

Enhancing The Human-Nature Connection Through Biophilic Design In the Built Environment: A Branch Library on the Banks of Lake Union

Heli Ojamaa

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Committee:

Gundula Proksch, Chair

Christopher Meek

Heather Burpee

Judith Heerwagen

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Heli Ojamaa

University of Washington

Abstract

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Heli Ojamaa

Chair of the Supervisory Committee:
Assistant Professor, Gundula Proksch
Architecture

The theory of biophilia states that we as humans have an affinity for and a biological need to connect with nature, living systems and processes. Research on the topic has demonstrated that the strength of this connection impacts on our personal wellbeing, productivity and societal relationships. With an increasing percentage of the global population living in urban areas, understanding these connections, the importance of them and how they can inform an architectural approach becomes even more important. Rooted in the research of the topics of biophilia and biophilic design, this thesis includes a translation of lessons learned from experience and analysis of projects in Nordic and Baltic countries through the lens of biophilic design. It explores the role architecture can have in enhancing the human-nature connection to both a general and project specific design approach, developing and refining frameworks and methodologies for analyzing and understanding the topic, how it relates to architecture and can be implemented in the design process. As part of the continued refinement, this thesis applied the developing ideas to see how this biophilic design approach can inform and connect a program, context and architectural response to meet the project design goals of reconnecting and enhancing the human-nature connection through a branch Public Library of the banks of Lake Union in Seattle, Washington. As a result, fostering and enhancing a biophilic connection and creating opportunities for engagement through the architecture that did not otherwise exist.

This thesis is dedicated to John Stamets: teacher, photographer, storyteller and friend.
Your enthusiasm and interest in my Estonian heritage and my studies always made me smile.
You left us too soon and it saddened me not being able to share these travel experiences with you.

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01 | BACKGROUND + INTRODUCTION

This thesis exploration began years ago with a realization I had after travelling in several countries where the languages and cultures were foreign to me, but I could always relate to and understand the nature around me.

Figure 1.1 Hyytiälä Forestry Field Station, Hyytiälä, Finland



NATURE



Years later I found out there was a term for this connection- Biophilia, or what can be defined as a love of life and living systems based on an innate human connection to all that is alive and vital. The concept of biophilia has a lot to do with how we as humans relate to our environment and the world around us.

Figure 1.2 Lake Union Park. Seattle, Washington.

