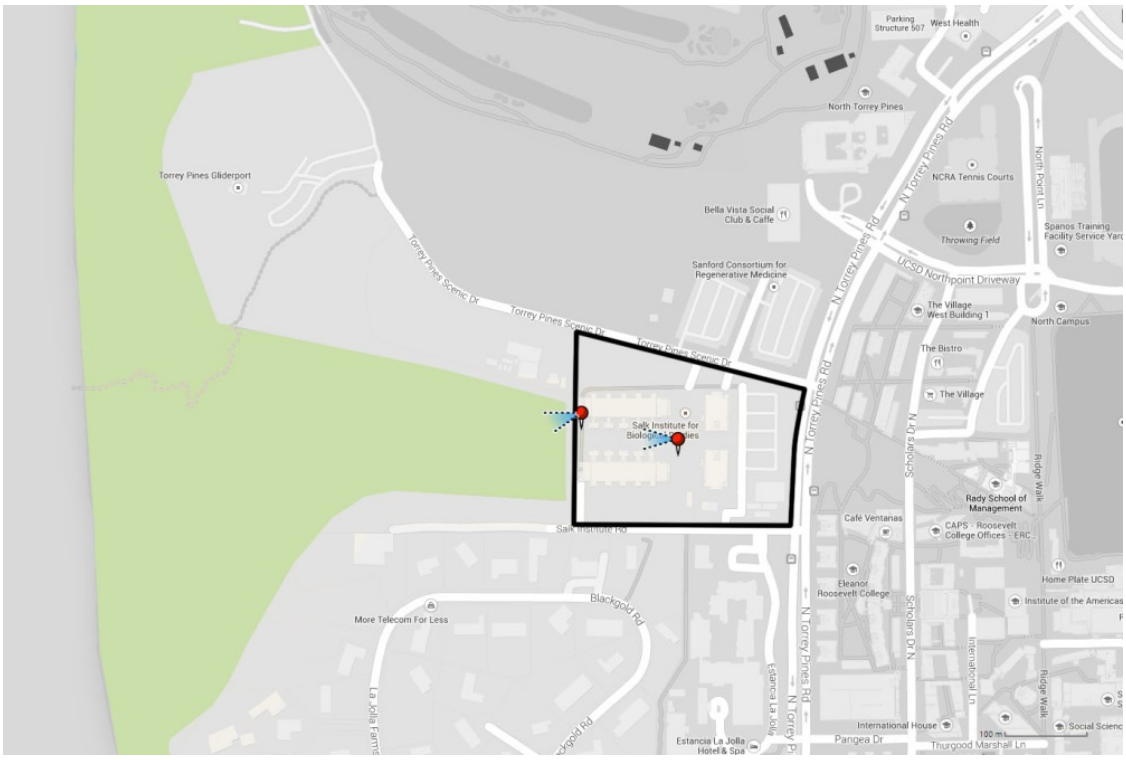


Figure 49. Schematic representation of the site and locations of image capture (*n* = 2) for the selected landscape settings in Salk Institute (La Jolla, USA).

Figure 50. Courtyard of the Salk Institute with the narrow channel (*The River of Life*) and the Pacific Ocean view. Photo #40 utilized in the expert' evaluation, as well as in the lab experiment in the CL block of pictures (photo by Author).

The visit to Salk Institute was motivated and inspired by two major factors. First of all, the space surrounding the research center had been described in multiple publications as a contemplative space. The second reason was related to meeting with members of Academy of Neuroscience for Architecture, which is located there.

Even though this place is not an urban park or garden, or even a green space as there is no vegetation planted in the main courtyard (Figure 49), it was very interesting to include in my research. One important factor that was worthy to check was how contemplative non-vegetated areas could be. Also, the fact that it is not vegetated does not mean it is not related to nature, for the far distance view reaches to mounds with naturally-planted native Californian sage scrub and a far ocean view. This is how Heinrich Hermann describes this space in his essay *On the Transcendent in the landscapes of contemplation*: "The biological research laboratory that Louis I. Kahn built …for Jonas Salk …is also on a site overlooking the Pacific Ocean. This project … transcended the utilitarian/functional level of the task at hand and facilitated a feeling of connection between visitors and the cosmos. As the design evolved, a balance was achieved between the need for places to foster concentrated thinking in solitude, and the need to foster interaction" (Hermann, 2005, p. 40).

From the point of view of my research, the most interesting was the main courtyard, even though the Salk Institute area is divided into three parallel zones. The courtyard, a 77x28 meter rectangle is flanked by two facades of buildings from the south and north side. This is what happens to the visitor after entering the courtyard (Figure 50) according to Hermann's description: "After a glance around, one's mind is powerfully pulled out to the Pacific Ocean where a limitless sky seems to rise and vault back over the courtyard. One's mind gradually returns to the courtyard to observe in greater detail what it finds …attention captivated by a square travertine fountain, where a narrow water channel emerges; called *The River of Life* (Hermann, 2005, p. 42).

*On-site Photographic Documentation***.** The on-site photographic documentation of the landscape settings was a self-directed process. This method had been used by multiple researchers as a method in photo-based studies because a photograph is successfully filling in the gap between the "real-landscape" experience and the researchers' subjective interpretation of the same landscape (Markwell, 2000). To ensure the coherence of the collected material, particular guidelines of capturing needed to be established beforehand. These rules concerned (1) the equipment, (2) the timing of the site visit, (3) the weather conditions, (4) the site selection, and (5) the final setup and capturing guidelines.

Capturing Equipment. The equipment included a camera (SONY DSC-Hx5V) and a 3D camcorder (SONY® HDR TD30) (Figure 51). A tripod (Hama Star 62) was a vital accessory. Each piece of equipment had to produce specific output and present specific properties. For details, see Table 3.

Figure 51. The capturing equipment used for the study: LEFT- digital photo camera RIGHT- 3D video camcorder

Timing of the site visits. The main rule established for the on-site image collection was the peak point of the vegetation designed in the park. Because the vegetation is a living and constantly changing element of the landscape, the timing of the visits had to depend mainly on the plant development. Considered as the peak point of vegetation was the time after flowering, beginning with the leaf and root senescence, until flower maturation and before development of the shoot (Figure 52).

Table 3.

Details of the main capturing equipment.

Device name / model	Output	Main settings
SONY® DSC-Hx5V photo-camera	Format: JPEG (“*.jpg”) photo file Size: 2592 x 1944 dpi Colors: RGB	Standard, no flash ISO: 250
SONY® HDR-TD30 3D camcorder	Format: Side-by side 3D AVCHD (“*.MTS”) video file, Size: 1920x1080 dpi; Proportion: 16: 9; Frame speed:50i, Recording time: 60sec	HD - 3D mode, default
SD Card, SanDisk® Extreme 45MS/s, SDHC1, 32 GB	—	—
Tripod Hama Star 62	—	Set to horizontal, lenses 165 cm above the ground

The peak point of the vegetation is also considered the most decorative and a target moment for park visits. Therefore, it should be an important factor to adress for thecontemplative designs. Due to the reasons mentioned above the main timing for data collection was late spring–summer, when the leaves are fully developed and continue to accumulate nutrition for further growth and reproduction. It is also when trees give the most shade and the colors are the deepest.

The weather conditions (sunny vs. cloudy). The question of the ideal weather conditions for capturing the photos for the experiment changed along the study process. Initially, it was decided that the best weather conditions would be a white-cloudy sky. The advantage of this kind of assumption is that all photos would be unified and comparable, because the sun, depending on the place and time of day, is shining differently, from a different angle, and with different intensity. Also, because of the incorrect assumption that the subjects of the experiment would be automatically excited

(experiencing a positive arousal) when viewing the beautiful weather in the photos (the lab experiments took place mainly during the winter months), which could influence the results of the experiment.

However, these assumptions were not entirely correct. Firstly, because the visibility of light and shade contrasts was important criterion for settings evaluation, and in the cloudy weather those are simply not visible. Secondly, as long as the factor of the sunny weather is present in both conditions (CL and NCL), it would be a controlled factor and would not increase the error.

The EEG pilot experiment was conducted with a cloudy sky, which, as the subjects reported, prevented them from experiencing the landscape properly, as the dominant colors on the pictures were shades of grey. The same scene in sunny and cloudy weather conditions looks significantly different (see example in Figure 53). Even for the experts, it could be troublesome to evaluate pictures beyond the weather conditions that were presented to them. Having in mind that the light intensity for each photo should be set in a similar way (the preset display monitor brightness), the sunny photos were collected to conduct the second EEG experiment (the full-scale experiment).

The site selection. More information about the selection of the sites concerning the content and depending on the stage of the research can be found in the next section *Image sampling procedure*. From a technical standpoint, it was important to maintain image clarity, brightness, color consistency and select the view with the least possible distracting elements, such as close-up images of people and animals that would move along the vista, falling leaves, flying objects, etc. (Kaplan et al., 1972). One of the main categories that enhance contemplative landscapes is the character of peace and silence; therefore, it was a priority to ensure the opportunity for a serene ambience to occur.

Video capture only took place when there were no people in the frame of the camera. Sometimes, it required a personal request to the walking visitors. Other times, it took long hours of waiting for our 60 second shooting opportunity. One could say that the park without other people is not in its natural, normal state. And that state (specifically in very busy parks) is not going to occur very often. But here it should be underlined once more that the research is only testing the physical attributes of the space, those that were planned by the designers and can be repeated somewhere else. It is clear that, walking people are an element of the landscape, but their motion, color of clothing, and many other characteristics are not something that the designer might ever plan for. In terms of this research, which is using the photographs as a representation of the existing landscapes, these features should be considered

Figure 52. The setup ready for image capturing in the vegetation peak point (photo by R. Guizzo).

Figure 53. Photographs taken in the same spot (Parchi di Nervi) in sunny and in cloudy conditions (photo by A. Chadala)

Figure 54. Image capturing from the perspective of a person sitting on a bench (by R. Guizzo).

distracting, and seeking after representations without distracting elements is reasonable (Kaplan & Kaplan, 1989).

The final setup. An important rule for the photographic data collection was to depict a point of view of a real person walking or sitting in the given space (Figure 54). The height of the tripod was set so that the lens sits at the height of the average visitor (165 cm tall). A sensation of balance also had to be preserved. That is why the tripod was set to a horizontal position, where the line of the horizon is parallel with the base of the camera. The camcorder (only the 3D mode), unlike the photo camera, does not capture the image in a wide-angle quality. So, in order for the camcorder to record the same content as a person might see, it would be appropriate to move the camera 3 to 5 meters back. The image stabilization rule was established too, since the images captured without the tripod were not considered to be of high enough quality. The image displayed in the lab should be stable.

Image sampling procedure. As mentioned in the beginning of this section, any environmental photograph-based research requires an adequate sampling process of the environmental representations. In the case of this research, a large database of landscape settings was collected—namely one-hundred twenty-eight photographs. These images depicted various urban parks and garden views that could be viewed by any random observer walking in those spaces.

The number of photographs that could be included in the expert evaluation had to be reduced to a maximum of 40 photographs, so some of the pre-selected landscape settings had to be excluded from the research, and only those most sharply representing the established contemplative / non-contemplative features were maintained.

The process of determining an appropriate number of instances and a feasible number of types to include in the lab experiment depended on many factors. In such decisions there is always an element of arbitrariness or intuition dictated by the personal experience of the researcher. Another factor involved concern for what would be manageable as a task for the experts and later participants of the lab experiments. This issue concerned the number of photos for each stage of the experiment, and how much time the participants would need to accomplish the task.

In considering the representation of each type of landscape by the feasible number of instances, all the photographs from the database were distributed according to their composition into five major types: canopied, enclosed, focal, feature and panoramic (Smardon et al., 1986). Each type should be represented by several settings, according to the Kaplans' *Preference Research Methodology* "*at least three, preferably four or five samples*" (Kaplan & Kaplan, 1989 p. 209). Table 4 presents four

landscape settings of the forty selected within five landscape composition types inside each of those.

Simultaneously, the rest of the decision-making took place for not only the composition type, but also other features (contemplative landscape features), which needed to be present within the forty photo group forwarded to experts. While making these decisions, some guidelines were adopted, suggested by the Kaplans' *Preference Research Methodology* as well as my own findings that arose at the moment, which include the following rules of pre-selection:

1) Avoiding so called "sore thumbs" "*if the scene has something visually striking that most other scenes do not have, its other content is likely to be ignored"* (Kaplan & Kaplan, 1989 p. 209).
2) Avoiding the temptation to use only more aesthetically pleasing settings, which could cause a bias on the ratings within one category. The database should contain the most contemplative as well as the least contemplative photos, and according to our expectations, their aesthetics have nothing to do with contemplativeness (Kaplan & Kaplan, 1989 p. 209).
3) Avoiding scenes that are too important or recognizable, because they might be interpreted in many ways, replacing those with the few others that fit each of the alternative interpretations, which enables subsequent hypothesis testing (Kaplan & Kaplan, 1989 p. 209).
4) Increasing the variety of settings by rejecting photos that are repeating in terms of composition type or general content (i.e., if there are two images of one site, photographed from different angles but with the same visible elements, then one of those photographs is deleted).
5) Increasing the contrast between conditions — In the case of visibly contrasting situations of two photos, according to the categories both photos should be kept for expert evaluation, especially when there is a possibility, inspired by the literature, that one photo could belong to the contemplative condition (CL) and another to the non-contemplative condition (NCL). For example, if there is a photo showing wild, spontaneous, native-looking vegetation, it is recommended to also keep the photo without any kind of vegetation.
6) Avoid temptation of using photos from each visited park.

Table 4.

Five landscape composition types with four landscape settings attributed to each(see Appendix 3 for the photo references)

Canopied	Enclosed	Panoramic	Focal	Feature
				
				
				
				

7) The final decision left to experts — In the case of doubts, the researcher will not delete the photo, but rather leave it to the experts for the final decision (For example, if there are two similar photos with long distance views from the same park and everything in the first plane looks similar, but there is a water feature in one of the photos, even if not very relevant, both photos are kept for the evaluation of experts, because the water feature element might be vital for the final expert evaluation as well as the brain response).
8) Ensuring each category has its representative picture — Regardless of how many contemplative characteristics are on the photo, each characteristic that was mentioned in the questionnaire should be represented at least once in the photos (for example, there must be at least one picture with a waterfall as an archetypal element of the setting, because the literature suggests that the waterfall is an archetypal element significant for the contemplative value of the setting).

Environmental sampling was not an easy task. Even following these rules, there was not always absolute certainty about the right choice. Fortunately, the evaluation by the panel of experts was a following step before final selection of most and least contemplative pictures. So, there was still an opportunity for a mistake to eventually be corrected by the experts.

Figure 55 lays out how the sampling actually worked at each stage, from the on-site data collection to the choice of scenes included in the lab experiment. The first stage of selecting images was an attempt to select the most representative (useful for the research) parks and gardens, and collect photos on-site. This part of the research was fully dependent on the literature review of parks, and the professional experience of the leading researcher. The landscape settings discarded from further research were those with repeating content or photographic imperfections.

Stage 2 of image filtering was also led by the researcher, based on professional experience and the rules of sampling the photographs for environmental-research, as described above. The output of that stage is the limited amount of landscape photographs that could serve for further expert evaluation. The number of photos was limited from 128 to 40 pictures, therefore the evaluation task was manageable for the panel of experts.

Stage 3 was an expert evaluation of the photos, where the evaluation was left exclusively to them. The scores that they attributed to the photos led to the ranking of landscape photographs organized according to their “contemplativeness”.

The final and fourth stage of the photograph filtering was simply observation of the result of the expert evaluation, attribution of the classifying criteria (half standard deviation above/below the mean score) to the ranking, and choosing seven photographs from the top, and seven photographs from the bottom of the ranking, which created, respectively, contemplative (CL) and non-contemplative (NCL) blocks of stimuli for the laboratory experiment.

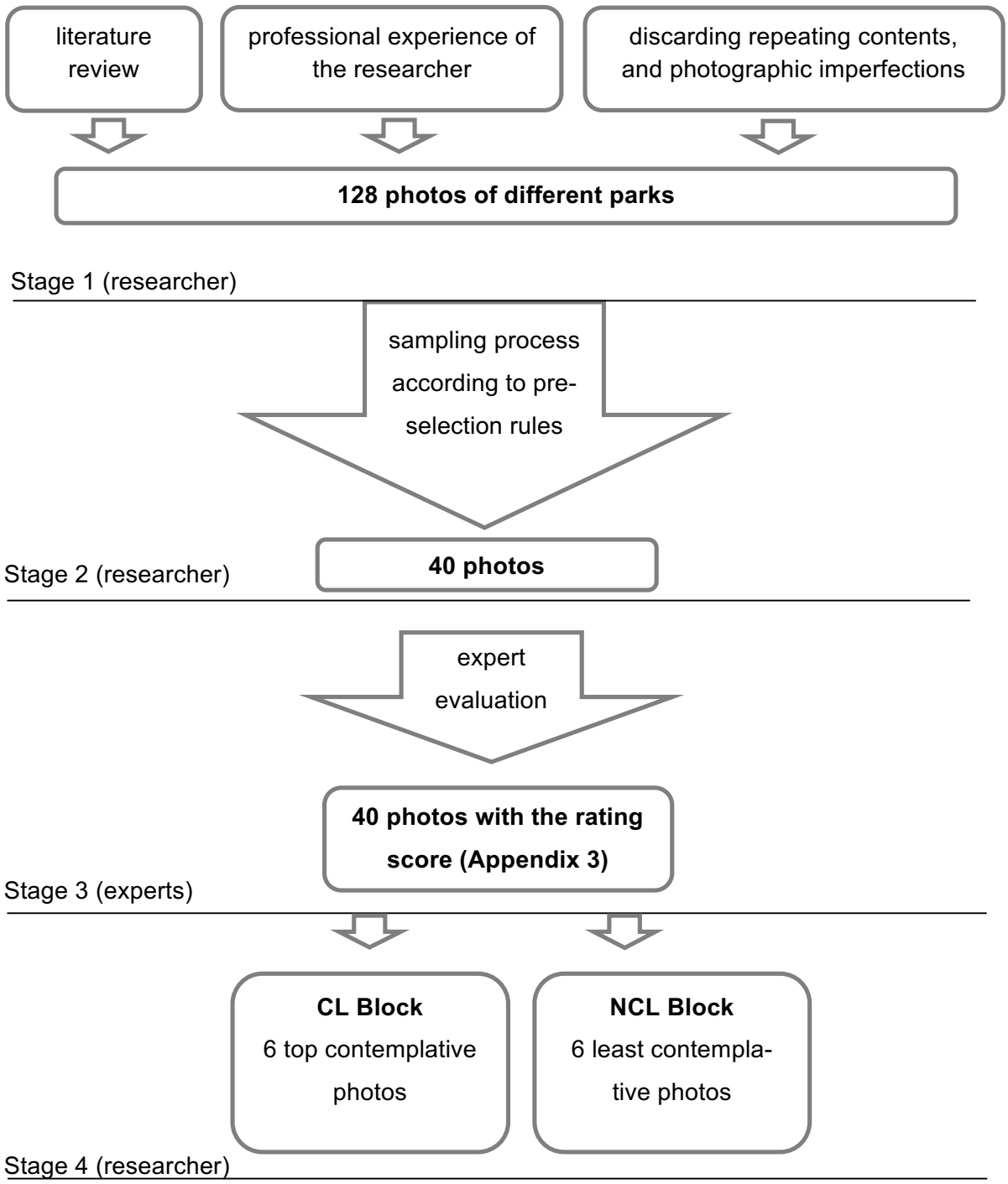


Figure 55. Scheme of the image sampling process.

Experts.

In order to check if a given item would characterize a landscape as contemplative or not, asking experts was considered an adequate approach. Multiple items of the list presented in Table 1 concern technical aspects of space design, because they originate from textbooks written by experts and are not directly addressed to the general public. Asking the public about contemplativeness of space would be feasible, but the general public rarely operates with technical terminology nor is able to technically evaluate different compositional aspects of the landscape. Thus, items would have to be adjusted to general knowledge and often followed by a small explanation, and due to the lack of technical criteria, variances on the appraisal of the landscape characteristics would be expectably higher, leading to the need of larger sample size than in the case of expert evaluation. There is also a high probability that addressing the CLQ to public could result in obtaining a different kind of results than expected, e.g., a landscape preference study, which is not a desired output. Due to these issues, the survey was addressed to experts only.