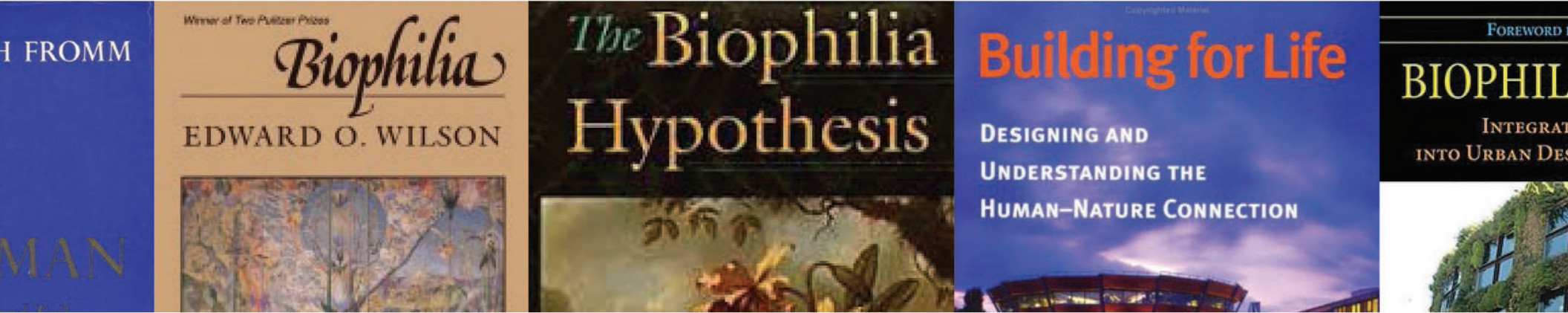


HUMAN - NATURE CONNECTION : BIOPHILIA

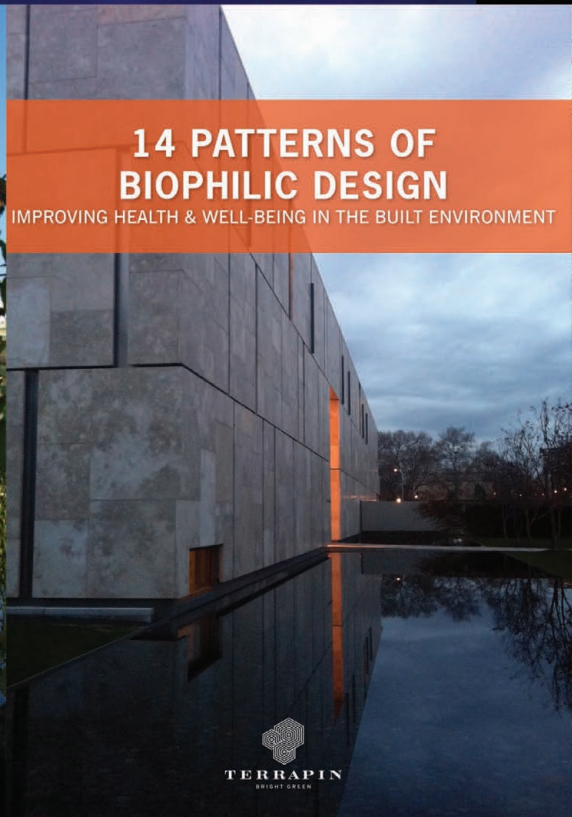
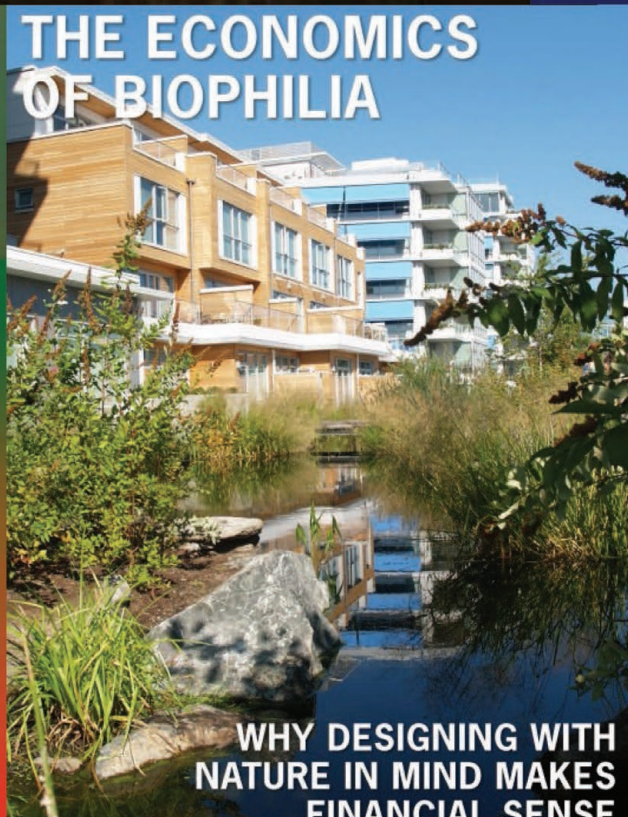
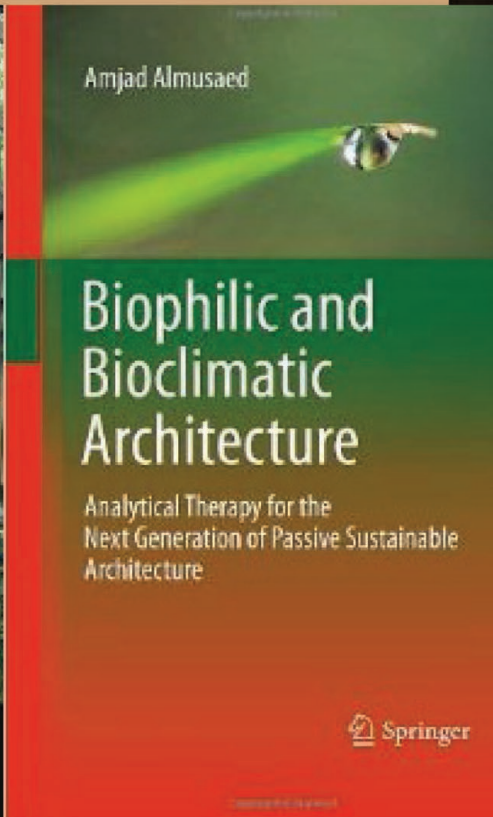
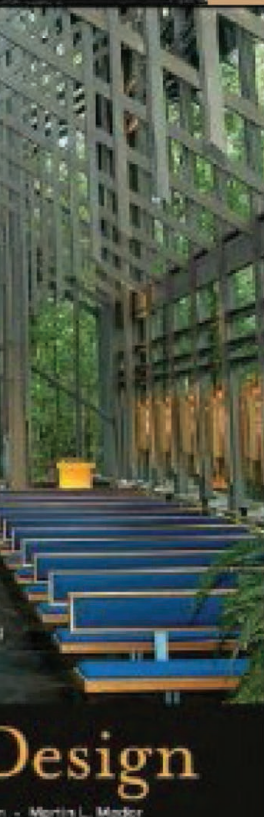


For a huge percentage of human evolution, our surroundings have mostly consisted of natural environments, but exponentially following the agricultural revolution we find ourselves living and spending time in built environments. Biophilic Design translates the understanding of the inherent human affinity to affiliate with natural systems and processes called biophilia into the design of the built environment. According to the EPA, 90% of our days are spent indoors (EPA, 2004, rev2009), but with increasing world population and urbanization even the time not spent indoors are spent in designed environments. Because research shows that a connection to nature is not just something that makes us feel good, it is vital to our health and wellbeing, an understanding of biophilia and how it informs how we design our environments becomes more critical.(W. Browning, Ryan, & Clancy, 2014)

Figure 1.3 Biophila and Biophilic Design Publications



THE HUMAN - NATURE CONNECTION THROUGH BIOPHILIC DESIGN IN THE BUILT ENVIRONMENT



Nature and design are both strong parts of the cultural identity of the Nordic and Baltic countries, a reason why I think that often we find very timeless pieces of design coming from the region. Even though it is doubtful that biophilic design was a specific intention, they offer a good precedent for understanding how design can functionally and beautifully connect us with nature.

Figure 1.4 Collection of Nordic-Baltic Design



nature+design NORDIC-BALTIC COUNTRIES cultural identity



This thesis began as research and remote case studies, but after receiving a Valle Scholarship and partaking in the Architecture in Scandinavia Program. I had the opportunity to spend several months experiencing and analyzing buildings and places throughout the Nordic and Baltic countries through the lens of biophilic design trying to understand what role architectural design can have in enhancing a human-nature connection. I set out with the goal of developing an overall understanding of the topic, how it has been applied- intentionally or not- and how that understanding can inform a new design approaches or ways of thinking that can both be general and project specific.

Figure 1.5 Artipelag, Stockholm, Sweden.

ENHANCING THE HUMAN - NATURE CONNECTION THROUGH BIOPHILIC DESIGN IN THE BUILT ENVIRONMENT:



Returning from my travels I began translating lessons learned from my experiences to a general understanding of biophilia and approaches for applying these principles in design. The general definition and approach was simultaneously developed and refined while testing the ideas through a design exercise using the specific program of a branch public library in the context of South Lake Union, in Seattle, Washington.

Figure 1.6 Design Concept Models



ENHANCING THE HUMAN - NATURE CONNECTION THROUGH BIOPHILIC DESIGN IN THE BUILT ENVIRONMENT:

A Branch Library on the Banks of Lake Union

02 | RESEARCH + FOUNDATIONS : General Biophilia and Biophilic Design Concepts

“we continue to see ourselves and our artifacts independently of the Grand Clock of Nature, but the challenge of today is also likely to alter the received polarity between nature and the human artifact....

....Modern architecture at large has been future oriented. Yet, we are primarily historical and biological beings whose neural systems, senses, and reactions have developed during millions of years. Time in biology has different scales than in human culture, such as organismic time, bio-chemical time, ecological time, and evolutionary time.”
-Juhani Pallasmaa (Pallasmaa, 2011)

OVERVIEW

Typically we approach understanding a topic from a certain perspective and with certain goals in mind shaping how we want or need to understand the information and then how we are going to use it. For example in looking at a food menu at a restaurant, a nutritionist is looking at nutrient content and interested in establishing a balanced meal, a chef is examining preparation time, ingredients and flavors and how to best combine them, while a restaurant owner is looking at the economics behind the menu. The same is true with the topics of biophilia and biophilic design, especially since the topics and related benefits cross over many professions and fields, meaning that both the type of documentation on topic and the audience it is directed towards can vary greatly. One can be trying to understand the topics from a general interest, academic, research, or professional perspective. Specifically from a professional perspective in the design and architecture field, one could have a general professional interest in the topic or one that is driven by or tied to a specific metric or certification-- both impacting the filter through which the topics are viewed.

I was introduced to the topics of biophilia and biophilic design through working on a project looking to achieve Living Building Challenge Certification where Biophilia is one of the Certification's Imperatives, or requirements achieved by including representations of the "six established Biophilic Design Elements" in the building design (I. L. B. Institute, 2010). As my first introduction to the topic, I did not initially realize that this only one interpretation and implementation method of biophilia. Biophilia and biophilic design began connecting many dots and elements that I saw being part of good design. My interest in the topic grew beyond the extent of knowledge I for the particular project application and certification to trying to get a much more comprehensive understanding of the topic and its application in the architecture and design field.

Understanding all the underpinnings and benefits of biophilia, to fully appreciate and be able to utilize its value, is difficult because of the complexity of the topic. A full understanding of biophilia and its benefits would require interdisciplinary dialogue and specific knowledge in the areas of evolutionary biology and psychology, biology, psychology, physiology, neuroscience, cognitive archeology and the general field of medicine to name a few. This complexity of the topic makes it extremely valuable and relevant because many disciplines could find a benefit in researching and understanding biophilia.



Figure 2.1 Painting from Chauvet Cave (Chauvet J., 1996)



Figure 2.2 Temppeliaukio Church

I quickly found out one of the first of many contradictions related to the topic-- it is very complex, yet very simple. This section, reflecting the approach of a getting a base understanding, surveying where the current dialogue is on the topic, and how the topics are implemented in the design field is a mere sliver of the research that I touched on throughout this thesis process and it has been a constant balance between this complexity and simplicity. Within the research, I searched for answers and clarifications, but found more questions to be answered and dialogue to be had. Because many aspects of the topics biophilia and biophilic design are not clearly defined or definitions widely accepted or agreed upon, this also gave me a bit of freedom to create my own interpretation and understanding as part of the process. Still, I often wondered how important clearly defined definitions of the topics and the aspects related to them are. As Shakespeare said “a rose by any other name is just as sweet”. However, clear language related to a topic gives a common language that becomes a tool to discuss, communicate and understand a topic. Slow acceptance and integration of biophilic design into practice could partially be attributed to there being a lack of a clear language about what biophilic design is, how it is defined and can be applied to practice.

Within that complexity, one must remember biophilia is innate, it speaks to something that is in us and has always been as a human race, maybe we just have to listen a bit more. Time, as Juhani Pallasmaa (Pallasmaa, 2011) discusses has different scales, but some inclinations and responses may not change with time. One can see and interpret many parallels between the image of cave paintings in Chauvet Cave from the Upper Paleolithic Era (Figure 2.1) and a boy following a rainstorm in 2014 at Temppeliaukio Church, Finland designed in 1969 (Figure 2.2).

COMPLEXITY

I found that both the topics of biophilia and biophilic design can be extremely complicated-- connecting many different fields and areas of study often making the topic difficult to understand, wrap your head around and especially to know how to implement



Figure 2.3 A complex spider web (ionEurope, 2011)

SIMPLICITY

At the same time it can be very simple. Something as simple as bench, under a light looking out the ever dynamic scene in front of you.



Figure 2.4 Inari, Finland overlooking River Juutua



Figure 2.5 Roses in Stockholm, Sweden.

BASE UNDERSTANDING_ BIOPHILIA

Returning to an analogy with roses, we have all heard the phrase “stop and smell the roses”, whose intended meaning is to slow down and enjoy life. According to research that will be discussed later, this cliché could be taken quite literally, as such an inherent attraction and connection with nature known as biophilia results not only a more “enjoyed life”, but a longer healthier life.

Broken down to its root origins, the term biophilia could be looked at as : -bio = indicating or involving life or living organisms and -philia = tendency towards, loving of (“ -bio” , “-philia,” 2015). Biophilia as a concept has been present and understood in many cultures for centuries, but the term rooted from Ancient Greek meaning “ love of life” was first used by German social psychologist Erich Fromm in the 70s to describe a psychological orientation and attraction towards that which is living (Fromm & Mazal Holocaust, 1973). The following decade contained two seminal works on biophilia and its benefits, one that popularizing the term and the other a significant study that made a case for the restorative benefits of having a visible connection to nature (R. S. Ulrich, 1984). In “Biophilia: The Human Bond With Other Species”, Edward O. Wilson through personal narratives rooted in a strong conservation ethic argues that biophilia, our “natural affinity for life” is the “very essence of our humanity and binds us to all living things” (E. O. Wilson, 1984). Ulrich’s study, although not referencing the term biophilia in its content, in many ways began the conversation about its associated health benefits through documenting and publishing results associating reduced recovery time with less negative evaluations and use of painkillers following surgery to patients with a view to the outdoors as opposed to a brick wall (R. S. Ulrich, 1984).

Two branches of psychology become important in understanding biophilia:

Evolutionary Psychology and Environmental Psychology

Evolutionary Psychology examines human evolutionary adaptations or what can be termed as human nature that is the product of a universal set of evolved psychological adaptations from our ancestral environment (WikipediaContributors, 2015) and Environmental Psychology studies the relationships between humans and their environments, including how we respond to them (Kopec, 2006).

The basic concept of biophilia is that we as a species have evolved and biologically developed in natural, not “built” or human created environments for 99% our species history and as a result we have an innately emotional affiliation with other living organisms and natural processes (S. Kellert, 2015). Evolutionary Psychologists use the term Environment of Evolutionary Adaption (EEA) to describe this-- the environment that a species has evolved in and is therefore adapted to live in (Grinde & Patil, 2009). Evolving in a natural environment has created a biological need for a connection with nature on a physical, mental, and social level that impacts our personal wellbeing, productivity and societal relationships, even now when it can be hard to distinguish what a natural environment even is (TerrapinBrightGreen, 2012).