The development of the questionnaire was based on the *Delphi experts' technique*, which is a commonly used tool to establish a professional, objective judgment about a complex problem with a wide range of scenarios. Evaluation of landscapes according to a set criteria fits well into that concept (Hsu & Sandford, 2007). According to the *Delphi method*, experts (raters) should be carefully selected individuals with a background related to the topic of investigation. For this study, an expert was defined as someone who: (1) is a highly experienced and knowledgeable individual with a background related to landscape architecture; (2) has a professional life set around these topics in an academic or design practice; (3) has developed research concerning contemplative landscapes or landscape perception; (4) has published in peer-reviewed journals. Also, experts were informed that they should be willing to sacrifice a reasonable amount of time for the purpose of this research (up to three hours), contributing with helpful insights.

There is no consensus on the optimal number of subjects in the Delphi expert evaluation (Hsu & Sandford, 2007). If the experts represent different areas, then up to fifty respondents is recommended. If the background of the Delphi subjects is consistent, which is the case for this research, ten to fifteen would be an optimal number of experts (Delbecq et al., 1975). Thirty experts were invited from around the world to participate in the investigation. The data collection was closed when the

number of respondents reached ten, which occurred two months after the invitation. All participating experts (four women and six men) were academics in the area of landscape architecture, with a PhD, 6 to 31 years of professional practice, and had at least one peer-reviewed publication on landscape design strategies, perception of the landscape, theory of design, or environmental psychology. Their countries of origin were: Portugal (*n* = 2), Poland (*n* = 3), United States of America (*n* = 2), Scotland (*n* = 1), Germany (*n* = 1), and Italy (*n* = 1).

Online collection of responses. The Questionnaire was made available online, using the Google-Forms tool. This allowed experts to evaluate the selected landscapes at their own individual pace. Invitations to take part in the study were sent individually to each of the pre-considered twenty-one experts. After their response and approval, the link to the online form was forwarded to them. An online form was available from the time that the first experts confirmed their willingness to participate. The data collection was closed when the number of respondents reached ten, which occurred two months after the invitation.

At the beginning of the online form, experts could see a welcome page, including a brief description of the research and instructions for further steps. The following page included the socio-demographic questionnaire, where each expert was asked to specify their academic level, age, professional experience, etc. (see Appendix 1).

After the socio-demographic form, experts could proceed to the actual evaluation of the landscape settings. Each of the forty pages of that section was dedicated to one image displayed on the top of the page. The first eight questions (1 to 8) focused on eight key-landscape categories established through CLM. Experts had to give a score from 1 to 6 regarding each of the categories, according to their professional evaluation of the image, which remained on the top as a reference.

We opted for a 6-point Likert scale as to avoid the so-called “central tendency bias”, which is a data collection error caused by the odd number of points in the Likert scale, which creates a single central point and a propensity on the respondents to choose it (Tatler, 2007).

Then, experts were asked to decide about the composition type of the presented image (Question 9), choosing only one most dominating option. The final question (10) had validation purposes, in which experts were asked to rate the contemplativeness of the setting according to their own experience and understanding of this word. The form was composed as presented in Appendix 1.

The expert’s task was to answer ten questions regarding each of the forty pre-selected landscape settings, thus each expert had to answer four hundred questions

altogether. This time consuming task, which could take up to 3 hours, depending on the expert, significantly exceeded expectations (after pre-testing of the questionnaire, the time needed to complete the form had only been estimated at 40 – 60 minutes). Therefore we ae even more grateful to those experts who volunteered their time.

Results

This section describes the results related to the development of the instrument for contemplative landscape identification. The following sections: *Statistical tests on the Questionnaire* and *Ranking of Pictures* present the results of this first study. The first section allowed verification of Hypothesis 1 (it is possible to develop a valid and reliable questionnaire to identify contemplative landscape features), with four subhypotheses concerning reliability and validity measures. Second section shown shows which photograph could be included in the second empirical study (*Study II*).

Statistical Tests on *the CLQ*

The questionnaire itself is an instrument originating from the area of psychometrics. Psychometrics is defined as "any branch of psychology concerned with psychological measurements" (Miller, 1995) that is focused on developing psychology as a quantitative rational science. Psychometrics is as old as psychology, first mentioned in 1860 by the physicist-philosopher Gustav Fechner in the publication *Elemente der Psychophysik*. Fechner, whose aim was to set the "fundamental relations of dependency between body and mind", experimentally established the relation between the measure of a physical stimulus I and the measure of an observer's sensation thereof (S):

$$S = k \log R$$

This formula started the research on psychometry around the world (Jones & Thissen, 2007, pp. 4-6). Across the decades, psychometry developed from the theory of errors of observation employing a statistical distribution (now known as the normal or Gaussian distribution) through experiments on individual differences to psychological testing (as in intelligence or mental age tests) and factor analysis. By the second half of the twentieth century, psychometrics developed significantly and served for psychological scaling, educational and psychological measurement, and factor analysis.

From the point of view of this investigation, the development of psychological measurement is the most relevant as expressed through the very important manuscript: *The Reliability and Validity of Tests* (Thurstone, 1931). This paper has served many researchers on the quest to discover the most adequate psychological

measurements. Introducing the concepts of *test score* and *true score*, and finding the relation between them, and the *random error* made it possible to establish a quality and usefulness of used instruments (Jones & Thissen, 2007, p. 10).

Thurstone set the scientific foundations for reliability and validity, which are two very important measures of the quality of any psychometric test, including questionnaires. Reliability focuses on the precision of the questionnaire and can be obtained through the analysis of its internal consistency or stability. A reliable questionnaire, applied twice to the same individual or group of individuals, will not produce significantly different results (unless some event occurs between administrations that can interfere with the responses). There are various factors that may influence the reliability of the questionnaire. In some cases, it is possible that the participants will answer differently depending on the time of a day or their mood. Also, the desired application of the method could be limited to only one phenomenon/group without the generalization attempt. On the other hand, the questionnaire is valid if it manages to correctly measure the intended variable. For example, the number of years and months since a person´s birth date constitutes a valid measure of age whereas a height measurement used to describe age would not be valid.

While the reliability focuses on the consistency of all items of the questionnaire, the validity concerns its veracity, its relation with the real world. And so a questionnaire can be very reliable and, at the same time, not valid. For example, a questionnaire can provide a very reliable measure of individual color preferences (same individuals will tend to give similar responses in different moments) or even moral opinions (individuals will tend to say that killing innocents is wrong every time they are asked on that issue), but we could not use this same questionnaire to measure the individuals' intellectual quotient. This would not be valid (it would be like using a ruler to measure temperatures or a thermometer to measure distances).

That is why a *reliable* questionnaire does not mean a *valid* questionnaire. However, good reliability is required for a valid measurement method. Thus, the reliability of the questionnaire was measured first, followed by examination of its validity.

The questionnaire consisted of three major parts: (A) Questions 1 to 8, which are supposed to define the physical attributes of contemplative space and is scored on a 6-point Likert scale; (B) Question 9, which provides information about the type of composition of the landscape setting (multiple choice between 5 options); (C) Question 10, which is a validity question, with the same scoring system as questions 1 to 8.

Because of the different scoring system of part A and B, these parts had to be considered separately in terms of reliability analyses, and only part A will be considered

while measuring the validity of the questionnaire (as only the items or questions of this part can be correlated with the responses to the validity question, i.e. Question 10).

Reliablity. There are various actions that may be applied to examine the reliability: (1) the questionnaire can be repeated in exactly the same form across the exact same individuals (*test-retest* method); (2) there may be two variants of the same questionnaire applied across the same group of individuals, and the results of both compared (parallel versions); (3) the items or questions can be divided in two equivalent parts, simulating the *test-retest* process (*split-half reliability* method). In addition, the internal consistency of the questionnaire can be computed through Cronbach's alpha, and this will index the upper limit of its reliability. Another form of reliability that is very popular in statistics is *inter-rater reliability* (or *inter-observer, inter-judge reliability*). It measures the homogeneity (agreement) between raters. For continuous data, even if measured through interval or ordinal scales, consensus is measured by *intra-class correlation (ICC)*. While it is viewed as a type of correlation, unlike most other correlation measures, it operates on data structured as groups, rather than data structured as paired observations (Koch, 1982).

The reliability of the questionnaire was analyzed through three different methods: (a) by computing the internal consistency of the first part (questions 1 to 8); (b) by measuring the split-half correlation coefficient and (c) by computing inter-rater reliability (ICC).

Internal consistency (Questions 1-8) – testing hypothesis H1.1. The estimated internal consistency of the questionnaire was performed using *Cronbach´s Alpha* measure. The *Cronbach´s Alpha* is a very popular measure that checks how informative a questionnaire is as a whole regarding the intended variable to evaluate and how much each item contributes to the overall score. In other words, how consistent the questionnaire is. *Cronbach's Alpha* is a function of the number of items in a test or questions in a questionnaire, the average covariance between item-pairs, and the variance of the total score (Nunnally, 1978).

The standardized *Cronbach's Alpha* for questions 1 to 8 is .798, which signifies good internal consistency. Other outputs of the computation of the *Cronbach´s Alpha* internal consistency coefficient are the *Item-Total Correlation* and the variations of *Alpha if deleted a certain item* (Table 5). *The Item-Total Correlation* is a correlation of the responses to each question with the total score, i.e. comprising all questions. When it is low, it means that the responses to the specific question that is being analyzed is lowly correlated with the overall score, and the researcher might consider deleting it from the questionnaire. The measure of *Alpha if Deleted* represents the estimated value of *Cronbach´s Alpha* after deleting this particular question from the questionnaire,

and it is considered a method to improve the internal consistency of the questionnaire. According to the results of Cronbach´s Alpha computation, Questions 1 to 6, and 8 are substantially informative and contribute to the total score of the Questionnaire (Table 5).

The item that appeared not to contribute to the total score is Question 7 (Artistic Expression). The correlation of Item 7 with the total score is close to zero, and the overall internal consistency of the questionnaire would be considerably higher if this item was gone. For this reason, Question 7 was excluded from the questionnaire.

Guttman *Split-Half reliability (Questions 1 to 8) – testing hypothesis H1.2.* As mentioned before, the split-half reliability is a method that can be used to analyze the reliability of the questionnaire when it is not possible to perform data collection for the second time. In this case, the collection of responses was performed via online questionnaire among experts. For many reasons, mainly time-efficiency, it would be difficult to repeat the same questionnaire. However, thanks to the split-half reliability calculation, the *test-retest* scenario can be simulated. The odd-even Guttman split-half method was used in order to compute that reliability index (Table 6).

The Guttman method is an adaptation of the most popular Spearman-Brown split-half coefficient, although it is considered less conservative, because it does not require equal variances between the two split forms. The Gutmann split-half reliability coefficient for the questionnaire is .854, which represents a very good result.

Inter-rater reliability (Questions 1 to 8) – testing hypothesis H1.3. Inter-rater reliability value (ICC) will approach 1.0 where there is no variance within the group of experts. The ICC below 0.5 signifies that the inter-rater agreement is not acceptable. There are three ICC models depending on the randomness of the experts selection and if they evaluate the same target or not: (1) one-way random effects model; (2) two-way random effects model; (3) two way mixed model (Shrout & Fleiss, 1979).

Table 5.

Item-Total Correlation and Cronbach´s Alpha analyses (n = 40)

Question #	Item-Total Correlation	Alpha if deleted
1	.710	.663
2	.552	.705
3	.431	.728
4	.447	.734
5	.831	.679
6	.502	.718
7	.002	.817
8	.545	.715

Notes: Standardized alpha = .798; Average inter-item correlation = .352

Table 6.

Split - Half reliability: Corr. 1st & 2nd half: .75; Guttman split-half: .85

N=40	Summary 1st Half	Summary 2nd Half
No.Items	4	4
Mean:	16.06	16.29
Sum:	642.20	651.40
Std.Dv.	2.30	2.05
Variance	5.30	4.18
Alpha	.50	.58
ITEMS 1:	Item 1	Item 2
2:	Item 3	Item 4
3:	Item 5	Item 6
4:	Item 7	Item 8

Table 7.

Interclass correlation for each item and the mean score of the questionnaire.

Question #	*ICC* (mean of 10 raters)	*F*	*p*
1	.877	9.43	<.01
2	.896	11.9	<.01
3	.889	9.65	<.01
4	.423	1.78	<.01
5	.599	2.74	<.01
6	.510	2.37	<.01
7	.838	8.16	<.01
8	.642	3.08	<.01
MEAN	.814	6.71	<.01

For the purposes of this research, the second model was applied, where experts are considered to be a random selection from among all possible judges and evaluate the same set of targets. Experts were selected as a result of brainstorming in the research team, from all around the world, based on their body of work and level of recognition, and then the invitations were sent to those chosen, but only 10 of the 30 invitees decided to take part in the online questionnaire. All of the submitted responses were accepted. In this model, targets (photographs of landscape settings) were selected in a way that, from the point of view of statistics, provides a random set of targets, even though the selection of photos was based on previously established rules (see the section Image Sampling Procedure).

Experts rated all 40 photos chosen from a database of photos and how each expert rated each photo is recorded. The *ICC* is interpreted as the proportion of Photo plus Expert Variance that is associated with differences among the scores of the photos, and is interpreted as being generalizable to all possible experts.

The Inter-rater agreements expressed by the *F* value (indicating whether agreement is significantly different from zero), and values of *ICC* for Items 1-8, as well as for item 10, are presented in Table 7. The *ICC* for a single rater = .305 (meaning the estimated value if a single rater is used), while the *ICC* for the mean of the 10 raters = .814 ($F = 6.71$, $p < .01$). *ICC* values above .80 indicate almost perfect agreement (values above .30 are fair, above .50 represent moderate agreement, and above .70 indicate strong agreement). The same measures for each item are presented in Table 7 in which *ICC* values vary from fair (.423) up to almost perfect (.896), and all agreement rates are significantly different from null.

Also, it should be pointed out that Question 7 performed well in the inter-rater agreement test, which means that the responses of experts concerning the *Artistic Expression* of the evaluated landscapes were similar. So, we can assume that Question 7 was formulated well and understood correctly by the experts even if *Artistic Expression* in the landscape design does not have much to do with the contemplative value of spaces, as the reliability tests have shown, leading us to exclude *Artistic Expression* from the final version of the Questionnaire (CLQ).

Inter-rater agreement (Question 9). In order to compute the inter-rater agreement for Question 9, the Fleiss kappa computation was used. It is a statistical measure of evaluating the reliability of agreement between a fixed number of raters after submitting categorical ratings to a fixed number of items (Fleiss, 1971). Unlike Cohen's kappa method for assessing the inter-rater agreement between two raters, Fleiss kappa works with multiple raters.

Question 9, which is about the type of landscape composition, consisted of 5 options (canopied, enclosed, feature, focal and panoramic), among which experts were supposed to choose only one, dominant type. Answers were converted to digits (1, 2, 3, 4, 5), and analyzed (Geertzen, 2012). As a result we obtained a Fleiss K = .304, which signifies fair inter-rater agreement (Landis & Koch, 1977).

Nevertheless, Question 9 is completely based on the already existing landscape composition classification described by Smardon et al. (1986), so it is treated rather as additional information that may be used to describe the other set of results. Measuring the quality of that item is not essential for us, thus this classification was not invented.

Validity - Testing hypothesis H1.4. The validity of a questionnaire in most situations is not easy to determine. Researchers have to find a method of assessing how accurately the data provided by their instruments correspond to the real world. Validity test measures "the degree to which evidence and theory support the interpretations of test scores" (Amer. Educational Research Assn., 1999).

Many researchers simply use opinions of people who are knowledgeable or competent in some area as validity data to which they compare their results. For example, to measure the validity of a set of questions that are supposed to evaluate individual preferences, the validity can be estimated by comparing subjects' answers with those obtained by asking the preferences of the inquired subjects to a group of people who know them very well, such as relatives and friends. If the responses of the individuals correspond with those of their relatives and acquaintances, then researchers have evidence that the questionnaire is valid.

In the case of our questionnaire, the validity of the 8 items of Part A (which are supposed to cover characteristics of the contemplative landscapes) was tested by

correlating the mean values across experts per image for questions 1 to 8, with the mean values for the question “How contemplative this landscape is for you?” (question 10), which was a validity question. The correlation between these two sets of data is presented in Figure 56.

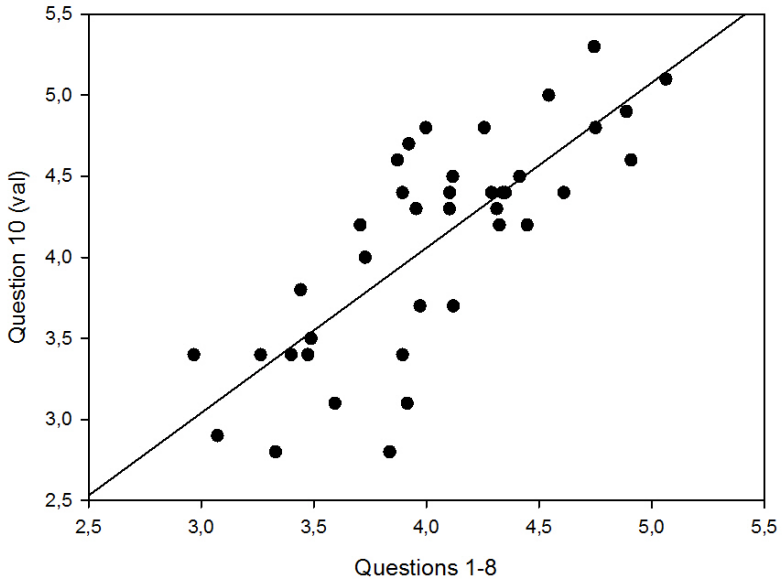


Figure 56. Correlation between two sets of data: mean of responses for Questions 1 to 8, and Question 10 (validity question)

The test used for obtaining this validity index was the *Pearson Product-Moment Correlation Coefficient* (Pearson, 1895; Stigler, 1989), which is a statistical measurement of the correlation (linear association) between two sets of values. The *Pearson Product-Moment Correlation Coefficient* for two sets of values, x and y, is given by the formula:

$$r = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

where x and y are the sample means of the two arrays of values.

If the value of *r* is close to +1, this indicates a strong positive correlation (if *r* is close to -1, this indicates a strong negative correlation and if close to 0 there is no correlation).

A correlation coefficient of $r = .772$ ($p < .001$) was obtained, which indicates a strong and significant positive correlation between the two sets of values, i.e. between

the mean scores of the responses to questions 1 to 8 and the validity question (10). This means that the experts' understanding (concept or definition) of a contemplative landscape can be well described by the 8 items from Part A of the questionnaire. Thus, the validity of the 8 questions that comprise Part A of the questionnaire for the evaluation of contemplative features of landscapes is statistically confirmed.

Testing the validity was also performed by measuring the statistical significance of the correlations between mean response-scores to each item and to item 10. This analysis showed that responses to items 1, 2, 3, 4, 5, 6, and 8 are significantly correlated to the item 10 (Table 8).

In an item-to-item analysis, very strong positive correlation coefficients between questions 5 and 8, and the validity question were found. Strong positive correlations between questions 1, 3, 4, and 6, and the validity question were also found.

Question 2 showed a moderate correlation (positive) with the validity question, while question 7 has a negligible relation to the validity question. In fact, all correlations were statistically significant (all $p < .05$), with the exception of the one between question 7 and the validity question. Therefore, the decision about deleting item 7 was reinforced.

In Table 6, a synthesis of the results is presented concerning the reliability and validity analyses that were performed on the questionnaire and its questions regarding the contemplative characteristics of landscapes.

Table 8.

Correlations between Questions 1 to 8 and Question 10.

Question #	Item 10 (val)	*p*
1	.614	< .001
2	.339	.032
3	.444	.004
4	.447	.004
5	.837	< .001
6	.559	< .001
7	.119	.463
8	.901	< .001
Mean 1:8	.772	< .001

Table 9.

Summary of the reliability and validity indexes of Questions 1 to 8 of the Questionnaire on contemplation features and their meaning.

Statistical index	Name of the test	Result	Meaning
Reliability	Cronbach´s Alpha (Internal consistency)	Alpha= .798 (if Item 7 deleted, alpha= .817)	Acceptable (Good, if Item 7 deleted)
	Gutmanns´s split-half	Alpha= .854	Very good
	Inter-rater agreement	ICC (10 raters) = .81	Almost perfect agreement
Validity	Pearson's correlation coefficient	r = .772 for the mean score	Strong positive correlation

Ranking of Photographs

A default output of the Contemplative Landscape Expert evaluation was a ranking of tested photographs (Table 10). It can be used for landscape research, together with the *Questionnaire* or without it. The purpose of this study was to select the six most contemplative photos and compare them with the six least contemplative ones in the laboratory experiment. In order to use any of the forty landscapes in the subsequent EEG experiment, where contemplation is a variable of interest, it was necessary to establish a classification system or criteria to select subsets of the most contemplative and the least contemplative landscapes in the ranking. Below, the classification criteria established for this study is presented, however future researchers can establish their own classification criteria and treat what is presented below as an example.