The importance and relevance of understanding this evolutionary adaption is that there can be negative effects as a result of changing something that the species has evolved to. When species evolve and deviate from an aspect or way of life that we have been genetically designed for, it is referred to as creating mismatches. These could have positive impacts like being able to heat your home during the winter as opposed to



Figure 2.6 Staircase with reconstructions from various stages of evolution of the human species at Moesgaard Museum of Prehistory and Ethnography in Aarhus, Denmark.

increased chance of death from freezing in a cave, but they could also have negative effects referred to as discords that cause some form of “stress” to the system (Grinde & Patil, 2009; Judith Heerwagen, 2008). Implications of these discords on the human species and benefits for restoring them will be discussed when discussing the benefits of biophilic design, but knowing that the effects of stress have been identified as having a direct impact on our physical, mental and emotional state, one can imagine the relevancy in understanding this evolutionary adaptation.

There are a couple facts and statistics that emphasize the importance and timeliness of understanding the concept of biophilia:

- There is a rapidly growing body of research and evidence demonstrating that contact with nature reduces stress and a lack of that connection is directly related to stress (W. Browning et al., 2014; Ulrich, 2008)

- 70-90% of all doctor's visits are for stress-related complaints or stress-induced illnesses

- Stress contributes to 50% of all illnesses in the U.S. (NationalCenterForHealthStatistics, 2001; Olpin & Hesson, 2013; Salleh, 2008)

- Americans spend an average of 90% of their day indoors (EPA, 2004, rev2009), with the remaining 10% is most likely in urban areas.

- In 2011, the global population reached a milestone of 7 billion people, more than 50% of which living in urban areas, with both of these numbers being projected to increase exponentially to 70-80% of 9 billion people globally and 90% in the U.S. living in urban areas by 2050

- (Combitech, 2013; Organization, 2014)

We as a species will continue to evolve, rooted in and influenced by our evolutionary past yet we are as Kahn and Habasch describe “a technological species and have been since we fashioned tools out of stone” (Kahn & Hasbach, 2012). Technology evolves at a much faster speed than the human psychology, as discussed by both Kahn and Kopec and as alluded to by Pallasmaa in the section's opening quote “time in biology has different scales than in human culture” (Kahn & Hasbach, 2012; Kopec, 2006; Pallasmaa, 2011). It becomes a challenge to keep up with the speed of technological evolution while remembering and keeping in perspective our slower biological evolution as organisms that have just as much impact on us today.

We once as humans depended solely on the rising and setting sun for light with which to be productive and function in this world. The sun not only controlled our daily and seasonal activities, but wavelengths of light affect and control parts of our body's chemistry and impact functions of our “nervous system, circadian rhythms, pituitary gland, endocrine system, and the pineal gland”. We may now through technology be able to control the light around us, extending it far past the setting sun, but the stable functioning of our body systems still depend on this daily, or circadian rhythm as a regulator. (Hobday, 2006; Torcellini, 2002)

Although the advancement of a light switch gives us the ability to turn light quickly “on/off”, as shown in Figure 2.8 we may be “programmed” for a more gradual transition that when out of sync can have impacts on our health. This is an example of how technology, here the example of the invention of electric light, creates a rapid change, while our human systems and responses may evolve on a much slower scale and disregarding this can have significant impacts on our health. (Hobday, 2006; Torcellini, 2002) To put this in a larger perspective, it is helpful to see various developments in the larger timeline representative of human existence as is represented in the long timeline of our species history (note: timeline not to scale) as reflected in Jason McClennan’s diagram “A Timeline of Disconnect” (Figure 2.9).



Figure 2.7 Studies Show that contact with nature reduces stress, and a lack of connection to nature is directly related to stress—not just for people but for the buildings and ecosystems in which we live and depend for our survival.

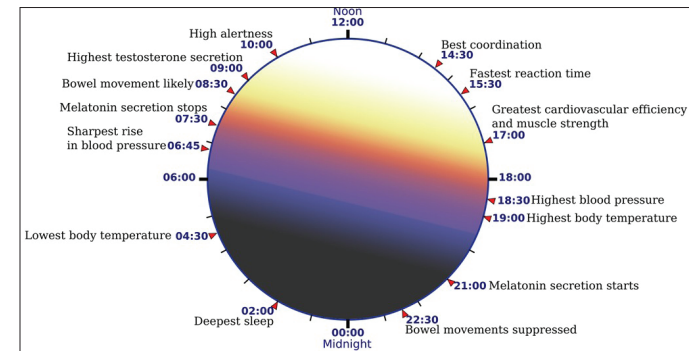


Figure 2.9 Graphic of circadian clock and circadian rhythms relation to body systems and functions

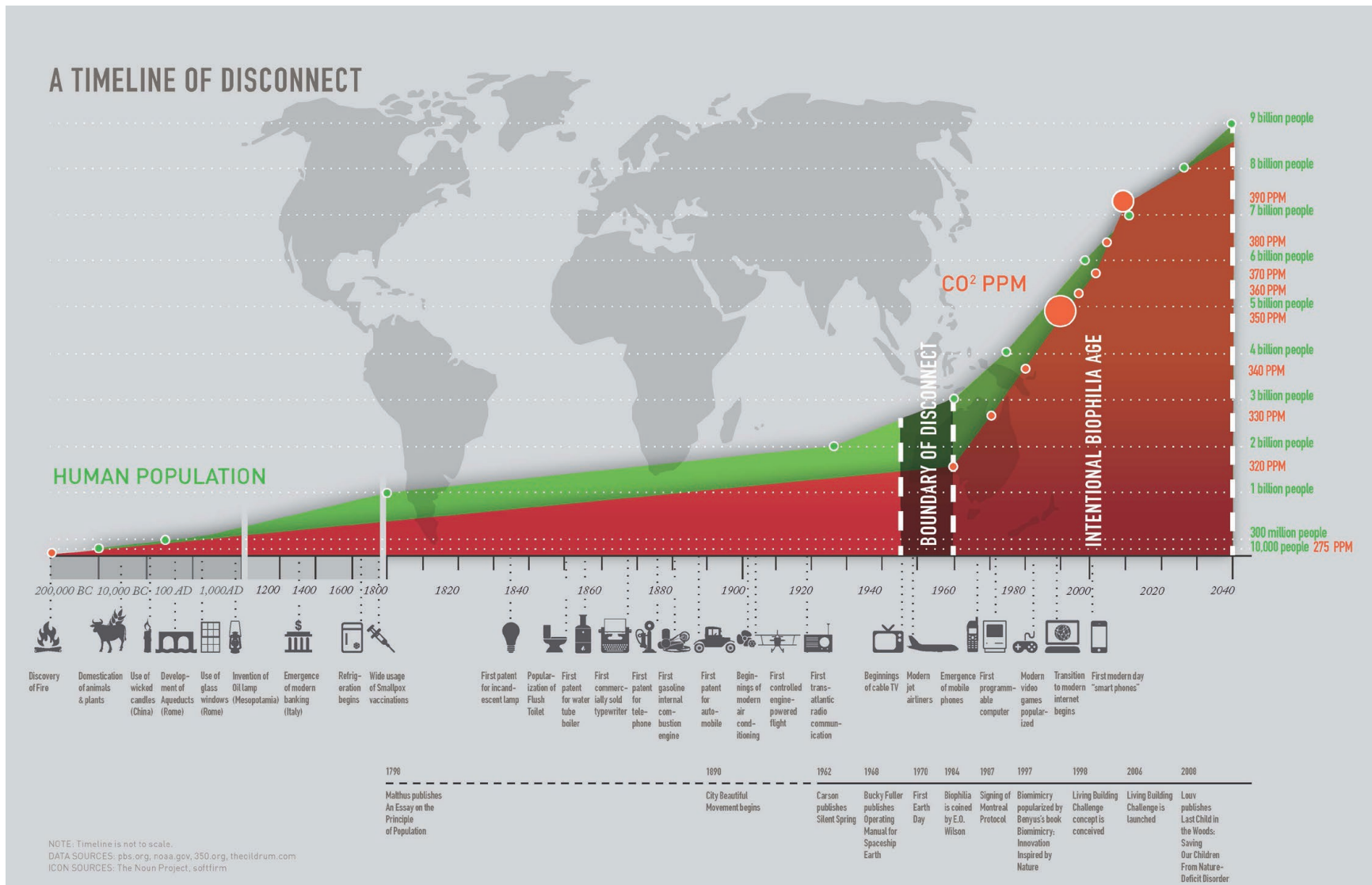


Figure 2.10 Time Line of Disconnect (J. F. McLennan, 2013)

This timeline can also give us a perspective on our “built environment” in the scale of human history. In our more than 200,000 year history, the invention of the city is only 6,000 years old. Now as we become a more and more urban species, designing and building our own habitats can be done with a sensitivity to and understanding of how we have evolved and the impact our environment, whether natural or built, has on our health. Or, it can be done with disregard of this evolution and connection and continue to create a disconnect that can have negative impacts on us and the world in which we live and depend on. (S. Kellert, 2015; J. F. McLennan, 2013).

While our connection to nature used to, no pun intended, come more “naturally”, with increasing global population and urban development, the existence of and access to what can be defined as more natural environments becomes more limited, while biophilia and this inherent affinity and need to connect with life and living systems remains. This means, as alluded to by McClennan’s use of the term “Intentional Biophilia Age”, that we need to become more intentional in fostering and creating opportunities for a biophilic connection in our environments (J. F. McLennan, 2013). To do so, we must remember and understand how we as biological organisms have developed, how we have and continue to respond to our environment, and that we may need to translate and reinterpret elements and qualities of beneficial natural connections to a modern “built” environment.

In admiration of Carlo Scarpa,
Louis Kahn wrote a poem-

*“ In the work of Carlo Scarpa
“Beauty”
the first sense
Art
The first word
Then Wonder
Then the inner realization of “Form”
The sense of wholeness of inseparable elements
Design consults Nature
To give presence to the elements.
A work of art makes manifest the wholeness of “Form”
The symphony of the selected shapes of elements
In the elements
The join inspires ornament, its celebration.
The detail is the adoration of Nature.”*

(Kirk, 2005)



Figure 2.11 Brion Vega Cemetery by Carlo Scarpa. Altivole, Italy.

BASE UNDERSTANDING_ BIOPHILIC DESIGN

A design dialogue between nature and architecture is not new and has existed since the building of the first primitive hut. Humans first built shelters to protect themselves from the natural elements. These shelters, our built environment, began then to inform and shape our relationship with the natural environment around us. As the functions that we had to perform and our expected level of comfort changed, so did our built environment and the resulting relationship with our natural environment. The result could be something that screens, removes or isolates us from our natural environment or it can enhance a connection with it, while creating a better built environment to be in.

“Aalto believed that “immediate contact with nature” enriches life and addresses the social and psychological factors facing architecture. Yet he also recognized that not only mechanization, but human actions themselves “estrangle us from nature” The architect’s task is therefore one of mediation as well as creation- “to make our life patterns more sympathetic”” (Aalto, Reed, Frampton, & Museum of Modern, 1998)

Were Aalto, Scarpa or Kahn aware of the concept of biophilia or a formal biophilic design approach? It is highly unlikely, but one could say their projects embody elements of biophilic design regardless, since most aspects of biophilic design are also rooted in good design practice. Why then does one need to understand or practice biophilic design specifically, and if elements of biophilic design are nothing new, what is new? What is new, besides a more refined definitions and applications of the topic, is the growing body of empirical evidence supporting the principles of biophilic design and emphasizing its importance in our health and well being. Although many designers practice biophilic design intuitively, the strength behind understanding the cross disciplinary research is in better application through knowledge and understanding of the topic. For example, in biophilic design discussions, the importance of windows is not only in enabling daylight for building energy reduction coordinated with lighting design and control systems or for providing natural ventilation, it is about the exposure to the dynamic intensity and color of light impacting our circadian rhythm functioning and that thermal airflow and variability that positively impacts human health and wellbeing including stress reduction, cognitive performance and improved perception of temporal and spatial pleasure (alliesthesia). Although concepts may be old, developing a formalized language around the topic creates a platform for dialogue between disciplines, in the academic and professional realms and for more effectively communicating with clients.



Figure 2.12 Rural example of biophilic design elements at Engholm Husky Design Lodge, Karasjok, Norway.

DEFINING BIOPHILIC DESIGN

The theory of biophilia can be translated to the design of built environments through what has been termed Biophilic Design. The term “built environment”, referring to human-made places and spaces ranging in scale to provide the human activities of live, work and recreate, itself distinguishes the built from the natural environment. The term biophilic design was coined with the publication of a collection of articles in 2008 by authors of diverse disciplines on the topic following a three day symposium on the topic two years prior, entitled “Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life”. In it, biophilic design is defined as an approach to designing the built environment in a way that emphasizes the necessity of “maintaining, enhancing, and restoring beneficial experience of nature” and is “the deliberate attempt to translate this understanding of the inherent human affinity to affiliate with natural systems and process in the built environment” (S. R. Kellert, Heerwagen, & Mador, 2008).