In this case, each landscape with a score of half standard deviation above the average (i.e., scoring higher than 4.33 on contemplative features) may be selected for the most contemplative set, while each photo with a score of half standard deviation below the average (i.e., scoring lower than 3.77) may be included in the least contemplative set (see Table 10).

According to this classification, any landscape photographs ranked between the 1st and 12th position can be utilized as a contemplative landscape, and any landscape photograph ranked between 29th and 40th position as a non-contemplative one. (see Table 10). Landscape photographs ranked between the 13th and 28th position were excluded from further study. For the laboratory experiment, only six landscape photographs were selected from each group due to the specific experimental design and technical issues. The following photos, which can be found in Appendix 3 were selected:

- CL (Contemplative condition): #24, #23, #19, #15, #32, #36
- NCL (Non-Contemplative condition): #27, #8, #3, #5, #6, #25

The criteria may be easily adjusted in order to select a lower number of landscapes for each subset, namely by increasing the standard deviation around the mean score. This procedure may be particularly useful when only extreme contemplative and non-contemplative landscapes are desired. To that purpose, Figure 58 presents the three photos that scored the highest in contemplativeness and the three that scored the lowest.

Table 10.
Ranking of forty photos tested with the CLQ.

RANK	SCORE	Photo#		
1	5.13	**24**		Most contemplative landscape photos
2	5.11	**23**		
3	4.94	4		
4	4.86	16		
5	4.80	**19**		
6	4.73	**15**		
7	4.57	31		
8	4.50	**32**		
9	4.49	33		
10	4.37	**36**		
11	4.37	12		
12	4.33	10	*½ SD above the average*	
13	4.33	38		
14	4.30	20		
15	4.27	29		
16	4.21	11		
17	4.20	9		
18	4.17	1		
19	4.17	26		
20	4.04	37		
21	4.01	14		
22	4.01	30		
23	4.00	39		
24	3.96	21		
25	3.93	18		
26	3.91	13		
27	3.83	34		
28	3.83	35		
29	3.76	17	*½ SD below the average*	Least contemplative landscape photos
30	3.67	28		
31	3.66	22		
32	3.56	40		
33	3.51	**27**		
34	3.37	**8**		
35	3.36	2		
36	3.30	**3**		
37	3.21	**5**		
38	3.17	**6**		
39	3.14	7		
40	2.83	**25**		

Notes: M = 4.05, *SD* = 0.56; results obtained after rejection of an Item 7; Scores in bold signify photos selected for the EEG experiment.

The results concerning the landscape composition type (expressed in the *CLQ* as Question 9) were also evaluated. According to these results, experts classified the majority (43%) of the most contemplative landscape settings as panoramic, 29% as focal, 14% as feature, and 14% as enclosed composition type. None were classified as a canopied landscape (see Figure 57). Experts classified the majority (50%) of the least contemplative landscape settings as enclosed, 30% as canopied, 10% as a feature, and 10% as a focal composition type. None were classified as a panoramic landscape (see Figure 57).

All of the forty photographs that were selected for the expert evaluation are presented in Appendix 3.

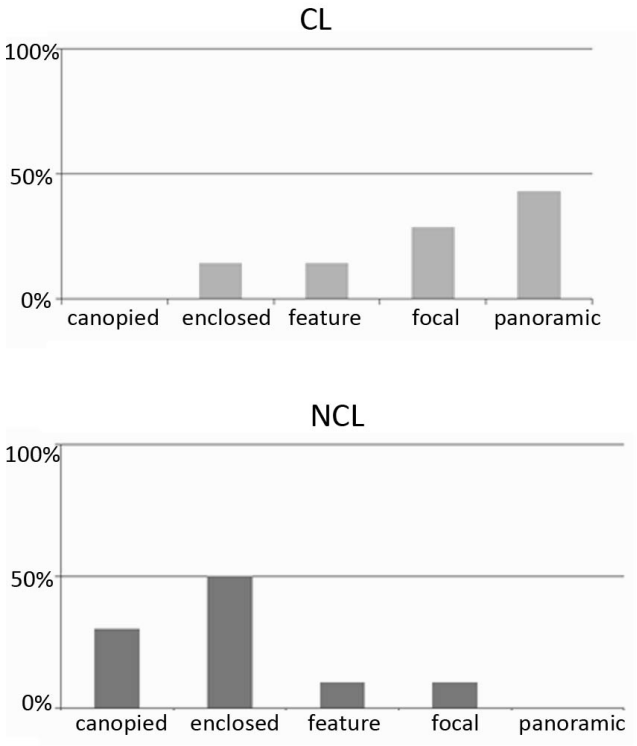


Figure 57. Distribution of the most contemplative (CL) and the least contemplative (NCL) landscape photos across composition types

Figure 58. LEFT: The three most contemplative landscape settings from the test group: (1) Photo #24, Score: 5.13 points, viewing terrace in Naumkeag Garden by Fletcher Steele, (Massachusetts/USA, 07/2014); (2)Photo #23 Score: 5.11 points, rosary axis, Parchi di Nervi (Genoa/Italy, 07/2013); (3) Photo #4, Score: 4.94 points, main clearing, Parchi di Nervi (Genoa/Italy, 07/2013); and three least contemplative landscape settings from the test group: (40) Photo #25, Score: 2.83, El Prado, Balboa Park (San Diego/ California/ USA, 07/2014); (39) Photo #7, Score: 3.14, Parchi di Nervi (Genoa/Italy, 07/2013); (38) Photo #6, Score: 3.17, Parchi di Nervi (Genoa/Italy, 07/2013)(photos by A. Olszewska and A. Chadala).

Brief Discussion & Conclusions

Through all the steps of the developed methodology (literature review; list of contemplative features i.e. *Checklist*; instrument for the evaluation of those features i.e. *Questionnaire*; selection of landscapes; evaluation of those landscapes by a panel of experts), the tool to define and evaluate the landscape settings in terms of their contemplativeness has been established, which in its final version is called the *Contemplative Landscape Questionnaire* and is presented in Appendix 2. The CLQ was evaluated via different statistical tests and showed:

- good internal consistency (*Cronbach´s Alpha* = .817), which confirms H1.1.;
- good reliability (*GSH* = .854), which confirms H1.2.;
- almost perfect inter-rater agreement (ICC = .81), which confirms H1.3.;
- strong positive correlation between the seven questions and a validity question (*r* = .772), which do not confirm H1.4, but is still very good indicator of validity.

The *Questionnaire* included eight key-components of the landscape setting that were tested in terms of reliability and validity. The reliability measures showed how much each of the eight items contributed to the overall score. Items 1, 5 and 8 (*Landscape Layers*, *Compatibility*, and *Character of Peace and Silence*) proved to provide the highest contribution to the contemplative character of space (Table 5). Also, items 2, 3, 4, 6 (*Landform, Vegetation, Light and Color, Compatibility*) proved to be important. On the other hand, the contribution of Question 7 (*Artistic expression*) to the overall score was radically lower than other items, diminishing the overall score of the *Questionnaire* in terms of reliability. One could suggest that it is due to the incorrect formula of Question 7. Nonetheless, the inter-rater agreement test (see Table 7) showed this not to be the case. It may also be that the artistic expression has less to do with the overall scene in general, because there are more powerful aspects of the overall setting perception than the use of certain artistic strategies. However, considering the radical difference between the average value (0.798) and the *Cronbach's Alpha* value of item 7 (.001), it seems that the level of importance of this item is so low, that it is in fact deteriorating the quality of the *CLQ*.

This statement may be controversial, as contemplation of landscape has traditionally been connected with the contemplation of art. Also, art is considered to be an important factor in improving the quality of public space. Nevertheless, in light of the presented study, it may be more reasonable to distinguish natural and artistic contemplation as two separate concepts, even though this statement needs further research.

The Question 5 (*Compatibility)* showed the highest contribution to the total contemplativeness score, thus it is the most important of all categories for creating the contemplative character of designed space. It confirms that the design strategies related to compatibility in design play the most important role in the contemplative landscape design.

According to the authors, spatial order, harmony and absence of distracting stimuli is vital for creating the "inner silence" and redirecting one's thoughts from the surrounding stimuli inwards (Hermann, 2005; Kaplan et al., 1998; Krinke, 2005; Tuan, 1974). Inward orientation of the space composition can help stimulating psychological introvertism. According to the literature, this leads to the character of a "created sanctuary" or "silent oasis", and induces contemplation, beyond any religious program (Hermann, 2005, p. 39). It manifests the central and peripheral components in a hierarchical way. This inward composition of space can also present itself by the clear signage system, which is very important for avoiding the feeling of being lost in space.

The study showed that, in terms of landscape composition, the panoramic and focal types are the most contemplative. On the other hand, the least contemplative landscape settings were those of the enclosed and canopied type (see Figure 57). This suggests that open landscapes with long distance views are the most contemplative, no matter if it is a wide-open vista or an axis leading to one distant point. Question 1 (*Landscape Layers)* showed very high contribution to the overall contemplativeness of the scene. Enclosed and canopied landscapes were much less contemplative, which suggests that the contemplative experience depends on how far one can see into the landscape!

Some existing research seems to confirm this statement. For example, the previously mentioned study about comfort of the long-distance view (Skalski, 2005) or the *Savannah hypothesis,* according to which people prefer open areas unlike those with dense, complex environments (such as forests or mountains) because of their anatomic and psychological construction (Lidwell et al., 2010).

These results also seem to correspond to the findings of environmental psychology with its study on landscape preference. According to such field of research, people prefer landscape settings with long distance views while framed with dense vegetation, even though they found the desert and prairies landscapes less interesting (Kaplan et al. 1998). Nevertheless, the enclosed open forest (canopied or enclosed composition type), which is often a preferred landscape, was rated low by experts in contemplation. This could suggest that the contemplative experience of the landscape may need more open sky/distant views in some cases or at least a far-away focus within an enclosed landscape. The difference between landscape preference and

contemplative landscape is probably connected with the research scope and balances between public- versus expert-based surveys. It is assumed that the contemplative experience of the landscape is unconscious and does not depend on ones' preference, but instead is regulated by neuro-psychophysiological mechanisms.

One limitation of the presented framework is item 9 (composition type), which is based on the landscape composition classification developed by Smardon et al. (1986). This item showed fair inter-rater agreement, which is not considered satisfactory in terms of reliability. It means that experts were not consistent about composition types of landscape. This is why including or rejecting this item should be carefully pre-considered. It would not be recommended to use item 9 for evaluation of a small number of landscape settings. Some general conclusions have been placed on this item, mainly due to the larger number of landscape settings and the intention to illustrate some general tendencies.

Another issue that may be considered a limitation is the fact that the history of landscape quality assessment, as well as the practice of design, has featured a competition between two approaches: the expert- and perception-based model. Both of these approaches have as many supporters as opponents.

However, some recent studies showed that the perception-based approach generally achieves higher levels of reliability and validity that the expert-based, because the resulting landscape aesthetic quality measures may vary as much between different experts assessing the same landscape as between different landscapes (e.g. Craik & Feimer, 1979; Feimer et al., 1979; Feimer et al., 1981). What is more, some researchers suggest that the expert-based approaches belong to the "traditional" movement and are now challenged by "the deep ecology and green philosophy movements", which involve perception-based approaches (Daniel, 2001).

This study was based on the expert approach, however we considered not one but ten's experts decision consensus, and it showed that the reliability, as well as the validity in the case of contemplative landscape expert evaluation, can be quite satisfactory. The developed *CLQ* (Appendix 2) seems to be a valid and reliable instrument for evaluating the contemplativeness of designed outdoor spaces (mainly, urban parks and gardens). The study proved that the contemplativeness of space is real and it depends on the level of aggregation of seven key elements, respectively according to importance: *Compatibility, Layers of the landscape, Landform, Character of peace and silence, Archetypal elements, Light and color,* and *Vegetation*.

CHAPTER V

STUDY II

EFFECTS OF CONTEMPLATIVE LANDSCAPES ON BRAIN ACTIVITY

Effects of Contemplative Landscapes on Brain Activity

Studies ideally need to use interventions that are as effective as mindfulness meditation in producing the beneficial effects on target variables, but that allow for assessment of the unique mechanism underlying the mindfulness practice (Tang, 2015).

Introduction and the State of the Art

People have always been interested in the mind and brain as the source of their mental activity. The interest in studying the brain emerged from philosophy and then spread to other disciplines. Attempts were made to localize the mental functions in terms of the specific brain regions where they occur, and then to look for the mechanisms of responses to different stimuli as well as brain mapping (Uttal, 2011).

Recently, there has been a growing interest in cognitive neuroscience, which became an academic field exploring the biological substrates underlying cognition with a specific focus on the neural substrates of mental processes. It addresses the questions of how mental phenomena are produced by neural circuits in the brain. Even though the launching of the first official Neuroscience Association – *Society of Neuroscience* – dates back to 1969 (Mason, 2009), in many ways, the discipline is still in its infancy. Nevertheless, due to its multidisciplinary nature, cognitive neuroscience joins insights with disciplines such as: bioengineering, psychiatry, neurology, physics, psychology, sociology, anthropology, biology as well as the computer sciences, philosophy, dynamical systems, linguistics and even socio-emotional development.

Methods developed by neuroscience include techniques, such as: functional neuroimaging (e.g., fMRI, PET), electrophysiology (EEG, ERP), cognitive genomics, and behavioral genetics, among others. The development of neuroscience also reflects on everyday life, thanks to advances in non-invasive and easy-to-access tools. One example is in the area of gaming and entertainment (Figure 59).

Figure 59. The brain-computer interface enables the playing of computer games with one´s thoughts, presentation of the application called "SOCI" - Screen-Overlay Control Interface (intendiX, n.d.)

Neuroscientific tools have also been used in a new branch of marketing, i.e. neuro-marketing (Lee et al., 2007), and in sports (e.g., Moran, 2012), among other areas. An increasing number of people (not only researchers, but also the general public) are interested in neuroscience tools, because it enables them to visualize and even analyze the functioning of their brain. It seems that being able to interpret brain responses to different stimuli has the potential to provide ultimate understanding of the phenomena occurring during everyone's lives.

The human brain is the organ that serves as a center of the nervous system. Its surface is covered by the cerebral cortex (the largest part), which in a typical human is estimated to contain 15–33 billion neurons (Pelvig et al., 2008). Each neuron is able to produce and transmit electrical impulses by the diffusion of calcium, sodium, and potassium ions across the cell membranes. During different activities and exposure to different stimuli, different parts of the brain are activated. The activity of the brain regions can be analyzed as electromagnetic waves with different frequencies and amplitudes.

The four most important brainwave power bands distinguished are: (1) Delta (<4Hz); (2) Theta (4-7.5Hz); (3) Alpha (7.5-14 Hz); (4) Beta (>14 Hz) (Niedermeyer, 1993) (Figure 60).

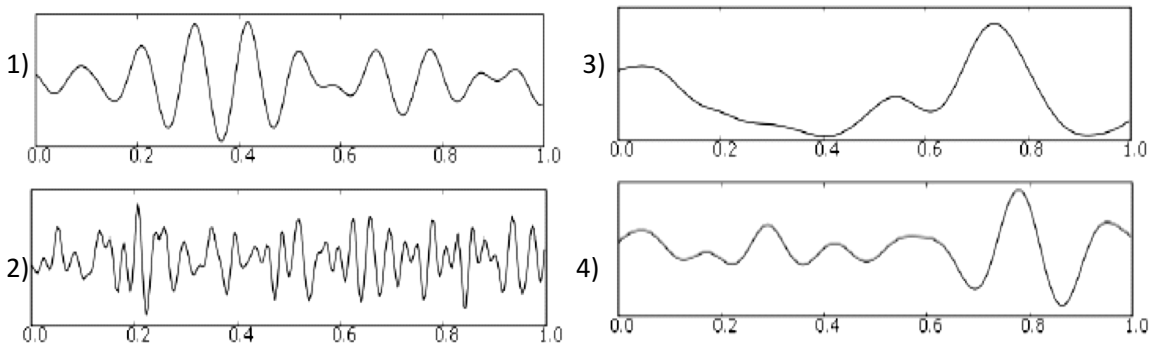
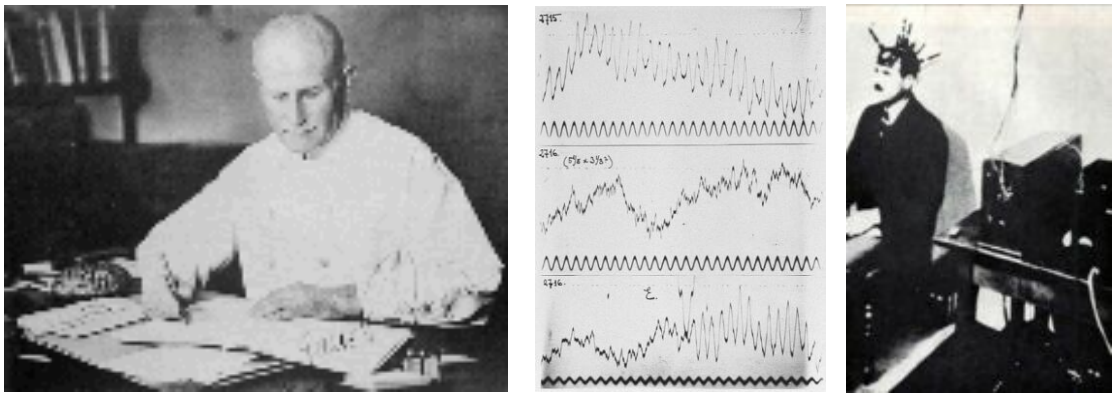


Figure 60. Four most important power bands distinguished: 1) Alpha (7.5 – 14Hz): awake, closed eyes, relaxed; 2) Beta (>14 Hz): awake, alert; REM sleep; 3) Delta (< 4 Hz): deep sleep; 4) Theta (4 – 7.5 Hz): infants, sleeping adults.

These neural potentials have become the base for developing the EEG method which uses special machinery, usually in a laboratory-based environment, to monitor and record raw electrical signals from the brain. The first EEG machine was developed during the early-twentieth century (see Figure 61), and it has continuously been improved along with the tools needed to process, analyze and interpret the data.



a) b) c)

Figure 61. a) Hans Berger (1873 - 1941), inventor of the first EEG machine; b) Hans Bergers' lab with a participant of his experiment connected to machinery; c) Berger's EEG recordings.

The main advantages of contemporary EEG machines are that they are non-invasive, easy to use, mobile and wireless, while still reliable. The application of the EEG method is very wide, because it allows investigators a nearly infinite number of domains with the possibility of incorporating multiple different tasks and conditions (Light, et al, 2010). EEG experiments are usually performed with simple task design, where continuous recording with split second accuracy is performed. If the experimental design, including the sample size (the number of participants), is

established correctly and precisely enough, it provides reliable answers to the questions of investigation (meaning it is replicable and constitutes a so-called general scientific truth).

One limitation of the EEG method is its sensitivity to ambient noise or any electrical wave that may contaminate the raw signal with so called artifacts. Ambient noise can be generated by any type of electronic device or system near the location of the experiment (e.g. power lines or computers). In Portugal, as well as in most places around the world, the ambient noise equals 50 Hz (IEC, 2014). Thus, it is recommended to perform the recordings in an electrically-shielded chamber. If that is not possible, at least all the electronic devices should be turned off for the time of the experiment. There are also other type of artifacts that may occur during the EEG signal recording, including:

1) Ocular artifacts – some of the most common artifacts contaminating the EEG signal due to eye and eyelid movements. For instance, blinks produce peak-like interferences that can be larger than 100uVs. These artefacts are easy to detect by sight and remove; however, it should not take place too often in the recording.
2) Cardiogenic artifacts – potentials generated by the heart, which have a much larger amplitude than EEG potentials and therefore can interfere with the recording. However, they are easy to detect by sight, as a rhythmic ECG QRS complex of larger amplitude than the measured EEG.
3) Muscular artifacts – the muscular contraction, especially in scalp muscles, induced by actions such as chewing or clenching the jaw, produce high amplitude EMG (electro-miographic) interferences superimposed upon the EEG recording.
4) Movements - head and body movements produce irregular voltages that, among other effects, modify the drift and low frequencies of the measured EEG.

The artifacts mentioned above are a real limitation of the EEG method, but with the proper experimental design and ability to recognize them, they are possible to avoid or remove from the recorded raw EEG signal.

Mindfulness in neuroscience

Together with development of electroencephalography, the knowledge about electrical activity located in different brain regions and associated with various mental states has increased. Different patterns of brain activity have been associated with different mental states. For example, right frontal alpha asymmetry is related to depressive states (Henriques & Davidson, 1990). Over the past two decades, research about the neuroscience of mindfulness has been increasing in an almost exponential manner, promoting the claim that practicing mindfulness reduces stress and exerts general benefits on physical and mental health and cognitive performance (Tang, 2015).

Concerning EEG activation, the current studies on mindfulness have revealed that the prefrontal cortex plays the most significant role, with a higher activation of theta and alpha activity observed across subjects during mindfulness meditation practice (Aftanas & Golosheykin, 2005; Berkovich-Ohana et al., 2011; Lagopolus et al., 2009; Takahashi et al., 2005). There were at least two other reliable experiments conducted that suggest different brain activation patterns during mindfulness practice, but for this research the above mentioned were selected.

Taking landscapes to the laboratory

One could ask: why take landscapes into the lab and not the opposite? Each landscape is very complex and cannot be represented by a model (photograph or video). Also, there is much more than just visual character of the landscapes, as we perceive the space with all five senses. Must environmental research be performed *in situ,* or can it also be represented (by photographs, for example) and performed elsewhere? Studies show that the use of photographs of existing environments poses no serious problems in terms of scientific validity. There is a strong positive correlation between the ratings of the photographs versus real landscape settings (Pitt & Zube, 1987; Stamps, 1990). What is more, taking subjects to the site could cause serious limitations to the quality of the measures and, thus, the results of the investigation.

First of all, during design of the experiment, it is important to consider all factors that influence the changes in brain functions and try to eliminate those factors that cannot be controled for. For example, temperature, light, humidity, etc., are factors that may interfere with brain responses. For this reason, neuroscience experiments take place in laboratory environments, where interfering and distracting stimuli can be eliminated or at least controlled. In the outdoor environment (e.g. park), even minor changes in the light intensity can change the brain response from subject to subject (Tatler, 2007). Other factors such as random animals, other people, smells and temperature conditions, among many others, would be very difficult to control for. In

this research, where the effects of visual stimuli are being studied, all other stimuli should be eliminated or controlled for in order to enable clarity of the results.

Nevertheless, a great deal of effort was put into making the displayed stimuli as realistic as possible for the subjects. A study from 2005 suggested that 3-D shapes engage higher visual areas in the brain than 2-D shapes (Welchman, 2005). Due to this, all videos presented during the final experiment were recorded and displayed in 3D quality.

It is important to emphasize that this research concerns only the *visual* values of the designed spaces, which are within the expertise of landscape architects. Any other sensory stimuli occurring in the landscape is out of our scope. For this reason all the sensory stimuli present in the landscapes, except for the visual, were discarded from the experiment. The established conceptual model serves, merely enough and so much, to confirm the hypothesis and to suggest some design strategies to designers.

The following study will test the second hypothesis (H2), which is based on the association of the contemplative sense while watching the landscapes with the state of mindfulness. So far, there has been no contemplative brainwave activity pattern discovered, and because the contemplation of landscapes and mindfulness seem similar to each other (in terms of attention focused to the present experience, personal character of the activity and possible health and well-being benefits), is seemed reasonable to check if those terms are also similar in terms of brain activity pattern.

The EEG experiment was performed in two steps across two consecutive years: (1) pilot experiment, (2) full-scale experiment (see Table 11). The first step had a preparatory character toward the second, final step. The pilot experiment was performed in order to see what quality of data could be expected. Its main goal was to test the experimental design and equipment, and go through the data processing part. The final experiment resulted from improvements after the pilot trial; it was conducted with a different sample, the best available equipment, and thus provided more reliable data.

The next part of this chapter is a brief description of the pilot experiment, followed by subchapters describing the full-scale experiment in more detail. As the pilot experiment constitutes a “small” study, the decision was made to describe it and its outcomes.

Table 11.

Summary of the experimental process including the specification of each of two steps of the EEG experiment

	Pilot Experiment	Full Experiment
Time	January 2014	February 2015
EEG acquisition device	Emotiv EPOC	EnoBio
Number of channels	14	8
EEG acquisition software	Test Bench	N.I.C.
Number of subjects	30	32
Stimuli type	video	video
Depth	2D	3D
Display	Projector-wall (2657 x 1494 mm)	Stereoscopic screen-mirror system (3321 x 1868 mm)

Method of the Pilot Experiment

Participants.

The number of participants of the pilot experiment was 30 (13 female) with a mean age of 25 years (*SD* = 4.9 years). Six participants were left-handed. All participants had normal or corrected to normal vision and none reported mental or neurological diseases. Also, none of the participants reported use of medication that could alter the functioning of the Central Nervous System at the time of the experiment.

Materials.

Data acquisition equipment. The EEG data acquisition device used for the pilot experiment was the Emotiv EPOC wireless headset (see Figure 62). The Emotiv EPOC neuro-headset is composed of 14 channel electrodes, located regularly across the scalp (excluding the midline electrodes), and a small integrated embedded system powered by an onboard battery for signal conditioning and transmission. At the time of the experiment, the Emotiv EPOC headset was a relatively new piece of equipment, and some existing publications suggested that it "proves a valid alternative to the laboratory ERP systems" (Badcock et al., 2013, p. 1).

Visual stimuli. The stimuli material, collected in the park (*Phase I* of data collection), consisted of still videos in 2D quality. All photographs included in the pilot experiment were taken with cloudy weather (white sky). The photographs were divided into two groups, ten contemplative (CL) and ten non-contemplative (NCL), according to the preliminary ranking of photos from *Phase I.*

Experimental design and procedures.

The experiment was based on a transversal study with a within-subjects design, where the same group of participants went through two conditions: observation of Contemplative (CL) and Non-Contemplative (NCL) landscapes. The experiment was prepared as a passive-task EEG recording session, where subjects were instructed to observe the displayed landscapes within two blocks of stimuli (CL and NCL) in a balanced order. There were also baseline recordings (BL) performed for each subject before displaying the blocks of stimuli, while participants remained in resting state.

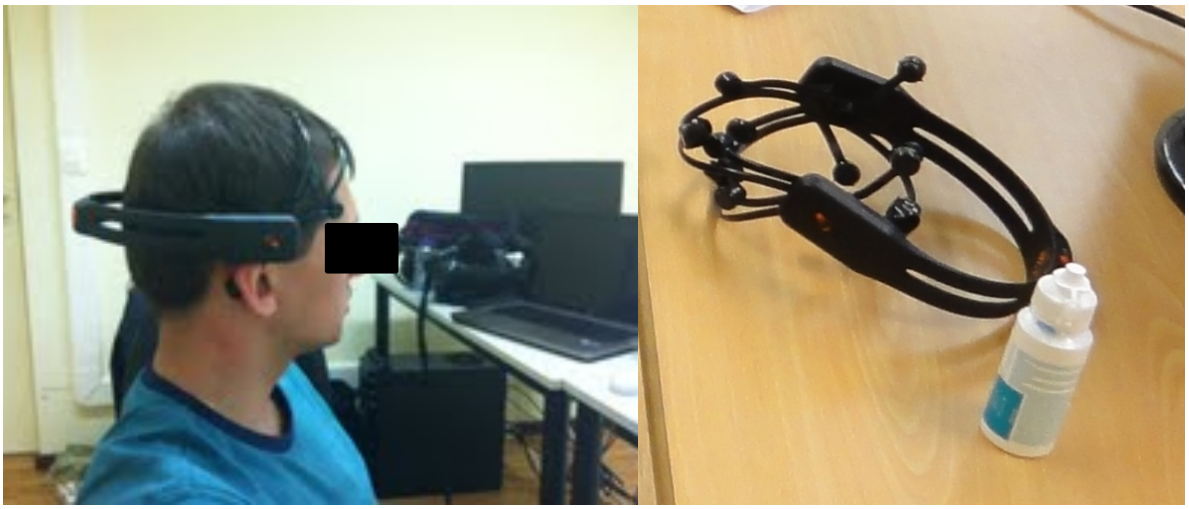


Figure 62. Participant of the pilot experiment wearing the Emotiv EPOC headset (left) and Emotiv EPOC headset with the saline solution (right) (photos by author).

Laboratory setup. Data acquisition took place in a room made available by PIC especially for the experiment. The lab setup consisted of the Data Collection equipment and stimuli display equipment, prepared as shown in Figure 63.

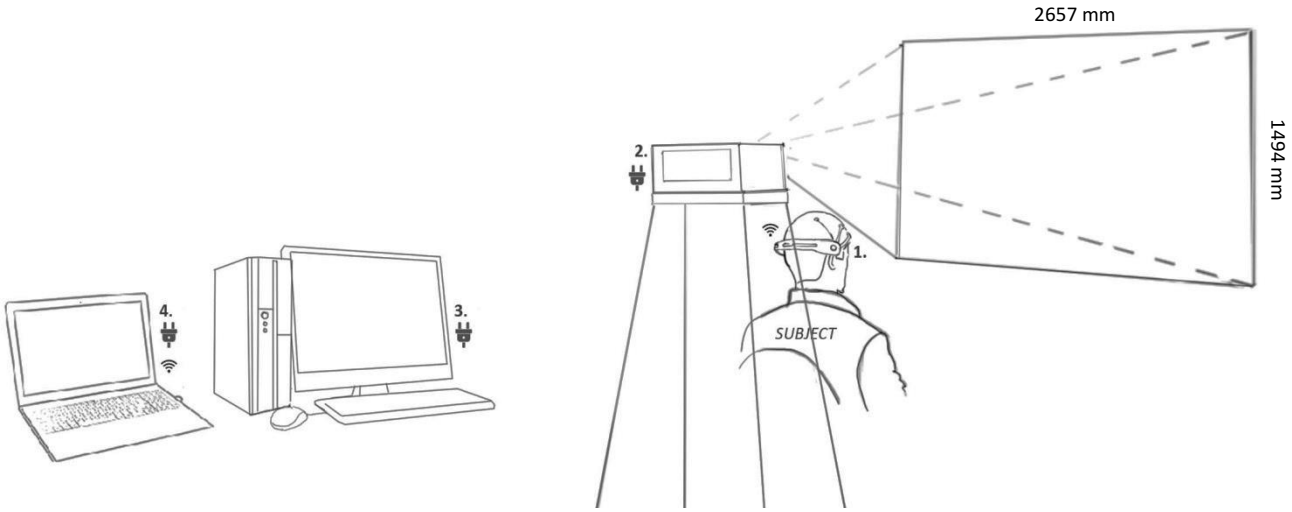


Figure 63. Laboratory setup scheme for the pilot experiment: (1) Emotiv EPOC® 14-channel headset; (2) DepthQ® HDs3D-1, stereoscopic projector; (3) Stimuli presentation PC; (4) Aquisition computer with TestBench® software.

Instructions for participants. Subjects were instructed to calmly watch the displayed photographs and imagine they were in the space they observed at the moment.

Displaying 2D videos*.* Video files were transferred from the camera memory to the laptop and organized in two playlists in the Windows Media Player® software, with the fixation-cross image at the beginning. The order of the files was randomized in the playlists. The start of the presentation, as well as the sending of markers, was operated manually by the researcher. The videos were displayed on the wall, and the size of image was 2657mm x 1494 mm, in colour and HD quality of image, through the projector (DepthQ® HDS-3D-1), which was connected to the laptop. The audio was muted (Figure 64).

Figure 64. 2D videos were displayed on the wall with the projector.

EEG signal recording. The visual stimuli were displayed in two subsequent presentations of videos, following the resting state (baseline) recordings, which included 60 seconds with eyes opened plus 60 seconds with eyes closed, and again 60 seconds with eyes open (Figure 65). The EEG was recorded using 14 active electrodes in addition to 2 reference electrodes (common mode sensing (CMS) and drive circuit (DRL), fixed in P3 / P4 locations). Available channels (based on the International 10–20 locations) are presented in Figure 66. The headset is wireless and, according to the Emotiv website, has a lithium-based battery autonomy of 12 hours (Emotiv, n.d.). The sampling rate reached 128 Hz. The recordings frequency was 0.2 - 45Hz, filtered on-line by a built-in digital 5th order *SincSync* filter. Electrode impedance was decreased

by using saline liquid until the level required by the software was reached (in the 10–20kΩ range) and was checked along the experiment.

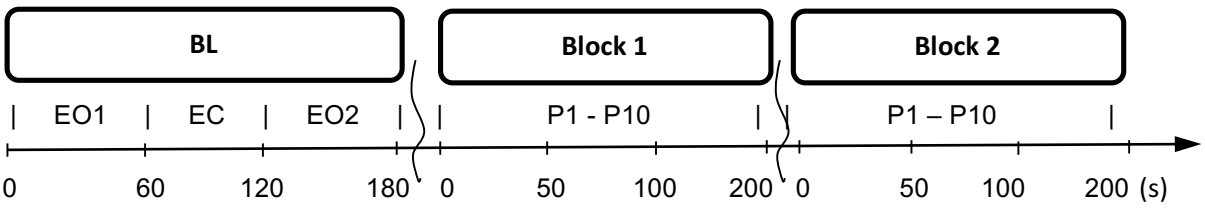


Figure 65. Timeline of the EEG-recordings during the pilot experiment, included three segments: (1) resting state/ baseline (BL): EO1 (60s with eyes opened) + EC (60s with eyes closed) + EO2 (60s with eyes opened) (2) first presentation (block) of videos – Contemplative (CL) or Non-contemplative (NCL) condition: Picture #1 (P1) through Picture #10 (P10), each one displayed for 20s; (3) second presentation (block) of videos – Contemplative (CL) or Non-contemplative (NCL) condition: Picture #1 (P1) through Picture #10 (P10), each one displayed for 20s.

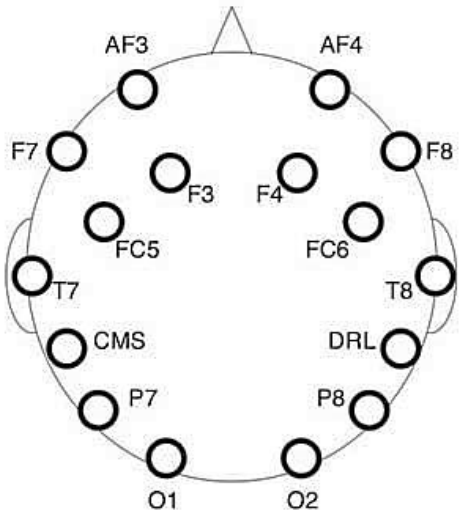


Figure 66. Emotiv EPOC electrodes. 14-channel neuro-headset; fixed electrodes: AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8, AF4 and 2 reference electrodes CMS and DRL.

Signal Processing. The raw EEG signal acquired during the experiment was then processed in the MatLab® software (*eeglab* tool). The files with the continuous data recorded from each participant and condition were imported to Matlab® and transformed into dataset files. The following steps of pre-processing included: channel location, visual inspection, rejection of ocular artifacts, and interpolation of noisy channels, and channels for regional analyses, inserting missing markers, and verifying the length of the continuous data. After those pre-processing steps, an offline filtering of (0.3-30Hz) was applied in order to separate the following frequencies: delta (0.5-4 Hz), theta (4-7.5 Hz), alpha (7.5-14) and beta (14-30Hz). Three time-frames of each CL and NCL recording (T1, T2, and T3) were also separated in order to control for fatigue. Each of the three time-windows represented 60 seconds of the recording. Afterwards, files from each participant were organized into one study, and extracted into a regular Microsoft Excel Spreadsheet. After that, the values of CL and NCL condition were corrected with baseline values (*CL-BL*, and *NCL-BL*). Then, they were transformed using a logarithmic transformation in order to normalize the output data. In order to perform the tests on asymmetries, the formula *log(R)-log(L)* was applied to the data and Repeated-Measures ANOVA tests were performed in order to examine the effects of the condition (CL, NCL) on theta, alpha, and beta asymmetries for different brain regions.

Results.

The pilot experiment was performed as a proof of concept and a test of sample size and equipment. Therefore, the results of ANOVA are shown only as a general summary.

One-Way Repeated Measures ANOVA revealed significant effect of condition for frontal theta asymmetry, $F(29,1) = 4.91$, $p = .035$, suggesting increased right theta power in the contemplative condition($M_{CL} = -4.79$, $SD = 6.23$) compared to the non-contemplative condition ($M_{NCL} = -5.46$, $SD = 6.45$).

Also, One-Way Repeated Measures ANOVA revealed the significant effects of condition for temporal alpha asymmetry, $F(29,1) = 18.9$, $p < .001$, suggesting the increased asymmetry towards the right in the contemplative condition ($M_{CL} = -2.37$, $SD = 1.53$) in comparison to the non-contemplative condition ($M_{NCL} = -2.63$, $SD = 1.53$).

Finally, One-Way Repeated Measures ANOVA revealed significant effect of condition for temporal beta asymmetry, $F(29,1) = 20.6$, $p < .001$, suggesting the increased asymmetry towards the right in the contemplative condition ($M_{CL} = 0.24$, SD

= 0.35) compared with the non-contemplative condition(MN_{CL} = -0.003, *SD* = 1.73). The summarized results are presented in Table 12.

The ANOVA analyses with the time factor (T1, T2, T3) showed that there is no downward tendency of the brain activity (all $F < 1$) that could be connected with the participants' fatigue (Figure 67).

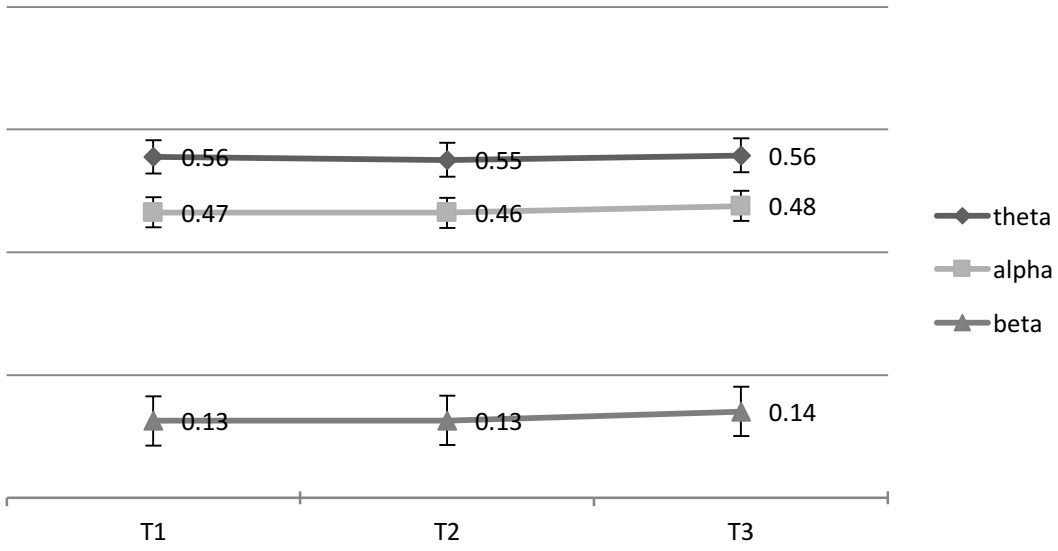


Figure 67. Scheme presenting the least square means for the time factor (T1, T2 and T3) for theta, alpha and beta frequencies (Hz) normalized with log(x+5) formula.

Table 12.

Statistical Significance of the Differences Between Conditions (CL and NCL) in Terms of Asymmetries of Alpha, Theta and Beta Power-Bands in Different Brain Regions Across all Participants.

Region	Analysis	statistically significant difference between CL and NCL
Frontal	Alpha asymmetry	No
	Theta asymmetry	Yes
	Beta asymmetry	No
Temporal *(T7; T8)*	Alpha asymmetry	Yes
	Theta asymmetry	No
	Beta asymmetry	Yes
Parietal *(P7; P8)*	Alpha asymmetry	No
	Theta asymmetry	No
	Beta asymmetry	No
Occipital *(O1; O2)*	Alpha asymmetry	No
	Theta asymmetry	No
	Beta asymmetry	No

Conclusions.

Due to the exploratory nature of the pilot experiment, no rigorous conclusions can be drawn. The purpose of the pilot experiment had been achieved, namely, the sample size and the feasibility of the procedure were tested, and the data analyses were conducted correctly.

The results of the pilot experiment suggested that significant differences of alpha, beta and theta activity between brain hemispheres in frontal and temporal regions of the participants' brains may be associated with the observation of contemplative landscapes in comparison to non-contemplative ones. That finding was consistent with the expectation that the frontal and temporal areas would be the most interesting to include in a full-scale experiment.

The analysis of time windows (T1, T2 and T3) did not show a significant loss of attentiveness, suggesting that the experiment is not too tiring for participants. Therefore, the full-scale experiment could be repeated with a similar design and stimulation protocol.