Yet it seems like an industry accepted standard of a single definition does not exist, and there are several interpretations of how to break down and apply the topic changing the definition and understanding of the topic. For example, in one organization or framework as will be discussed later in more detail, biophilic design is defined through the form of connection with have with nature (direct, indirect or symbolic) or through Nature in the Space, Natural Analogues, or Nature of the Space that is then further divided into fourteen patterns (W. Browning et al., 2014; TerrapinBrightGreen, 2012), while another defines the topic through two main dimensions of either naturalistic or vernacular that are applied to six biophilic design elements like “light and space” and “evolved human-nature relationships” that are further broken down to 70 design elements and

attributes(S. R. Kellert et al., 2008). Even though specific definitions, interpretations and means of implementation may vary, they are mostly still looking answer the question posed by Bill Maclay in his book on the “New Net Zero”- “but how do we reinforce our connection to nature via our built environment (Architects, 2014) ?”

Biophilia is the root to biophilic design- what if anything is lost or added in the translation from this “biophilia hypothesis” to biophilic design? Yannik Joye takes a critical stance on biophilic design and how the term biophilic design is being used that begins to help define some of these distinctions. Within a collection of works on ecopsychology, the focus of Joye’s article is the integration of nature into the built environment through what he calls nature-oriented design. Although he admits that his proposal has parallels to those of biophilic design theorists, including elements like structural landscape features, natural contents, animal life, vegetative and water features and fractal geometry, he makes a conscious and vocal choice to separate himself from the “evolutionary psychology straightjacket” of biophilia and biophilic design, calling his approach “nature-oriented architecture” (Joye, 2012).

Similar to Andy Fisher’s critique of ecopsychology of not being “developed in a manner faithful to its radical nature”, Joye raises a valid critique on how the term biophilic design is being used (Fisher, 2012).



Figure 2.13 Urban example of biophilic design elements at Tallinn Airport, Estonia.



Figure 2.14 Interior view of Tallinn Airport, Estonia.

Biophilia, as defined by EO Wilson is the “innate human tendency to focus on or to affiliate with life or lifelike processes and elements”. In their classifications of biophilic design, Kellert et al defined two main dimensions of biophilic design as being of either:

1. An organic or naturalistic dimension
2. Place-based or vernacular dimension

Considering Joye’s stance of biophilic design being rooted in the “evolutionary straightjacket” of biophilia, an important distinction occurs in the definition of these two dimensions of biophilic design (S. R. Kellert et al., 2008). In using these two dimensions as a base of biophilic design, the concepts of both biophilia and topophilia (a love of place) are being incorporated, not just biophilia. The inclusion of a relation to place and not just solely “life and lifelike processes” widens the definition of biophilic design, changing the “root” of the concept to include biophilia and topophilia. This raises the question if another term should be used that more accurately reflects this combined “root.”

If one were to take a similar “radical” stance as Fisher and apply it to biophilic design, this could become an important distinction, even more so depending on your definition of topophilia. In his topophilia hypothesis, Sampson states that humans “possess an innate bias to bond with local place, including living and nonliving components”. The key word in this definition is innate. In contrast, in the Biophilia Hypothesis, David Orr describes topophilia as being “less rooted in our deep psychology than it is in our particular circumstances and experiences...It is not innate but acquired”.(Orr, 1993) This conversation begins to parallel the nature vs. nurture and constructivist definitions of the influence of nature in childhood development.

The question is then, how important is this distinction and what impact it has on the language used to discuss the topic. As Joye points out, biophilic design has had a strong psychological justification and attempts to provide a “scholarly and science based explanations for our affiliations with nature.” How the distinction informs the understanding or value of the biophilic design will most likely be shaped by the culture of the individual, for example an architect may respond to this distinction differently than a doctor, but the distinction should nonetheless be made. Distinguishing the differences between the two main frameworks or methodologies discussed earlier becomes important for implementing biophilic design.

In its very simplest form, one could say that biophilic design is about the relationship between humans and nature and the role that built environment plays in that connection. However as one can begin to see, definitions, goals and applications of biophilic design vary slightly depending on the author and their perspectives. It is not necessarily the goal of this thesis to say which definition or approach is correct, but in critical evaluating the varied approaches to the topic better understand the topic to develop my own interpretation.

Dr Amjad Almusaed comes to define the topic in his book on Biophilic and Bioclimatic Architecture much from the perspective of the human in our approach to what has become a very energy number focused approach to sustainable design, stating that Biophilic Architecture is

“a part of an innovative view in architecture, where nature, life and architectural theory combine to create a lively habitable building component to satisfy the demands, constraints and respect for both people and the environment.”

He associates successful applications of Biophilic Architecture very similarly to the distinction between a Building and Architecture, going beyond a built environment where one can function to one where the occupants are “inspired, invigorated, comforted, and reassured by their surroundings.” (Almusaed, 2011)

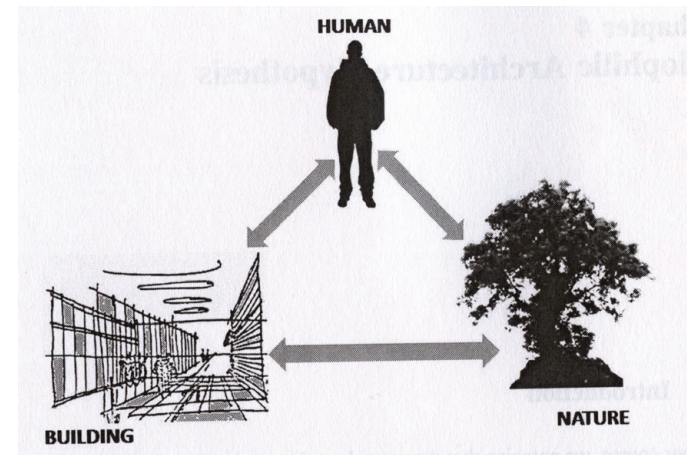


Figure 2.15 Building-Human-Nature, components of human settlement as defined by Almusaed (Almusaed, 2011)

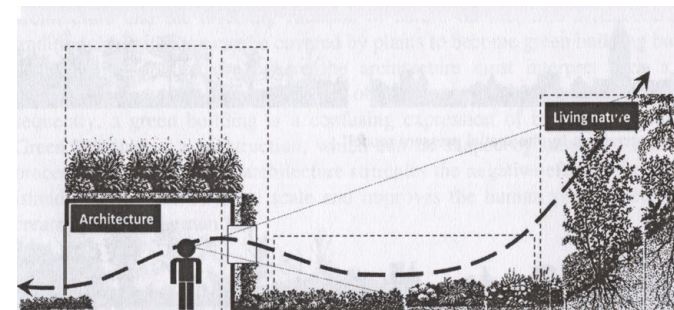


Figure 2.16 Living Nature as part of architectural concept (Almusaed, 2011)

Terrapin Bright Green, an environmental consulting and strategy planning firm, has published two of the more recent comprehensive white papers on biophilic design, “The Economics of Biophilia,” making a case for “Why Designing With Nature in Makes Financial Sense”(TerrapinBrightGreen, 2012) and the “14 Patterns of Biophilic Design” (W. Browning et al., 2014) aiming to bridge the gap between biophilic design theory and research and practice with a focus on improving health and well-being in the built environment. In “The Economics of Biophilia”, no clear definition of biophilic design was made and the translation went directly from biophilia to Biophilia-Based Design and what they called “three pillar concepts” or tenants of biophilic design :

Nature in the Space, Natural Analogues, and Nature of the Space.

In the definition included within “14 Patterns,” the health-wellness aspect was clearly evident:

“Biophilic design is the designing for people as a biological organism, respecting the mind-body systems as indicators of health and well-being in the context of what is locally appropriate and responsive.”

Often, instead of a definition specifically for biophilic design or biophilic, terms like “characteristic of biophilic buildings,” biophilic principles, elements, attributes, qualities, values, experiences, strategies, all which will be discussed in the following section are used. Again, going to practice and application of biophilic design, if one is trying to achieve a certification or meet prescribed requirements design implementation becomes a more difficult challenge without a clear definition. In the architectural competition brief for the “Montreal Space for Life,” along with obtaining LEED Platinum and Living Building Certifications, the project proposals are to employ biophilic and biomimicry design principles. Along with defining several project specific biophilic design goals and considerations, they define biophilic design as the following:

“The term biophilic design and architecture does not refer to the certification, but rather to criteria (or prescription, based on meta-analyses of research into human relationships with nature, in terms of health, psychological well-being, healthy childhood development, etc) aimed at ensuring that new buildings help to reconnect human with nature and contribute to human health.” (Bureau du Design, February 10, 2014)

Relating to the topic of biophilic design, a much clearer definition and understanding of the topic and how an understanding of biophilia can be translated to the built environments comes out of frameworks and methodologies established to implement biophilic design, but first to put the design dialogue in perspective it is useful to understand the broader dialogue and topics being researched and published on related to biophilia and biophilic design as well as an overview of the benefits related to them.

PROUDLY SUPPORTING



DAVID SUZUKI FOUNDATION

CottageCountry.com Presents

The BIG DISCONNECT

FOR THE FIRST TIME IN HUMAN HISTORY, MORE PEOPLE LIVE IN CITIES THAN IN RURAL ENVIRONMENTS. INSTEAD OF INHABITING WIDE OPEN GREEN SPACES WE LIVE IN CROWDED CONCRETE JUNGLES, SPENDING OVER 90% OF OUR TIME INDOORS AND AWAY FROM THE NATURAL ENVIRONMENT.

THE URBAN MIGRATION HAS IMPORTANT PHYSICAL, MENTAL AND COGNITIVE IMPLICATIONS. WE URGENTLY NEED TO WAKE UP TO THE LINK BETWEEN HUMAN HEALTH AND THE NATURAL ENVIRONMENT AND MAKE A PERSONAL AND COLLECTIVE COMMITMENT TO RECONNECT WITH THE GREAT OUTDOORS.

★THE URBAN MILLENNIUM★

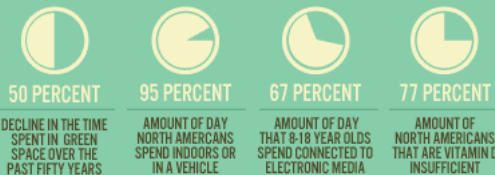
PER CAPITA CARBON FOOTPRINT IN BIG CITIES AROUND THE WORLD
BASED ON MEASUREMENTS OF SIX GREENHOUSE GASES IN TONS OF CO2 EQUIVALENT



CITY LIFE IS CHARACTERIZED BY CONSTANT CONSUMPTION (E.G. HOME ELECTRONICS AND KITCHEN APPLIANCES THAT REMAIN PLUGGED IN 24/7)

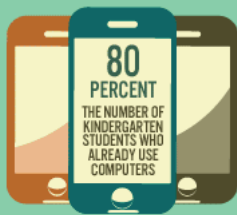
FYI: NEARLY 4 BILLION PEOPLE CURRENTLY LIVE IN CITIES. THAT IS EQUIVALENT TO 4X THE TOTAL WORLD POPULATION IN 1800

URBAN LIFESCAPE



6 HRS

AVERAGE TIME CHILDREN SPEND EACH DAY IN FRONT OF THE TV OR COMPUTER



6 MIN

AVERAGE TIME CHILDREN SPEND EACH DAY DOING OUTDOOR ACTIVITIES

TWENTY PERCENT



OF CHILDREN IN NORTH AMERICA ARE OBESE AS COMPARED TO 4% IN 1960



TREND: URBANIZATION
% WORLD POPULATION THAT LIVES IN CITIES



★ WE HAVE REACHED A TIPPING POINT ★
95% OF THE WORLD POPULATION LIVES ON 10% OF THE LAND

CONDITIONS ON THE RISE



OBESEITY - A.D.H.D.
HEART DISEASE
DIABETES - CANCER
ARTHRITIS - ASTHMA
ANXIETY - DEPRESSION

THE GRASS IS GREENER



RESEARCH AND BENEFITS OF BIOPHILIA AND BIOPHILIC DESIGN

Environmental Psychologists explore the symbiotic relationships between humans and their environments, stating that there is stimulus and reaction through human response whether from an experiential or physiological perspective. In a real basic form, this is saying that our body is made of many systems that are interconnected and along with our normal functioning they respond and react to triggers in the environment we are in.