Methods of the main experiment

Participants.

In most situations, researchers do not have access to the entire population of interest. This is because the population is too large (which is the case of this research), not willing to participate, or it would be too time consuming or too expensive to invite everyone of interest to take part in the experiment. For this study, the population of interest was adult, healthy members of the community, who live in cities. Only a small segment of this population was observed in the EEG experiment; however, thanks to statistical methods, the characteristic of the population can be estimated and the statistical power of the found phenomena can be computed. The sample size (the number of participants of the experiment) plays an important role here. It must not be too low, because then the experiment would lack the precision to provide reliable answers to the research questions (or, in other words, the sampling error would be too large). Also, the sample size should not be too large, because this wastes time and resources (Designing an Experiment, Power Analysis, n.d.). It was important to make the sample size large enough, but not so large as to be wasteful.

For this experiment, the number of participants was established using the sample size computation software, *G-Power*, which is available online (Heinrich-Heine-Universität Düsseldorf, n.d.).

Providing the parameters and ideal quality to be achieved in the experiment, the minimal sample size to achieve these goals could be computed. The parameters that needed to be specified were:

1) *Effect size (f)* – a quantitative measure of the strength of a phenomenon (in our case, effects of contemplation in brain activity) and expressed by a decimal fraction in which Small $f \leq .1$ is considered a small effect size, $.1 < f \leq .3$ is a medium effect size, and a big effect size is when $f > .3$ (Cohen, 1988); for this study, it was set to .3.
2) α error probability – the probability of incorrectly rejecting H0 (null hypothesis) when it is, in fact, true; usually (and for this study as well) it is expected to be .05.
3) Power of the test (1-β error probability) – the probability of incorrectly retaining H0 when it is, in fact, false; for this study, it was set to .8.

4) Number of groups – this is an observational study, with a within subjects design and, unlike cross-sectional studies, comprised one group of subjects who were exposed to contemplative and non-contemplative stimuli;

5) Number of measures – there were three measurements in this study (BL, CL, and NCL) recorded for each participant.

6) Correlation among repeated measures – set at 0.5

As a result of the computation in *GPower*®, the estimated number of participants needed to perform the experiment was established at 20, with critical *F* set at 3.24. However, due to some unexpected circumstances, the decision was made to invite 30 participants, in order to safeguard against any data acquisition errors (in the end, there were 32).

Participants (*n* = 32, 12 female) were recruited mostly from among the students of the Faculty of Sciences. Most of them were computer science students and researchers. Twenty-six were Portuguese, four Polish, one Russian, one American, and one Greek. The mean age of the sample was 27 years old (*SD* = 6.5 years). Four participants were left-handed. All participants had normal, or corrected to normal, vision (glasses or contact lenses). None reported mental, neurological, or cognitive diseases. Also, none of the participants reported use of medication that could alter the functioning of the Central Nervous System at the time of the experiment. All the participants had completed at least 12 years of education.

All the participants signed the *Informed Consent* form (Appendix 4), and filled in the *Socio-Demographic* form (Appendix 5). Exclusion criteria included: brain injury, pacemaker, intracranial electrodes, implanted defibrillator or plates, and otologic surgery in the last 12 months or any dentures. None of the recruited participants were excluded.

Materials.

Visual stimuli. Twelve 3D videos representing the same landscape images that were evaluated by experts as the most contemplative and least contemplative were prepared for the experiment. More specifically, 3D videos of the settings from photos: #24 (score 5.13); #23 (score 5.11); #19 (score 4.80); #15 (score 4.73); #32 (score 4.50) and #36 (score 4.37) (see Appendix 3), were included in the contemplative condition (CL). The non-contemplative condition (NCL) included 3D videos of settings from photos: #25 (score 2.83); #6 (score 3.17); #5 (score 3.21); #3 (score 3.30); #8 (score 3.37) and # 27 (score 3.51). Each of the twelve videos was 20 seconds long.

With the equipment available at the time, some technical adjustments were necessary in order to present the video stimuli. The recorded video format was TS(AVC)("*.m2ts") with a frame size of 1920x1080 pixels, 50i frame speed and 16:9 aspect ratio, recorded with the Sony® HDR-TD30 camcorder.

Figure 68. A Sony® 3-D camcorder with a pair of lenses.

The 3D camcorder used in the experiment, utilizes a pair of lenses and a pair of CCD image sensors (see Figure 68). The recorded video actually consists of two 2D videos overlaid, each one captured separately by the two lenses and processed by each of the two CCDs. In this way, the camera mimics what the human brain performs in order to acquire and process any image. Twelve videos representing contemplative and non-contemplative parks were converted, using the Magix® Movie Edit Pro 2015 software. The output format was a "*.mp4" file" with side-by-side composition of images, preserving the initial image resolution and aspect ratio (Figure 69).

Figure 69. Side-by-side video format, image acquired from left lens and image acquired from the right lens are simulating the view from left and right eye that are slightly different from one another.

Figure 70. The 3-D video displayed on the stereoscopic wall visible to the naked eye. The illusion of depth is visible only while wearing the 3D shutter glasses (photo by author).

The videos were displayed, using the free software Bino 3D® video player, in the *Left/Right* and *Open GL* mode. This allowed the display of the entire set of videos for each condition (CL and NCL) by the projector (DepthQ HDs3D-1) on the screen (2440 x 1800 mm) (Figure 70).

In order to actually see the depth of the image, each subject wore the 3D shutter glasses Nvidia®, which were connected to the PC and received the infrared signal from the IR 3D emitter.

Laboratory Setup. Data acquisition took place in the room made available by PIC especially for the experiment. The lab setup consisted of the Data Collection equipment and the stimuli display equipment, prepared as shown in Figure 71.

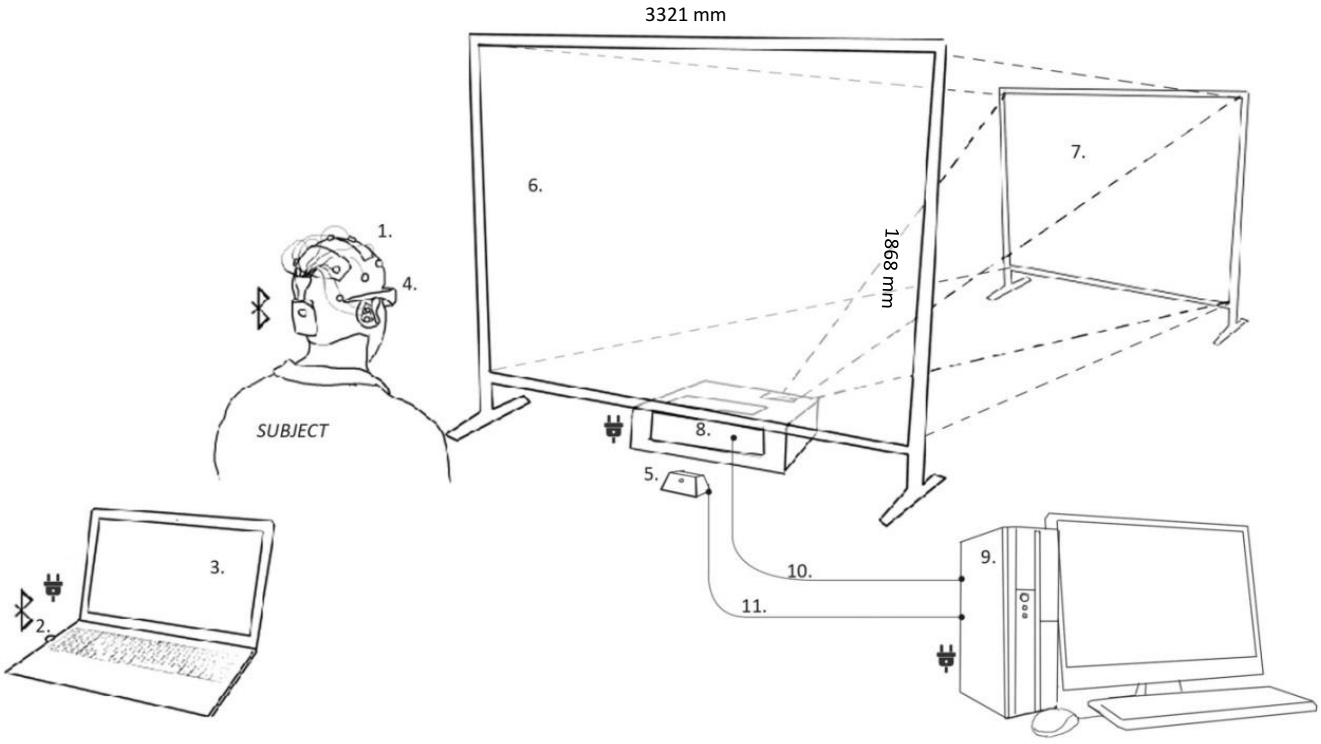


Figure 71. Laboratory setup scheme for Experiment II: (1) EnoBio 8-channel headset; (2) Bluetooth adapter; (3) Aquisition computer with NIC® software; (4) Nvidia 3D Vision Active Shutter Glasses; (5) Nvidia IR Emitter; (6) and (7) Stereoscopic screen - mirror projection system; (8) DepthQ HDs3D-1, stereoscopic projector; (9) Stimuli presentation PC (Nvidia graphics card); (10) HDMI-DVI cable, 11. USB-USB cable

Data acquisition equipment. The EEG data was collected using an eight-channel electroencephalographic amplifier, Enobio model, placed at the back of a Neoprene Headcap, and connected via Bluetooth to a laptop through the NIC 1.2

software (Enobio, 2013). The EEG signal was acquired in the 0-250 Hz band, digitized at 500 Hz and recorded continuously through dry electrodes (Grozea et al., 2001; Ruffini et al., 2007) while participants were observing the landscapes (figure 72).

Figure 72. Enobio 8 Neoprane headcap, with installed 8 dry electrodes (left) and the EEG data acquisition kit including 1. Washable cap; 2. Battery with bluetooth emitter; 3. Set of 8 dry electrodes; 4. Cables. (photos by author).

Experimental design and procedures.

The experiment was a transversal observational study based on a within-subjects design, which means that the same participants went through different conditions (CL and NCL), as its primary goal was to test hypothesis H2 – whether the most contemplative landscape settings can induce in the observer a pattern of brain activity that can be associated with a state of mindfulness.

The experiment was prepared as a passive EEG task with a single continuous recording session, where subjects were instructed to simply observe the displayed landscapes within two blocks of stimuli –CL and NCL (which were balanced to control for order effects). There were also baseline recordings performed for each subject before displaying the blocks of stimuli, while the subject remained in the resting state.

Preparation of participants. After arriving to the laboratory, each of the participants was asked to fill in two forms: an *Informed Consent* (see Appendix 4) and a *Socio-Demographic Questionnaire* (Appendix 5). Meanwhile, the cap with dry electrodes was prepared by mounting eight dry electrodes and two disposable reference electrodes, and connecting them with cables (according to the appropriate channel-location, see Figure 73). The location of the electrodes on the Enobio cap was dictated by the areas of interest discovered during the pilot experiment and literature review, which included: frontal, temporal, midline and parietal regions.

After filling in the forms, the scalp of the participant was cleaned with a cotton-pad wetted with ethylic alcohol, with special attention to the areas of electrodes placement. Then, two disposable electrodes were placed on the right mastoid, and connected to the reference/ground channels-cables (CMS and DRL).

During the cap and electrodes placement, the subject was seated on a fixed chair, placed two meters in front of the projection screen. Then, the 3D shutter glasses were put on over the eyes without interfering with the cap, cables, or electrodes (Figure 74). In the case that the subject wore correction glasses, they were kept under the 3D shutter glasses. All the procedures above were performed using disposable gloves. After these procedures the Enobio device as well as the 3D shutter glasses could be turned on.

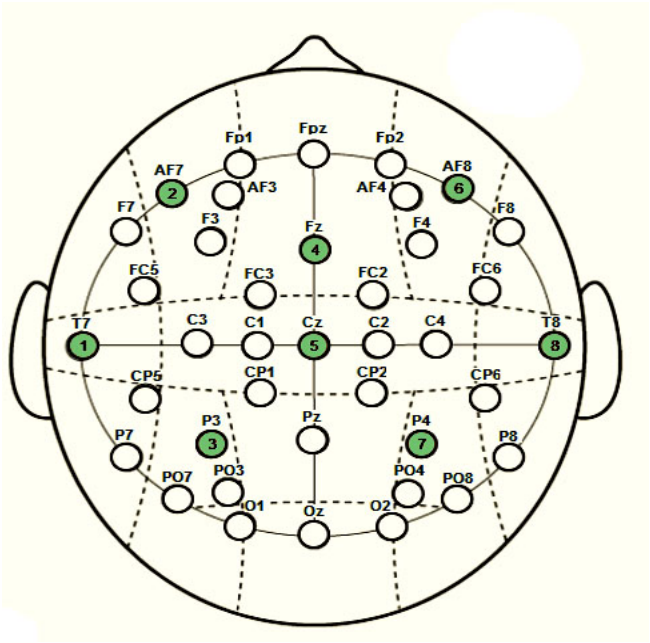


Figure 73. Electrode placement in the Neoprene Headcap (Neuroelectrics, 2013): AF7, T7, P3, Fz, Cz, P4, T8, AF8; reference and ground electrodes (CMS and DRL) are disposable, placed on the right mastoid of each subject.

Figure 74. A participant with Enobio device and 3D shutter glasses installed. On the left: turning on the Enobio connecting device, on the right: participant ready for the data collection.

Instructions for participants. Subjects were instructed to sit still on the chair, without crossing their arms or legs, avoiding movements, particularly of the head, and trying to focus their eyes on one, central spot of the displayed images (preventing eyeball movements). They were also instructed to slightly open their mouth (as a means to relax the facial muscles) and asked to try to reduce their eye-blinking to minimum, or to times between presentations. By doing so, muscle artifacts were reduced to a minimum. Subjects were instructed to quietly watch the displayed photographs and imagine as if they were in each particular space. Each subject was also informed about the three parts of the experiments and their duration (baseline recording – 3 min, followed by two blocks of stimuli, each comprising twelve videos of parks presented in continuous sequence – 2 min each – Figure 75).

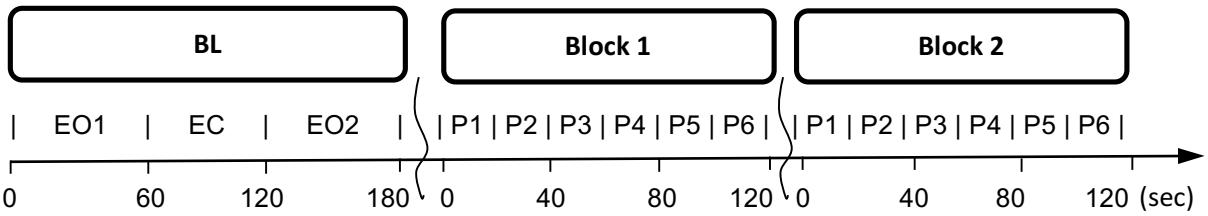


Figure 75. Timeline of the EEG-recordings during the experiment, including three segments: (1) Resting state/ Baseline (BL): EO1 (60s with eyes opened) + EC (60s with eyes closed) + EO2 (60s with eyes opened) (2) first presentation (block) of videos – Contemplative (CL) or Non-contemplative (NCL) condition: Picture #1 (P1) through Picture #6 (P6), each one displayed for 20s; (3) second presentation (block) of videos – Contemplative (CL) or Non-contemplative (NCL) condition: Picture #1 (P1) through Picture #6 (P6), each one displayed for 20s;

Displaying 3D videos *and acquiring EEG signal.* After the instructions, the light in the room was turned off and the EEG recording, as well as the displaying software, were turned on.

The EEG was recorded using 8 dry electrodes fixed on the Neoprene Head-cap, in addition to 2 disposable reference electrodes (CMS and DRL placed on the right mastoid). Available channels (based on the 10–10 EEG system) are presented in Figure 73. The impedances of each electrode were checked on the screen of the collecting PC, and corrected until all were below 20 kΩ, which is considered by the company who produce the device to be an acceptable contact for dry electrodes. The device is wireless (operating with Bluetooth) and, according to the Enobio website, has a Li-Ion battery autonomy of 14 hours (Enobio, n.d.). The sampling rate of recordings was 500Hz. Line noise filtering was set at 50Hz.

After baseline recordings were finalized, the subject was informed, and instructed to quietly wait until the first presentation of videos to start. As previously mentioned, the order of the conditions was balanced (randomized) between participants in order to avoid the *order effect*. The sequence of the videos within each of two blocks of stimuli is presented in Figure 76.

Figure 76. Sequence of the videos of landscape settings within each of two blocks of stimuli, preceded by the fixation cross: (1) CL-block – Six most contemplative landscape settings: P1 (photo #24), P2 (photo #23), P3 (photo #19), P4 (photo #15), P5 (photo #32); (2) NCL-block – six least contemplative landscape settings: P1 (photo #17), P2 (photo #27), P3 (photo #08), P4 (photo #25), P5 (photo #06), P6 (photo #05).

The output file from the 3D camcorder consists of two data streams recorded from two lenses. Their specific format had to be adjusted to the display device being used. Because our 3D projector (DepthQ HDs3D-1) was not compatible with the Sony video file format, all recorded files had to be converted to the side-by-side format, which involved separating data from each lens and putting them side by side within one frame. As previously mentioned, this video format is not supported by the neuroscience stimuli software. It also was not possible to display videos in a playlist without stopping the procedure and disturbing the data collection. Therefore, all six videos of each condition were mounted into one long video, starting with a fixation cross, displayed for 5 seconds. This cross helps the subject to focus in the center of the screen, in order to avoid ocular artifacts.

Event marks (at the beginning and end of each block) were manually inserted in the EEG recording software, and the time point of the recording was noted (in seconds) when the beginning/end of the block took place.

Saving the raw-signal data files*.* Immediately after each recording, the files ("*.edf" and "*.info") were saved on the hard disc with a reference to the subject number, name of the stimuli block, date and a timestamp. Additional notes and comments on each individual EEG recording were also taken, concerning the quality of the signal and any other factors that seemed important during the data analysis and processing.

Post-experimental protocol*.* After each recording, the EEG cap was demounted from the head of the participant, cleaned with neutral soap and warm water, and left to dry. The dry electrodes were sprayed with the disinfectant solution and left to dry. The battery and cables were disassembled, while reference electrodes and gloves were disposed. The Enobio battery and the 3D shutter glasses battery were re-charged according to the current usage. The 3D projector was turned off and the lens was closed. All the equipment was stored in a dry warm place until the next usage.

Data processing*.* The processing of the raw EEG signal was performed in MATLab ® with the "eeglab" toolbox. The steps undertaken in order to pre-process the raw EEG data from the experiment were:

- *Importing the data files.* Each of the "*.edf" files with continuous data was imported to MatLab, converted into microvolt values (uV) per time-point, and saved as dataset files.
- *Visual inspection.* Each dataset file was visualized in MatLab and inspected in terms of general quality, missing channels (i.e., electrodes without signal), artifact/noise contamination, presence of markers, etc.

- *Channel locations.* In order to locate the channels, the BESA file for 4-shell dipfit spherical model was utilized, and channels were localized as shown on Figure 77.

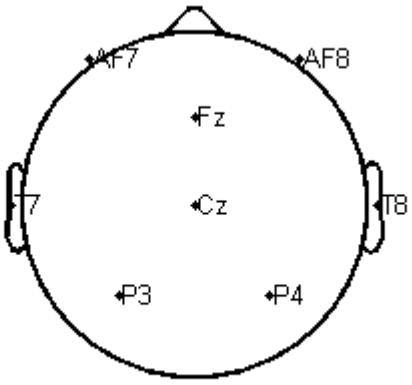


Figure 77. Enobio channel locations. AF7 and AF8 – prefrontal electrodes, T7 and T8 – temporal electrodes, P3 and P4 – parietal electrodes, Fz – frontal midline electrode, Cz – Central midline electrode.

- *Re-referencing.* The signal of each electrode was re-referenced to the averaged signal resulting from all channels (electrodes).
- *Adjusting the length of the continuous data.* This procedure was performed manually and included rejecting all parts of the signal recording outside of the stimulation time-window, namely the time before the presentation started and the time after the presentation of stimuli finished; in case of the baseline, only the second 120 to 140 of the recording was kept (corresponding to a segment of 20 seconds from the second stage of eyes opened) for the following reasons:
    1. The EEG signal recordings during the stimuli presentations are performed with the eyes opened, therefore the baseline recording should include the time when the eyes were opened.
    2. During the first seconds of the recordings, the subject might still be distracted or anxious due to the experimental procedure or new situation, so it is usually recommended to consider later recordings
- *Digital Filtering.* After applying an offline filter of (0.3-30 Hz), a power bands filter was used in order to smooth out the data, remove unwanted frequencies, and separate the four frequencies of interest: delta (0.5-4 Hz), theta (4-7.5 Hz), alpha (7.5-14) and beta (14-30Hz).
- *Organizing the peak scorings.* This procedure systematizes the output in terms of number of channels of interest, number of conditions, and number of subjects. The frequency domain analysis was performed using the Fast Fourier Transform (FFT) algorithm (with the resolution of 0.125 Hz) to calculate

absolute power (μV^2/Hz). After which the power-bands for each subject, condition, and brain region were extracted and copied to a regular Microsoft Excel Spreadsheet.

- *Building a study.* After all the files from all the participants were pre-processed, it was time to create a "*.study" file, where the computer can process all the data files together at once. After the study was created, it was easy to extract the powers in uV for each subject and copy it to the Microsoft Excel Spreadsheet.
- *Data transformations.* Once exported to Excel, a logarithmic (log) transformation to the power values was applied, in order to normalize its distributions. Afterwards, power asymmetries per EEG band were computed by applying the formula of *log(R)-log(L),* where R is the power of a particular EEG band on the right hemisphere and L is the power on the left hemisphere. This formula had been widely used in studies on asymmetries (e.g., Davidson, 1995; Henriques & Davidson, 1990, 1991). The score is zero (no asymmetry) when left and right power are equal, whereas increased right over left activity results in higher scores (Baehr et al., 1999).
- *Statistical analyses.* Once the assumptions were verified for parametric statistical analysis (normality and homogeneity of variances), a One-Way Repeated Measures ANOVA design was used for testing hypotheses H2.1. and H2.2., with frontal alpha and frontal theta asymmetry values as dependent measures, and *Condition* (BL, CL, NCL) as an independent variable. Regarding Hypothesis H2.3., a Two-Way Repeated Measures ANOVA was performed, entering with *Condition* (BL, CL, NCL) and *Side* (Left: AF7 electrode, Right: AF8 electrode) as factors, and frontal alpha power as a dependent variable. Whenever the ANOVA showed a significant condition effect, post-hoc tests were performed in order to find out between which conditions significant difference occurred. The post-hoc analyses were performed using All Pairwise Multiple Comparison Procedures according to the Holm-Sidak method (Guo & Romano, 2007). Supplementary exploratory analyses included the same computation for temporal and parietal delta, theta, alpha and beta asymmetries.

Results

Statistical tests on Hypothesis H2.1. (Observation if Contemplative Landscapes are associated with left-sided frontal alpha asymmetry). One-Way repeated-measures ANOVA revealed that the experimental *Condition* had no significant effect on frontal alpha asymmetry, $F(2, 62) = 1.51$, $p = .229$. The differences in the mean values of frontal alpha asymmetry between the resting state ($M_{BL} = 0.885$, $SD = 0.321$), when subjects were watching the contemplative landscapes ($M_{CL} = 0.951$, $SD = 0.291$) and when they were watching the non-contemplative landscapes ($M_{NCL} = 0.940$, $SD = 0.327$) were not great enough to exclude the possibility that such differences are due to random sampling variability.

Post-hoc analyses for hypotheses testing purpose (Holm-Sidak method) indicated that there are no significant differences between any of the three pairs of possible comparisons (all $p > .05$). Thus, these increased asymmetry scores in all conditions suggest higher frontal alpha power on the right and lower on the left. As alpha power is inverse to brain activation, lower scores on the left are indexes of higher activation on that side of the brain.

Statistical tests on Hypothesis H2.2. (Observation if Contemplative Landscapes are associated with left-sided frontal theta asymmetry). One-Way repeated-measures ANOVA revealed that the experimental *Condition* had a significant effect on frontal theta asymmetry, $F(2, 62)=4.95$, $p = .01$. The differences in the mean values of frontal theta asymmetry between the resting state ($M_{BL} = 0.665$, $SD = 0.304$), when the subjects were watching the contemplative landscapes ($M_{CL} = 0.802$, $SD = 0.354$) and when they were watching the non-contemplative landscapes ($M_{NCL} = 0.741$, $SD = 0.312$) were greater than would be expected by chance.

Post-hoc analyses for hypotheses testing purpose (Holm-Sidak method) indicated that there are no significant differences between NCL and BL nor CL and NCL (both $p > .05$). The only significant difference was found between CL and BL ($p = .003$). Increased asymmetry scores in all conditions suggest higher frontal theta power on the right and lower on the left. Higher scores on the right are indexes of higher activation on the right.

Statistical tests on Hypothesis H2.3. (Observation of Contemplative Landscapes is associated with increased left frontal alpha power). The Two–Way repeated measures ANOVA revealed a main effect of *Side*, F (1, 31) = 339, $p < .001$, with lower frontal alpha power on the Left (M = 0.001, SD = 0.32) than on the right side of the brain (M = 0.926, SD = 0.26). It was also found a main effect of *Condition*, F (2, 62) = 142, $p < .001$, with higher frontal alpha power for BL (M_{BL} = 0.693, SD = 0.03), whereas subjects showed similar values for CL and NCL (M_{CL} = 0.331, SD = 0.04; M_{NCL} = 0.370, SD = 0.06), but the interaction between *Side* and *Condition* revealed no effects, F (2, 62) = 1.51, p = .229.

The Post-hoc analyses using the Holm-Sidak method enabled the verification that there was no significant difference between the CL and NCL condition, neither within AF7 electrode (p = .200) nor within the AF8 electrode (p = .347). On the contrary, the test revealed that the frontal alpha power was significantly different between AF7 and AF8 within all conditions (all $p < .001$). Again, lower frontal alpha power on the left suggests higher activation on that side of the frontal lobe.

Supplementary Analyses

Considering the issues related to the recent mindfulness studies and the results of the pilot experiment, supplementary analyses were performed in addition to the tests of the hypothesis H2, namely, analyses of asymmetries of the power bands in the temporal region (electrodes T7 vs. T8) were thus performed. The results are presented below in the following order:

- Delta temporal asymmetry,
- Theta temporal asymmetry
- Alpha temporal asymmetry,
- Beta temporal asymmetry,

Delta temporal asymmetry. One-Way repeated-measures ANOVA revealed that the experimental *Condition* had a significant effect on temporal delta asymmetry, $F(2, 62)=39.05$, $p < .001$. The differences in the mean values of temporal delta asymmetry between the resting state ($M_{BL} = 0.225$, $SD = 0.308$), when the subjects were watching the contemplative landscapes ($M_{CL} = 0.426$, $SD = 0.286$) and when they were watching the non-contemplative landscapes ($M_{NCL} = 0.347$, $SD = 0.292$) were greater than would be expected by chance.

Post-hoc analyses (Holm-Sidak method) indicated that the significant differences are between all pairs: NCL and BL ($p < .001$), CL and NCL ($p = .001$) and between CL and BL ($p < .001$) (see Table 13).

The asymmetry values were calculated according to the formula log(R)-log (L). So, in the case of all BL, CL and NCL conditions, participants had higher delta power on the right temporal side of the brain (Figure 78)

Table 13.

Mean power (μV^2) and Standard deviations (within parentheses) for the delta band as a function of condition across all subjects.

	T7 (Left)	T8 (Right)	*p*
BL	0.336 (0.247)	0.561 (0.174)	<.001
CL	-0.134 (0.203)	0.293 (0.197)	<.001
NCL	-0.117 (0.200)	0.230 (0.183)	<.001

Notes: negative values occurred due to the performed log transformation

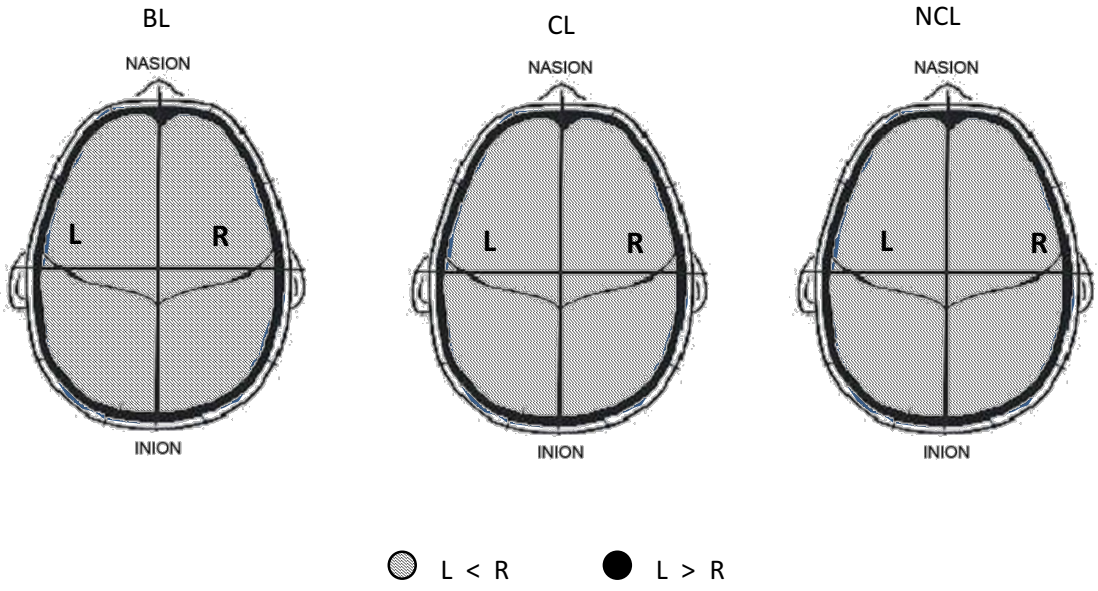


Figure 78. Topographic display showing the delta temporal asymmetry between left and right hemispheres within each condition.

Theta temporal asymmetry. One-Way Repeated-Measures ANOVA revealed that the experimental *Condition* had a significant effect on temporal theta asymmetry, $F(2, 62)=20.07$, $p < .001$. The differences in the mean values of temporal theta asymmetry between the resting state (M_{BL} = 0.001, SD = 0.242), when the subjects were watching the contemplative landscapes (M_{CL} = 0.169, SD = 0.239) and when they were watching the non-contemplative landscapes (M_{NCL} = 0.121, SD = 0.191) were greater than would be expected by chance (Table 14).

Post-hoc analyses (Holm-Sidak method) indicated that the significant differences are between pairs: NCL and BL (p <.001) and CL and BL (p <.001). The difference between the CL and NCL condition was not significant (p =.08).

The asymmetry values were calculated according to the formula log(R)-log (L). So, in the case of all BL, CL and NCL conditions, participants showed higher theta power on the right temporal side of the brain than the left temporal side (Figure 79).

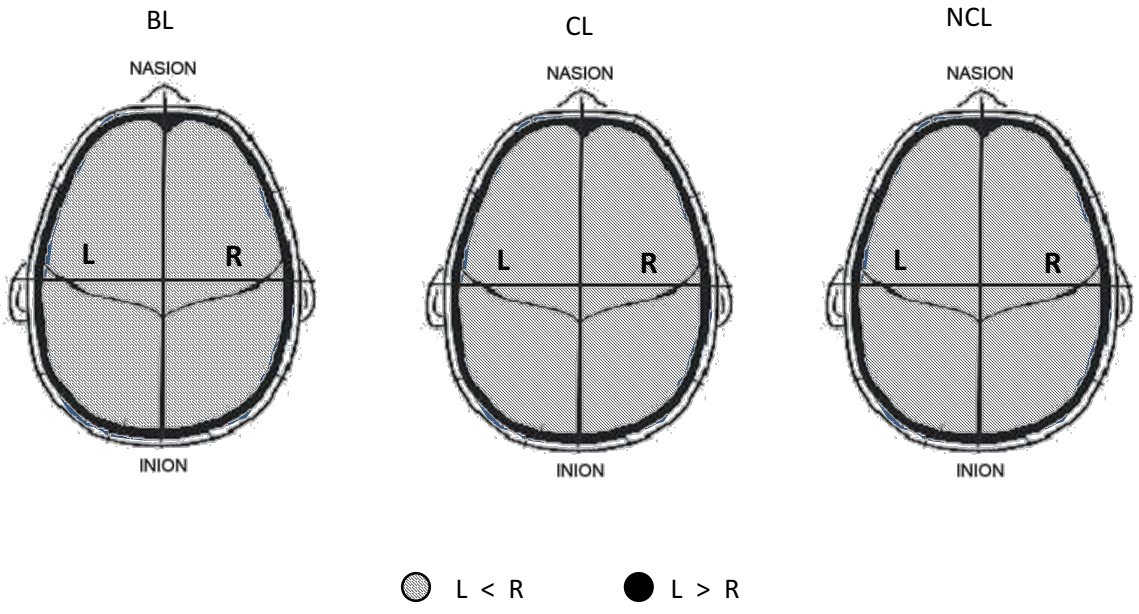


Figure 79. Topographic display showing the theta temporal asymmetry between left and right hemispheres within each condition.

Table 14.

Mean power (μV^2) and Standard deviations (within parentheses) for the theta band as a function of condition across all subjects.

	T7 (Left)	T8 (Right)	*p*
BL	0.380 (0.223)	0.381 (0.218)	.979
CL	-0.105 (0.184)	0.064 (0.222)	<.001
NCL	-0.083 (0.167)	0.038 (0.177)	<.001

Notes: negative values occurred due to the performed log transformation

Alpha temporal asymmetry. One-Way Repeated-Measures ANOVA revealed that the experimental *Condition* had a significant effect on temporal alpha asymmetry, $F(2, 62)=19.157$, $p < .001$. The differences in the mean values of temporal alpha asymmetry between the resting state (M_{BL} = 0.180, SD = 0.250), when the subjects were watching the contemplative landscapes (M_{CL} = 0.345, SD = 0.258) and when they were watching the non-contemplative landscapes (M_{NCL} = 0.257, SD = 0.239) were greater than would be expected by chance (Table 15).

Post-hoc analyses (Holm-Sidak method) indicated that the significant differences are between all pairs: NCL and BL (p =.005), CL and NCL (p =.002) and between CL and BL (p <.001).

The asymmetry values were calculated according to the formula log(R)-log (L). So, in the case of all BL, CL and NCL conditions, participants showed higher alpha power on the right temporal side of the brain than the left temporal side (Figure 80).

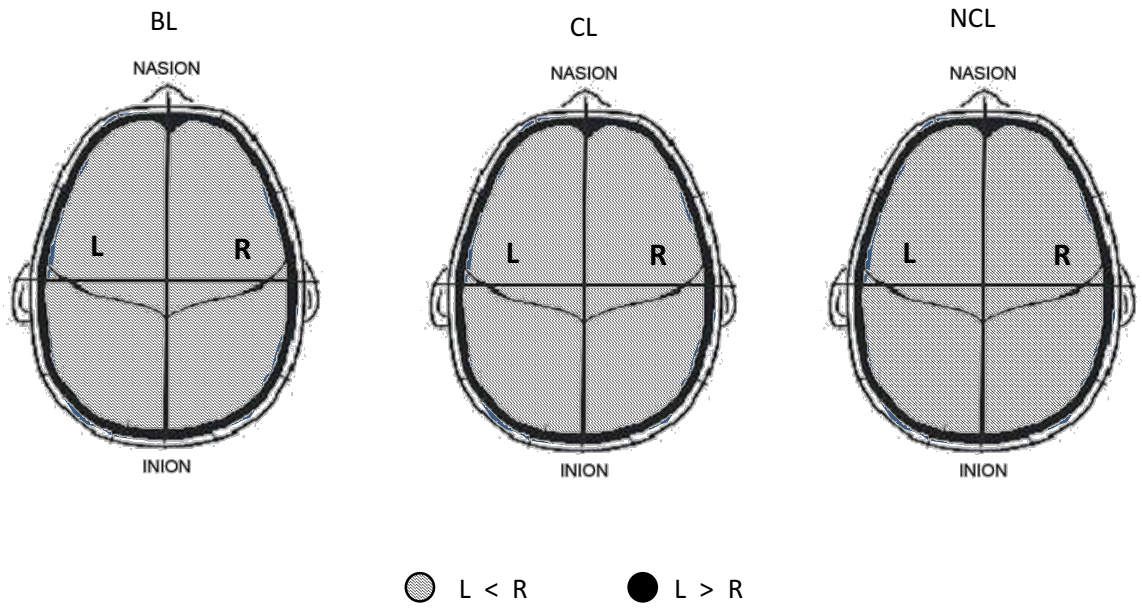


Figure 80. Topographic display showing the alpha temporal asymmetry between left (L) and right (R) hemispheres within each condition.

Table 15.

Mean power (μV^2) and Standard deviations (within parentheses) for the alpha band as a function of condition across all subjects.

	T7 (Left)	T8 (Right)	*p*
BL	0.391 (0.242)	0.571 (0.177)	<.001
CL	-0.036 (0.245)	0.308 (0.176)	<.001
NCL	-0.010 (0.251)	0.247 (0.163)	<.001

Notes: negative values occurred due to the performed log transformation

Beta temporal asymmetry. One-Way repeated-measures ANOVA revealed that the experimental *Condition* had a significant effect on temporal beta asymmetry, $F(2, 62)=24.203$, $p < .001$. The differences in the mean values of temporal beta asymmetry between the resting state (M_{BL} = -0.016, SD = 0.208), when the subjects were watching the contemplative landscapes (M_{CL} = 0.156, SD = 0.199) and when they were watching the non-contemplative landscapes (M_{NCL} = 0.093, SD = 0.167) were greater than would be expected by chance (Table 16).

Post-hoc analyses using All Pairwise Multiple Comparison Procedures (Holm-Sidak method) indicated that the significant differences are between all pairs: NCL and BL (p <.001), CL and NCL (p =.01) and between CL and BL (p <.001).

The asymmetry values were calculated according to the formula log(R) - log (L). So, in the case of all BL, CL and NCL conditions, participants showed the higher beta power on the right temporal side of the brain than the left temporal side (Figure 81).

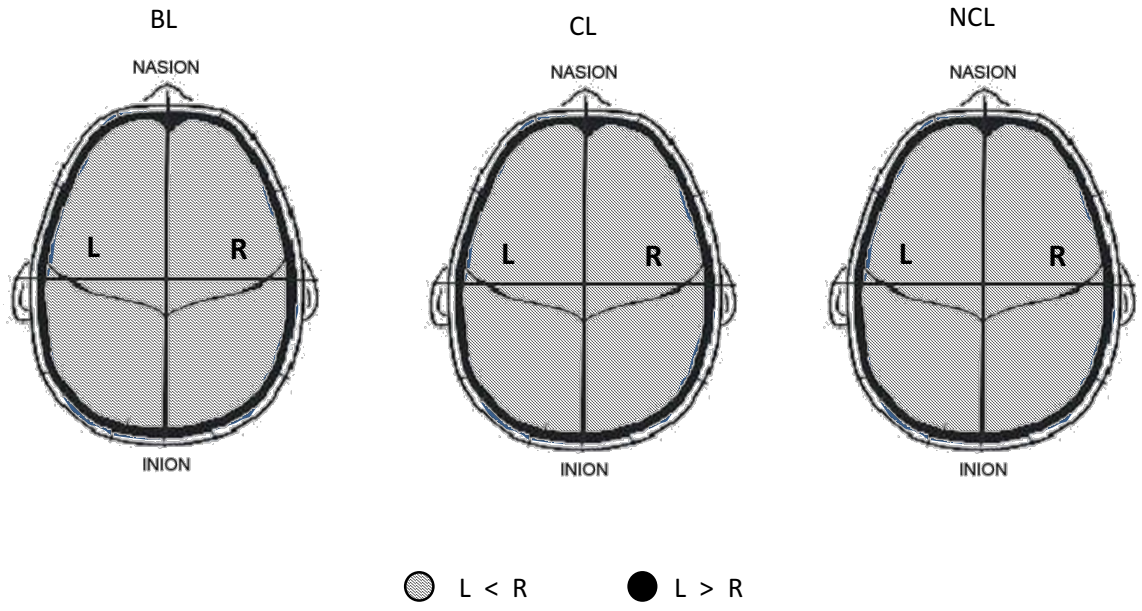


Figure 81. Topographic display showing the beta temporal asymmetry between left (L) and right (R) hemispheres within each condition.

Table 16.

Mean power (μV^2) and standard deviations (within parentheses) for the beta band as a function of condition across all subjects.

	T7 (Left)	T8 (Right)	*p*
BL	0.391 (0.242)	-0.036 (0.245)	.641
CL	0.571 (0.177)	0.308 (0.176)	<.001
NCL	0.391 (0.242)	-0.036 (0.245)	.009

Notes: negative values occurred due to the performed log transformation

Summary of supplementary analysis. The table below (Table 17) presents the summarized supplementary analyses, which were performed in order to support the explanatory effort in drawing the conclusions of this research. In order to prove that contemplative landscapes induce different brainwaves than non-contemplative ones, only statistically significant differences between CL and NCL conditions can be taken under consideration.

The supplementary analyses show that there was a significant difference in brainwave pattern between the contemplative and non-contemplative photos across all participants, in the case of delta, alpha and beta temporal asymmetry, and an almost significant difference in the case of theta temporal asymmetry.

Table 17.

Summary of performed supplementary analyses in terms of the statistical significance.

Name of supplementary analysis	Statistically significant difference between CL and NCL	*p*
Delta temporal asymmetry	Yes	.001
Theta temporal asymmetry	Almost significant	.050
Alpha temporal asymmetry	Yes	.002
Beta temporal asymmetry	Yes	.015

Brief Discussion & Conclusions

The Hypotheses of this experiment were formulated based on existing studies that associated the state of mindfulness with specific brainwave patterns. It was predicted that contemplative landscapes would induce, in the brains of participants, the pattern that was associated by researchers with the one induced by the mindfulness state, namely: left-sided alpha and theta asymmetry and increased left frontal alpha power.

Statistical tests showed that the most contemplative landscape photographs did not induce a pattern of brain activity characterized by greater left-sided frontal alpha asymmetry (H2.1, H2.2 and H2.3 are false). In fact, concerning the frontal alpha, brain responses to contemplative landscapes do not differ from brain responses to non-contemplative landscapes, and we found increased right alpha power in both cases. This means a right frontal cortex less active than the left (as higher brain activity is associated with a reduction in alpha).

Similarly, statistical tests showed that the most contemplative landscape photographs did not induce a pattern of greater left-sided frontal theta asymmetry. A similar pattern of brain activity was found in contemplative and non-contemplative conditions, regardless of a significant difference between the former and the BL, as this differences goes in an unexpected direction (higher right-sided frontal theta asymmetry associated with contemplative landscapes).

Consistent with the previous results on the frontal alpha asymmetry, the most contemplative landscape photographs did not induce the predicted pattern of greater left-sided frontal alpha power, but rather a lower alpha power on the left (meaning higher brain activation).

Taken together, the aforementioned data suggest higher activation on the left frontal lobe while observing both types landscapes, which is associated with positive emotional states (e.g., Davidson, 1996; Shaw, 2003), with the contemplative landscapes showing an increased trend to induce this phenomenon.

However, the supplementary analysis showed higher power in all bands, including beta (which has a direct association with brain activation) in the right temporal lobe during the observation of contemplative landscapes in comparison to the non-contemplative ones. Although not predicted, this finding may mean a general activation of the right temporal areas of the brain while watching the contemplative pictures, in which the difference between the hemisphere activity was the largest. In other words, it

seems that while watching contemplative landscapes (CL) participants had the right temporal parts of the brain very active. Neuroscientists call the right hemisphere of the brain the *holistic hemisphere,* because it is responsible for the global way of processing stimuli (Fink et al., 1997). It is associated with the intuitive, synthetic, non-verbal, visuo-spatial mode of processing visual input. It processes three-dimensional forms and images with a focus on similarities rather than differences, and so is seen as being strongly involved in tasks that require the understanding of complex configurations and patterns and the simultaneous processing of diverse information, like pattern recognition or spatial relationships.

The greater activation of the right hemisphere during the observation of the contemplative photos may suggest that participants were more intensely perceiving the holistic aspect of displayed landscapes, recognizing and processing the general spatial relationships between its elements, e.g., seeing a forest rather than a single tree. Considering that the majority of landscapes selected as contemplative for this study was of panoramic composition, while in the non-contemplative group there were no panoramic images, the above mentioned should be obvious: on the contemplative photos participants were induced to see panoramic, far-distance-view landscapes, which possibly stimulates the right hemisphere more. However, an increased activation of the right parietal lobe would be consistent with the above explanation, but such effect was not found.

The right temporal areas of the brain are, among other functions, responsible for visual attention (Kolb & Wishaw, 1990), interpreting visual information and memory of pictures, visual scenes and familiar faces (Milner, 1968). The difference between CL and NCL suggests that the effect of paying attention to the visual aspects of the landscapes and recognizing the scenes (i.e., associating them with familiar images or images from memory) was stronger in the case of contemplative photos.

Summing up, observing landscapes seems to induce activation on the left frontal lobe and right temporal lobe, and this pattern is possibly more pronounced when observing contemplative landscapes.

CHAPTER VI

GENERAL DISCUSSION & CONCLUSIONS

General Discussion and Conclusions

The presented thesis is set around the timeless question concerning the relationship between man and his environment. Recently the issues related to mental health and the well-being of inhabitants of urbanized areas have formed the principles for environmental psychology, which endeavors for continuous improvement of the quality of living space.

As the knowledge of these areas grows, so does the demand for evidence-based design, which led to the inclusion of different disciplines in the discourse on how to build better living environments. In the case of landscape architecture, it created the need for a design-based approach addressed directly to designers and decision makers.

The presented thesis is an example of an approach that connects the insights of landscape architecture and neuroscience, emphasizing that urban parks and gardens can be designed to provide mental-health benefits, and how powerful these design strategies can be.

Concerning the complexity of landscape itself and the creative aspect of the design process, (i.e., there is no one best design solution, but instead an infinite number of acceptable ones), the concept of contemplative landscape has been created for the purposes of this research. If we are able to describe the most contemplative landscapes by a set of variables (contemplative landscape features), we would then be able to create an evaluation tool that would measure the value of each variable and would, in the end, provide an overall contemplative score of a given landscape setting.

Having that kind of a tool could enable evaluation of existing landscapes and identification of the most contemplative ones. It would also constitute a set of evidence-based design guidelines for landscape architects that could reinforce their designs. Testing the most contemplative landscapes' influence on peoples' brains, mainly finding the benefits connected with watching those landscapes (such as the benefits of practicing mindfulness), could provide additional motivation for creating those spaces in our cities, with special concern on promoting mental health and well-being among city inhabitants.

Besides the operationalization of the concept of contemplative landscapes and investigating how they can influence our brain activity, an important objective of this

thesis was building interdisciplinary bridges by joining insights from the artistic and scientific disciplines.

One of the most important issues that this thesis was to explore was the feasibility of the operationalization of the concept of contemplative landscapes. (Are they for real? Are they distinguishable from others? Can we measure the level of their contemplativeness?). Once the contemplative score of landscape scenes is known, it would be possible to compare the most contemplative with non-contemplative ones in an EEG laboratory-based experiment. The analysis of the acquired data would lead to the answer for the second vital research question of this thesis, which was connected to the brainwave pattern induced by observing the most contemplative landscapes: can these brainwave patterns be associated with the brain activity during mindfulness meditation? The comparison of the brain activity pattern could lead to conclusions about the possible mental health benefits as an outcome of experiencing contemplative landscapes.

In order to explore the above issues, the research was divided in two parts: Study I and Study II.

The main objective of the first study was development and analysis of the Contemplative Landscape Questionnaire. First, the contemplative landscape features were identified through the literature review, which were then organized into a 10-item Questionnaire in an online-based form. Together with the preparation of the Questionnaire, the photograph collection and sampling took place. Out of 128 photos, 40 were selected and presented to ten experts together with the evaluation tool—the online version of the contemplative landscapes Questionnaire. The expert evaluation of the photographs was based on the Delphi method, commonly used for establishing consensus for a problem with multiple scenarios. After summing up the experts' responses, it was possible to analyze the Questionnaire in terms of its psychometric quality, namely reliability and validity. As a result of the first Study, the ranking of contemplative landscape images according to their contemplativeness-score, was obtained.

The first performed study (*Study I*) showed that it is possible to operationalize the concept of contemplative landscape by measuring the level of the contemplativeness of a particular setting. All of the contemplative landscape features have been identified and depend on 7 key-components of the landscape, namely: landscape layers, landform, vegetation, light and color, compatibility, archetypal elements, and character of peace and silence. The most contemplative landscapes are those with the high level of compatibility, characterized by adjacent scenery and all elements and views of the landscape worked out in terms of scale, balance and

harmony. Also, those with long distance views, where the observer is able to see the fore, middle and background, with a smooth landform and vegetation seemingly native, but maintained and organized, where all elements of composition are worked out in terms of scale and inter-relations, where colors are natural, and not too contrasting, but one can observe light and shade movements. The most contemplative landscapes contain archetypal elements, such as a water mirror or an old single oak tree, and invite rest and relaxation through their character of peace and silence.

What is more, we found that the strategies of artistic expression (such as abstract forms and repetition) do not contribute to the overall contemplative score of the landscape scenes, meaning that the landscape with explicit artistic expression strategies can score very high just as easily as very low in terms of contemplativeness.

Measuring the contemplativeness of a particular landscape view can be achieved by evaluating the image of the landscape scene of interest with the Contemplative Landscape Questionnaire. After collecting responses to seven questions of the Questionnaire and averaging the result, the score of contemplativeness of a landscape image, between 1 and 6 points, is obtained. The more contemplative the image is, the higher the score. The Contemplative Landscape Questionnaire as a tool demonstrated satisfactory measures of reliability and validity. It can also be utilized by professionals and the general public.

The CLQ can be utilized as an evaluation tool for already existing landscapes, and help with attributing a value and importance to a specific scene (for example, in order to protect it). In an inverted way, it can also serve as a landscape design tool, because it shows professionals which design strategies are the most important for creating contemplative landscape design.

The second performed study (*Study II*) was a neuroscience laboratory experiment (a transversal observational study with within-subjects design), in which the six most contemplative and the six most non-contemplative landscape settings (presented in the form of 3D videos) were displayed in two blocks of stimuli to 32 subjects, while simultaneous EEG signal recording was performed. After the raw signal processing, the One-Way and Two-Way repeated measures ANOVA analyses were performed in order to find if the differences between conditions were due to the effect of condition or random sampling variability. The analyses were performed in the case of frontal alpha and theta asymmetry and frontal alpha power—patterns associated with the state of mindfulness, according to previous studies (Aftanas, 2002; Berkovich-Ohana et al., 2011; Lagopolus et al., 2009; Takahashi et al., 2005).

The performed experiments showed that the patterns of brain activity induced by the contemplative landscape settings are different than patterns commonly

associated with the state of mindfulness, namely greater left frontal alpha and theta activity. However, this difference should come as no surprise if we consider the following limitations.

Firstly, all the referenced experiments were conducted while subjects had their eyes closed, or half-closed (looking at a neutral background). So, they were not exposed to any visual stimuli during the data acquisition. Therefore, it seems obvious that their brain activity pattern would be different than what it would be while watching landscapes. We do not know what the mindfulness pattern would be if the participants were experiencing some visual stimuli at the time of EEG signal acquisition.

Secondly, all the referenced experiments took as an indicator of the Mindfulness condition, the subject entering into a state that was primarily trained in the mindfulness course (e.g. MBSR or IBMT). As different courses generated different brain responses, the question arises: did researchers test mindfulness or a mindfulness course?

The conducted experiments showed that brain activity occurring in practitioners during mindfulness meditation cannot be associated with the pattern occurring while observing contemplative landscapes. For this reason, it seems that the only common ground between mindfulness and contemplative landscapes can be found in the initial stage of mindfulness practice—as in going outdoors, in green urban spaces or in the wild, or even watching landscape scenes on the computer—which is an important part of mindfulness training (Coleman, 2006; Langley, 2015).

Although the similarities in brainwave activity during mindfulness meditation and during the watching of contemplative landscapes are not the same, significant differences between the brain response to contemplative and non-contemplative landscapes have been found. These differences include more general activity in the right temporal lobe while watching contemplative landscapes. It suggests that the visual aspect of the images, and paying attention to the overall features together with interpreting the global context and recognition of the familiar aspect of perceived stimuli, was more intense in the case of contemplative landscape images, than in the case of non-contemplative ones.

According to the Attention Restoration Theory (ART), attention consists of two components: “involuntary attention, where attention is captured by inherently intriguing or important stimuli, and voluntary or directed attention, where attention is directed by cognitive-control processes” (Berman, 2012, p. 16). Directed attention includes all the tasks requiring mental effort and, after some time, it induces mental fatigue in people. Attention may be "restored" by switching to involuntary attention, which is associated with the exposure to natural environments.

It seems that the pattern of brain activity induced by landscapes in this experiment (greater right temporal brain activity) can be associated with the involuntary attention mechanism and does not involve direct attention. Also, in the case of contemplative landscape scenes, this effect was more intense. Following ART and the results of the presented experiment, being exposed to any green outdoor space may contribute to attention restoration, but in the case of being exposed to contemplative landscapes, this contribution seems more significant.

The presented findings suggest that contemplative landscape design can be beneficial for peoples' mental health and well-being. Should this be confirmed, experiencing contemplative landscapes can then be recommended as a part of attention restoration more than other landscapes, and can be expected to provide benefits for peoples' mental health and well-being, by giving a sense of well-being, contributing to psychological, intellectual and spiritual development, and stimulating creativity and stress reduction mechanisms (Kaplan & Kaplan, 1982, 1989).

The results also suggest lower alpha power on the left frontal lobe in comparison to the right while observing both types of landscapes, although more markedly in contemplative ones, revealing increased brain activation on the left side. This pattern is associated with positive emotional states. According to so called positive psychology, positive emotional states can stimulate mental health benefits (e.g. Bryant & Veroff, 2007), so it could also be a good reason for promoting contemplative green space design.

One of the main limitations of the presented research is the fact that the neuroscience of mindfulness is still in its infancy, so the concept of mindfulness as a state of mind while perceiving visual stimuli is not yet sufficiently explored by neuroscience. The presented study was one of the first of its kind, joining insights of landscape design and neuroscience, so this could be considered a limitation as well. Not including the pilot experiment, the study was not replicated. Therefore, there are many more questions connected to this field that remain unclear. For example, we only observed the brain response to short, twenty second videos, while it would be interesting to investigate the long term impact of contemplative spaces on our health and life-satisfaction. Also, in the presented study we worked with only healthy individuals, while it would be interesting to observe how contemplative landscapes influence the healing process of people diagnosed with different mental conditions. This, as well as many other research attempts, shall remain to be undertaken in the future.

Despite the limitations above, the presented thesis can significantly contribute to better understanding of how designed urban green spaces can influence a person's

brain activity. First of all, it is confirmed that the construct of contemplativeness of the designed landscape can be made operational, and the way the landscape is designed has a real impact on our perception. What is more, with the established *CLQ* we can evaluate the level of contemplativeness of an already existing landscape scene in order to compare and identify the landscape scenes with the highest scores. We also know which attributes of such spaces contribute mostly to the contemplative score. For that reason, we are able to reinforce the design process with evidence-based design strategies. As an effect of that, designers can gain awareness about which aspects are most important to include, and which ones to avoid, in order to achieve a contemplative character in some space.

Furthermore, the presented research identifies potential benefits of contemplative landscape design, which were found to be connected with the mental health and well-being of people exposed to them. Firstly, contemplative landscapes seem to induce, more intensely than other landscapes, a brainwave pattern that can be associated with attention restoration. With this understanding, the ART is being extended and the physical attributes of restorative spaces are included under the name of contemplative spaces. Secondly, we observed a trend of contemplative landscapes inducing more patterns of brain activity associated with positive emotional states, when compared with non-contemplative ones.

These findings can significantly benefit the landscape architecture community by demonstrating its importance as a profession, which is uniquely equipped to cope with all design aspects of contemplative landscapes for shaping urban environments. It also contributes to environmental research by helping to develop the principles of evidence-based design as well as by "blazing the trail" for similar research attempts, aiming to respond to the demand of addressing mental health benefits of designed environments (e.g., the call to research teams pronounced by the WHO at the Mental Health – Europe Conference in Helsinki [2005]).

Another contribution of this research, although not a direct one, is promotion of passive recreation and contemplating nature in urban parks and gardens among the city inhabitants, motivation for people to utilize urban green spaces as contemplative refuges, and for city decision makers to create more of those types of landscapes within the urban fabric.

Joining the insights of landscape architecture and neuroscience is not only connecting two subjects, but also two different areas of expertise, perspectives, and languages. The bridge built between art and science should only be seen as beneficial as it fosters the capacity to synthesize knowledge from multiple perspectives, and adapts to the changing disciplinary and professional realm.

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ADDENDUM

Addendum

Appendix 1. CLQ (research version), introduction and example of one setting evaluation

Appendix 2. CLQ (final version)

Appendix 3. Photographs selected for the expert´s online evaluation with CLQ, and the contemplativeness score (displaying order)

Appendix 4. Informed consent

Appendix 5. Socio-demographic questionnaire

Appendix 1

Expert Panel Evaluation of the landscapes

Dear Expert!

The following questionnaire is an evaluation addressed to a pre-selected panel of experts, who are highly experienced and knowledgeable individuals with backgrounds related to landscape architecture, architecture; design or assessment; with specialization in spatial composition and/or perception. Experts are recognized academics or designers that have developed research or designs in these areas.

Results of this questionnaire will serve for the research purposes of the PhD thesis "Contemplative Values of Urban Parks and Gardens" conducted by MLA Agnieszka Anna Olszewska under the program "Landscape Architecture and Urban Ecology" at the University of Porto (Portugal).

The questionnaire results are anonymous and will only serve for the purposes of the above mentioned unit. Your personal data can be revealed after your authorization in the list of members of the expert panel, if so desired.
Most questions concern the issues related to the design of presented settings. Please use your knowledge and experience to provide the most objective answers. In case of doubts don´t hesitate to contact me!
Before starting, please read the following instructions:

On the following page, you will find a code for expert evaluation consisting of part A and part B. (You don't have to remember the code because it will be recalled with every question; however, you can always return to the first page.)
Part A is a table containing 8 categories of designed contemplative landscape.
Part B concerns the type of landscape composition.

You will then be forwarded to evaluate 40 different landscape settings. There are 10 questions per setting repeating for each picture. The questionnaire will take approx. 40 - 60 minutes.

I really appreciate your participation!
Thank you,

Agnieszka Anna Olszewska

A - Contemplative landscape evaluation code (based on VRM model)

CATEGORY / SCORE	LAYERS OF THE LANDSCAPE	LANDFORM	VEGETATION	LIGHT/COLOR	COMPATIBILITY	ARCHETYPAL ELEMENTS	ARTISTIC EXPRESSION	CHARACTER OF PEACE AND SILENCE
6 5	Layers (fore, middle, background) greatly enhance the visual quality; far distance view (400m or more)	Ondulating lanform, natural lines	High diversity of vegetation, majority of native species; seasonally changing vegetation	Colors from, the warm palette (no vivid/ no contrasting colors) AND visibility of light/ shade	Physical relations between elements; openings and closings of views are worked out AND explicit spatial order, harmony, balance between "natural" and "created"	Archetypal elements strongly influence the overall perception	Contemplative artistic strategies strongly influence the overall perception	Explicit character of peace and silence, in contrast to the urban environment (reorientation); invites to rest and relax AND gives sense of solitude
4 3	Layers moderately enhance the overall visual quality	Flat OR rugged landform	Moderate diversity of vegetation, moderate changes across the seasons	Moderate amount of contrasting colors, moderate amount of light / shade	Physical and visual relations are not clear OR presence of some elements disturbing the harmony and balance	Archetypal elements are present but not important for the overall perception	Contemplative artistic strategies are present but not important for the overall perception	Moderate character of peace and silence AND/OR moderate sense of solitude AND/OR less contrast with urban environment
2 1	Layers do not enhance the overall visual quality OR no layers	Landform is not very significant to the setting OR hard to say	Low diversity of vegetation, minority of native species; no seasonal changes	Lots of vivid, contrasting colors, light and shade are not visible	Physical and visual relations are not worked out/ worked out well OR chaos/ lack of harmony	No archetypal elements	No contemplative artistic strategies	No character of peace and silence, busy, no conrast with the urban environment

Chart based on VRM model

B - Landscape composition types (based on: R.Smardon, et al. 1986; Foundations for Visual Project Analysis)

Canopied - Covered or bridged by the uppermost spreading branchy layer of a forest

Enclosed - Enveloped or surrounded; bounded or encompassed

Feature - A district or outstanding part, quality , or character of something

Focal - Of or placed at a focus; as a focal point

Panoramic - A continuous series of scenes or events, constantly changing scene

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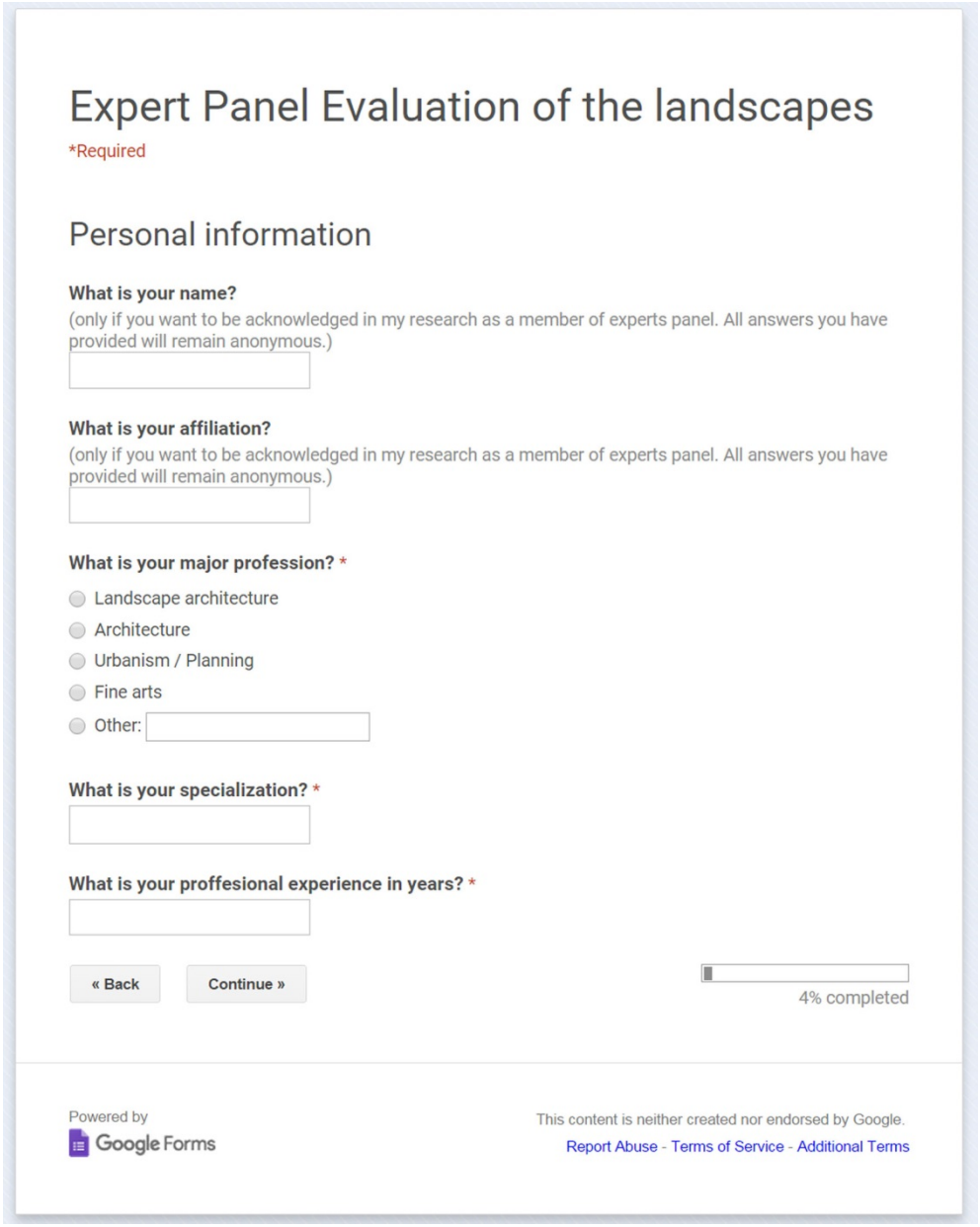

Expert Panel Evaluation of the landscapes

*Required

Personal information

What is your name?
(only if you want to be acknowledged in my research as a member of experts panel. All answers you have provided will remain anonymous.)

What is your affiliation?
(only if you want to be acknowledged in my research as a member of experts panel. All answers you have provided will remain anonymous.)

What is your major profession? *

- Landscape architecture
- Architecture
- Urbanism / Planning
- Fine arts
- Other:

What is your specialization? *

What is your proffesional experience in years? *

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Expert Panel Evaluation of the landscapes

*Required

Setting 1

1.1 Landscape layers *

	1	2	3	4	5	6	
Layers do not enhance overall visual quality OR layers are absent	○	○	○	○	○	○	Layers (fore, middle, background) greatly enhance visual quality; far distance view (>400m)

1.2 Landform *

	1	2	3	4	5	6	
Landform not very significant OR hard to say	○	○	○	○	○	○	Ondulating landform, natural lines

1.3 Vegetation *

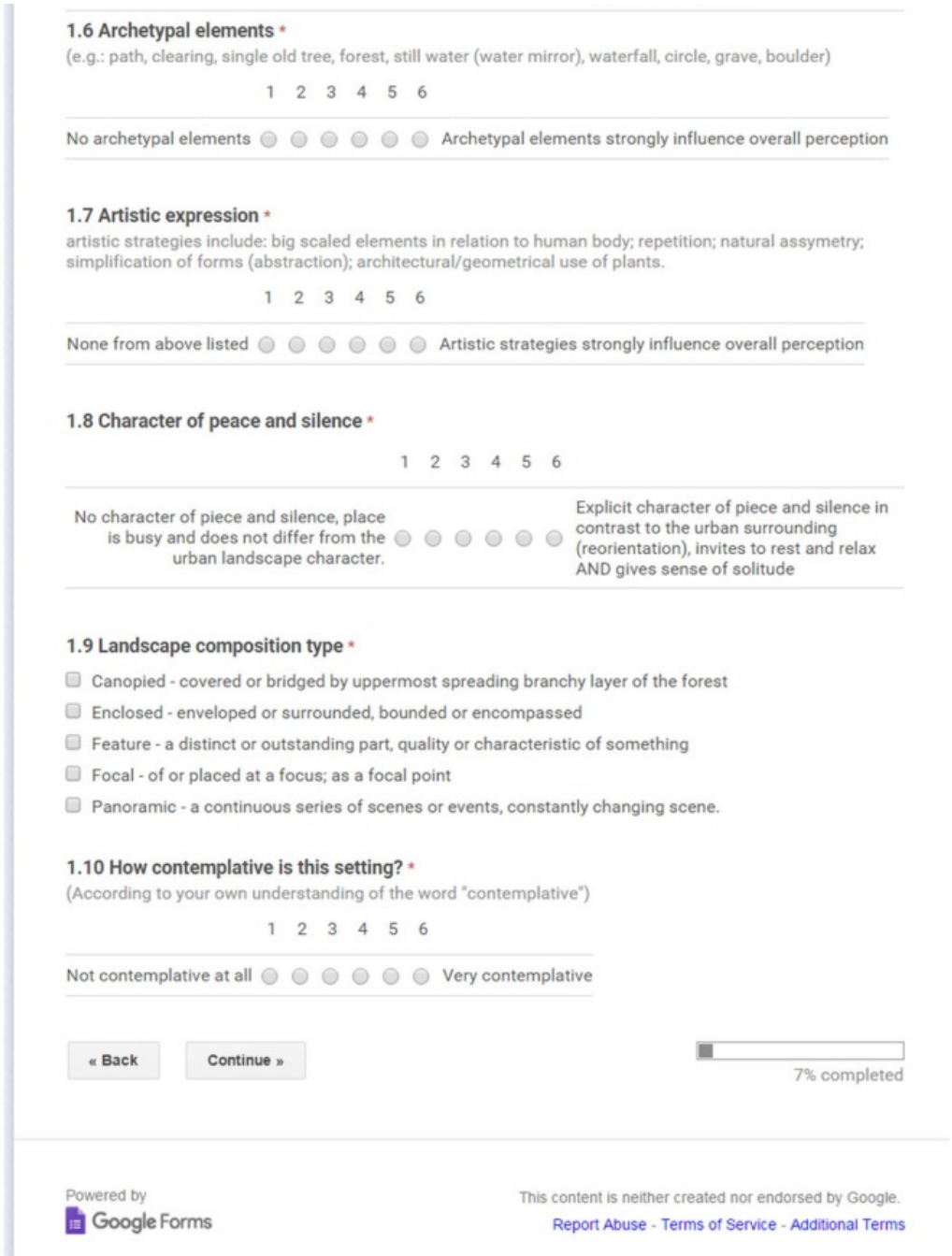
	1	2	3	4	5	6	
Low diversity of vegetation, minority of native species; no seasonal changes.	○	○	○	○	○	○	High diversity of vegetation; plants seem native; seasonally changing vegetation

1.4 Light /Color *

	1	2	3	4	5	6	
Lots of vivid, contrasting colors, light&shade not visible.	○	○	○	○	○	○	Colors from the warm palette (lack of very vivid contrasting colors) AND visibility of light&shade

1.5 Compatibility *

	1	2	3	4	5	6	
Physical and visual relations are not worked out well OR lack of spatial order OR lack of harmony between "natural" and "created"	○	○	○	○	○	○	Physical relations between elements as well as openings and closings of views are worked out AND explicit spatial order, harmony, balance between "natural" and "created"



1.6 Archetypal elements *
(e.g.: path, clearing, single old tree, forest, still water (water mirror), waterfall, circle, grave, boulder)

1 2 3 4 5 6

No archetypal elements ○ ○ ○ ○ ○ ○ Archetypal elements strongly influence overall perception

1.7 Artistic expression *
artistic strategies include: big scaled elements in relation to human body; repetition; natural assymetry; simplification of forms (abstraction); architectural/geometrical use of plants.

1 2 3 4 5 6

None from above listed ○ ○ ○ ○ ○ ○ Artistic strategies strongly influence overall perception

1.8 Character of peace and silence *

1 2 3 4 5 6

No character of piece and silence, place is busy and does not differ from the urban landscape character. ○ ○ ○ ○ ○ ○ Explicit character of piece and silence in contrast to the urban surrounding (reorientation), invites to rest and relax AND gives sense of solitude

1.9 Landscape composition type *

- ☐ Canopied - covered or bridged by uppermost spreading branchy layer of the forest
- ☐ Enclosed - enveloped or surrounded, bounded or encompassed
- ☐ Feature - a distinct or outstanding part, quality or characteristic of something
- ☐ Focal - of or placed at a focus; as a focal point
- ☐ Panoramic - a continuous series of scenes or events, constantly changing scene.

1.10 How contemplative is this setting? *
(According to your own understanding of the word "contemplative")

1 2 3 4 5 6

Not contemplative at all ○ ○ ○ ○ ○ ○ Very contemplative

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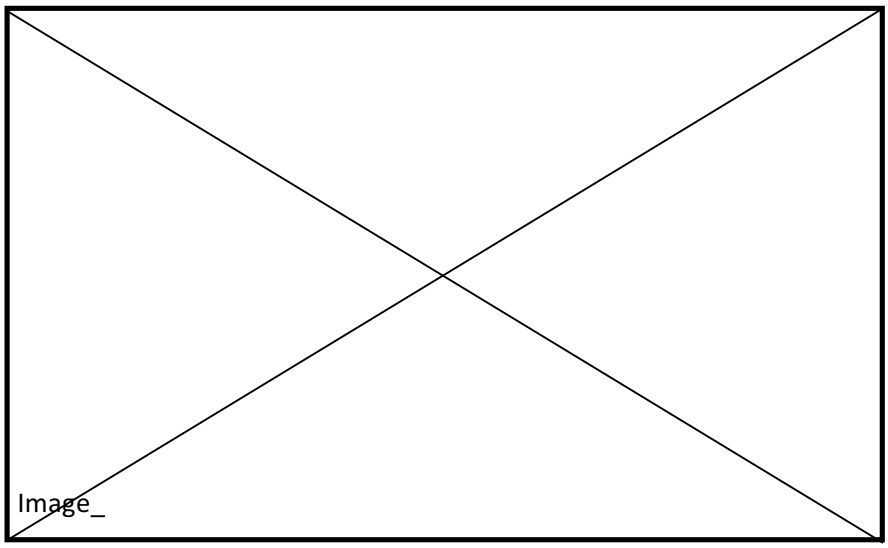
Appendix 2



1. Landscape layers
Mark only one answer

Layers do not enhance overall visual quality OR layers are absent.	1 O	2 O	3 O	4 O	5 O	6 O	Layers (fore, middle, background) greatly enhance visual quality; far Distance view (>400m)

2. Landform
Mark only one answer

Landform not very significant OR hard to say	1 O	2 O	3 O	4 O	5 O	6 O	Undulating landform, natural lines

3. Vegetation
Mark only one answer

Low diversity of vegetation, minority of native species; no seasonal changes.	1 O	2 O	3 O	4 O	5 O	6 O	High diversity of vegetation; plants seem native; seasonally changing vegetation

4. Light and Color
Mark only one answer

Lots of vivid, contrasting colors, light & shade not visible.	1 O	2 O	3 O	4 O	5 O	6 O	Colors from the warm palette (lack of very vivid contrasting colors) AND visibility of light & shade

5. Compatibility
Mark only one answer

Physical and visual relations are not worked out well OR lack of spatial order OR lack of harmony between "natural" and "created"	1 O	2 O	3 O	4 O	5 O	6 O	Physical relations between elements as well as openings and closings of views are worked out AND explicit spatial order, harmony, balance between "natural" and "created"

6. Archetypal elements
(e.g.: path, clearing, single old tree, forest, still water (water mirror), waterfall, circle, grave, boulder)
Mark only one answer

No archetypal elements	1 O	2 O	3 O	4 O	5 O	6 O	Archetypal elements strongly influence overall perception

7. Character of peace and silence
Mark only one answer

No character of peace and silence, place is busy and do not differ from the urban landscape character.	1 O	2 O	3 O	4 O	5 O	6 O	Explicit character of peace and silence in contrast to the urban surrounding (reorientation), invites to rest and relax AND gives sense of solitude

8. Landscape composition type (OPTIONAL)
Check one dominant answer

□ Canopied covered or bridged by uppermost spreading branchy layer of the forest
□ Enclosed enveloped or surrounded, bounded or encompassed
□ Feature a distinct or outstanding part, quality or characteristic of something
□ Focal of or placed at a focus; as a focal point
□ Panoramic a continuous series of scenes or events, constantly changing scene.

Appendix 3

#01_*Serralves*, Porto, Portugal
CLQ_score: 4.17

#02_The National 9/11 Memorial, New York, USA
CLQ_score: 3.36

#03_ Balboa Park, San Diego, USA
CLQ_score: 3.30

#04_Parchi di Nervi, Genoa, Italy
CLQ_score: 4.94

#05_*Serralves*, Porto, Portugal
CLQ_score: 3.21

#06_Parchi di Nervi, Genoa, Italy
CLQ_score: 3.17

#07_ Parque da Cidade, Porto, Portugal
CLQ_score: 3.14

#08_Parchi di Nervi, Genoa, Italy
CLQ_score: 3.37

#09_Naumkeag Estate, Stockbridge, MA, USA
CLQ_score: 4.20

#10_Parque da Cidade, Porto, Portugal
CLQ_score: 4.33

#11_Naumkeag Estate, Stockbridge, MA, USA
CLQ_score: 4.21

#12_Olmsted Woods, Washington DC, USA
CLQ_score: 4.37

#13_ Parchi di Nervi, Genoa, Italy
CLQ_score: 3.91

#14_ *Serralves*, Porto, Portugal
CLQ_score: 4.01

#15_ Procpect Park, New York, USA
CLQ_score: 4.73

#16_ Central Park, New York, USA
CLQ_score: 4.86

#17_*Serralves*, Porto, Portugal
CLQ_score: 3.76

#18_Parque da Cidade, Porto, Portugal
CLQ_score: 3.93

#19_*Balboa Park*, San Diego, USA
CLQ_score: 4.80

#20_Parque da Cidade, Porto, Portugal
CLQ_score: 4.30

#21_*Balboa Park*, San Diego, USA
CLQ_score: 3.96

#22_*Serralves*, Porto, Portugal
CLQ_score: 3.66

#23_ Parchi di Nervi, Genoa, Italy
CLQ_score: 5.11

#24_Naumkeag Estate, Stockbridge, MA, USA
CLQ_score: 5.13

#25_Balboa Park, San Diego, USA
CLQ_score: 2.83

#26_Naumkeag Estate, Stockbridge, MA, USA
CLQ_score: 4.17

#27_ Parchi di Nervi, Genoa, Italy
CLQ_score: 3.51

#28_Balboa Park, San Diego, USA
CLQ_score: 3.67

#29_*Serralves*, Porto, Portugal
CLQ_score: 4.27

#30_Bishop´s Garden, Washington DC, USA
CLQ_score: 4.01

#31_*Serralves*, Porto, Portugal
CLQ_score: 4.57

#32_ Prospect Park, New York, USA
CLQ_score: 4.50

#33_Parque da Cidade, Porto, Portugal
CLQ_score: 4.49

#34_ Parchi di Nervi, Genoa, Italy
CLQ_score: 3.83

#35_ Procpect Park, New York, USA
CLQ_score: 3.83

#36_Naumkeag Estate, Stockbridge, MA, USA
CLQ_score: 4.37

#37_ Prospect Park, New York, USA
CLQ_score: 4.04

#38_*Serralves*, Porto, Portugal
CLQ_score: 4.33

#39_Bishop´s Garden, Washington DC, USA
CLQ_score: 4.00

#40_Salk Institute, La Jolla, CA, USA
CLQ_score: 3.56

Appendix 4

Informed Consent

The following study is part of a PhD project called **"Contemplative values in Urban Parks and Gardens"** and consists of a new method of assessing the values of the urban landscapes basing on EEG data collection and analysis (electroencephalography).

In this experiment you will see images of some landscape settings, you need to relax and pay attention to them and try to feel like you are in the place which you are observing.

The research is realized in Porto Interactive Center in The Faculty of Sciences of University of Porto with ENOBIO equipment. None of the procedures is harmful or dangerous for your health.

The collected information is confidential and the results will not be treated individually but only in group. The results of the experiment will be anonymous and used only for purposes of that investigation.

Your participation is completely voluntary (your authorization or refusal will not have any consequences for you), and it will be a great support for our research in better understanding the functioning of human brain.

Thank you for your cooperation,

*I, signed below, (full name of the participant)*_____

declare, that I have obtained the knowledge necessary to participate in this experiment. I was informed of all aspects that I consider important, and I had a chance to consult all the doubts about the experiment. I participate in the anonymous form, and that experiment will not be harmful for me in any aspect

Participant (signature) ***Date***

_____ _____/_____/_____

Responsible researcher (signature) ***Date***

_____ _____/_____/_____

_ _

I, signed below, (full name of the participant) _____

declare, that I have obtained the knowledge necessary to participate in this experiment. I was informed of all aspects that I consider important, and I had a chance to consult all the doubts about the experiment. I participate in the anonymous form, and that experiment will not be harmful for me in any aspect

Participant (signature) ***Date***

_____ _____/_____/_____

Responsible researcher (signature) ***Date***

_____ _____/_____/_____

Appendix 5

Socio-demographic Questionnaire

Code			

1) Date of birth: ___/___/_____
2) Age: _____
3) Gender □ F □ M
4) Nacionality: _____
5) Civil status:
   - □ Single
   - □ Married
   - □ Widow/er
   - □ Divorced/ Separeted

6) Last education grade obtained:
   - □ None
   - □ Didn't finish the elementary school
   - □ 1st cicle (1-4 years)
   - □ 2nd cycle (5-6 years)
   - □ 3rd cycle (7-9 years)
   - □ Secondary school (10-11 years)
   - □ 12th year
   - □ Bachelor exam
   - □ Licence
   - □ Master
   - □ Other

7) Profession:_____
   - □ Active
   - □ Not active
   - □ medical problems
   - □ unemployed
   - □ Retired
   - □ Student

8) Lateralization:
   - □ Left-handed
   - □ Right-handed

9) Hearing:

□ Normal
□ Corrected. Method of correction: _____

10) Vision:

□ Normal
□ Corrected. Method of correction: _____

11) Medical record:

Mental health record:

□ No □ Yes, What?_____

Neurologic health record:

□ No □ Yes What?_____

12) Your alcohol consumption:

□ Often
□ Moderated
□ Occasional
□ No consumption

13) Describe your nutrition habits.:_____ _____

_____

14) Did you sleep well that night?

□ No
□ Yes

Estimated number of hours:_____

15) Describe the quality of your sleep :

_____

16) Is there any alternation of your daily routine during last week that you would like to mention here?

□ No □ Yes.

Which?_____

17) Is there any incident during last week connected to your health that you would like to mention here?

□ No □ Yes.

Which?_____

Please, check if you have answered all the questions
Thank you for you cooperation!