These reactions can be either positive or negative- for example walking into the Pantheon on a quiet morning as the sun just starts to filter through the oculus creating an experience of calm and awe compared being in the same space where a sudden flash rainstorm floods through the opening, causing a mass of people to come running, screaming at you creating a sense of panic. On the beneficial side, Kopec describes that positive environmental characteristics influence the secretion and absorption of neurochemicals that positively affect our physical and psychological health and wellbeing.

Figure 2.17 "The Big Disconnect" Infographic 30x30 Nature Challenge (Sofferin)

(Kopec, 2006) This understanding that our environment impacts our human systems and responses creates the basis for most research and data on the benefits of biophilia and biophilic design.

*“Want to get healthier, happier and smarter?
Add a daily dose of nature to your routine”*

Addressing what Tim Gill calls “humans as an endangered species in the outdoors” in 2012, the David Suzuki Foundation launched the 30x30 Nature Challenge, challenging Canadians and people around the world to spend 30 minutes a day in nature for 30 days. They define “time in nature” as “getting outside and taking time to notice and connect with the non-human life around you.” Along with giving daily tips such as listening to birds (Figure 2.18) and dining alfresco (Figure 2.19), their website includes an infographic entitled “The Big Disconnect” (Figure 2.17) discusses through quotes and statistics the impacts of urbanization and makes a strong case of for the benefits of spending time outdoors and a connection to nature- including that after two minutes of contact with nature, stress is relieved as measured by muscle tension, blood pressure and brain activity.

This infographic compiles many of the health, community, and productivity benefits that are also cited within much of the literature and research on biophilia and biophilic design.



Figure 2.18 30x30 Nature Challenge Daily Tip



Figure 2.19 30x30 Nature Challenge Daily Tip

WHEN YOU GET OUTSIDE

The COMMUNITY BENEFITS



NATURE MAKES YOU NICER: COMMUNITIES WITH MORE GREENSPACE HAVE LOWER RATES OF CRIME & VIOLENCE

ROOM WITH A VIEW GET A GLIMPSE OF GREEN

HOSPITAL PATIENTS WHO CAN SEE TREES & OTHER GREENERY FROM THEIR HOSPITAL ROOMS RECOVER FASTER AND REQUIRE LESS PAIN MEDICATION.



NATURAL VIEWS AT WORK LEAD TO INCREASED JOB SATISFACTION, BETTER CONCENTRATION, DECREASED MENTAL FATIGUE AND LOWER STRESS LEVELS.

"HUMANS ARE DISAPPEARING FROM THE OUTDOORS AT A RATE THAT WOULD MAKE THEM TOP ANY CONSERVATIONIST'S LIST OF ENDANGERED SPECIES."

TIM GILL, THE ECOLOGIST



The COGNITIVE BENEFITS



SPENDING TIME IN NATURE INCREASES CREATIVITY, CURIOSITY, AND PROBLEM SOLVING ABILITY

HEALTH BENEFITS

NATURE IS THE BEST NURTURE

MANY STUDIES SHOW SIGNIFICANT HEALTH GAINS FOR THOSE IN CONTACT WITH NATURE



REDUCED ANXIETY & DEPRESSION



DECREASED STRESS



INCREASED ENERGY



INCREASED IMMUNITY



50% LOWER RISK OF DIABETES



INCREASED VITAMIN D PRODUCTION



INCREASED WEIGHT LOSS & FITNESS



REDUCED SYMPTOMS OF A.D.D.

★ 50% LOWER RISK OF HEART ATTACK ★ 30% LOWER RISK OF COLON CANCER ★

SUGGESTED DOSAGE

CONTACT WITH NATURE IS AN AFFORDABLE, ACCESSIBLE AND EQUITABLE FORM OF PREVENTATIVE AND RESTORATIVE MEDICINE.



2 MINUTES

STRESS IS RELIEVED WITHIN MINUTES OF EXPOSURE TO NATURE (AS MEASURED BY MUSCLE TENSION, BLOOD PRESSURE AND BRAIN ACTIVITY)

2 HOURS

MEMORY PERFORMANCE AND ATTENTION SPAN IMPROVES 20% AFTER SPENDING AN HOUR INTERACTING WITH NATURE

2 DAYS

LEVELS OF CANCER FIGHTING WHITE BLOOD CELLS INCREASE 50% AFTER SPENDING TWO OR MORE CONSECUTIVE DAYS IN NATURE

CONNECT WITH
COTTAGECOUNTRY.COM + THE DAVID SUZUKI FOUNDATION



Figure 2.17 "The Big Disconnect" Infographic 30x30 Nature Challenge (Sofferin)

“Diversity confers resilience, adaptability and the capacity for regeneration”

-Janine Benyus

Biophilia, as discussed earlier, is a complex topic with many attributes and determinates that should not be viewed in isolation and that draws on many areas of expertise and disciplines. As a result, comprehensive research on the topic would have to be interdisciplinary. For example, if looking at a biophilic design element of light and space, even though an engineer, architect or lighting designer may typically evaluate and design the lighting levels of a space, they may not have an understanding of the physical and psychological or photobiological impacts of light in order to understand circadian rhythms and how the natural variability of daylight and sunlight can reduce recovery time from surgery or patient stays related to treatment of bipolar or seasonal affective disorder. (Lieberman, 1991; Snyder, 2008)

An architect may also not consider the heat gain from designing in too many windows or not specifying the correct U-values and solar heat gain coefficient in the glazing without having a conversation with the engineer or energy modeler. Even if one person did have enough general knowledge about the topic, they would not alone be able to generate and communicate research to make the impacts of lighting in terms of biophilia accepted in the architectural, engineering, medical and psychological fields that it applies to.

Unfortunately there has been a trend towards specializations in fields and also for current research in general and on green buildings tends to happen in a stovepipe fashion. (Frumkin, Coussens, Institute of, Roundtable on Environmental Health Sciences, & Medicine, 2007; Novitski, 2009) The act of building itself, in the physical sense, is extremely complex with many systems being integrated together to act as and function as one. Integrating this built environment into an ecosystem responsibly and to respond to environmental conditions that are unpredictable year by year is a challenge all in itself. Ironically, the biggest challenge may be the one closest to us as mysteries to how the human brain and body work, function and respond are perpetually surprising us. The success of biophilic design could very easily lie in the emergence or reemergence of polymaths—the generalist that is educated, informed and experienced in multiple disciplines (J. McLennan, 2011) and very certainly relies on interdisciplinary collaboration and research.

Research on biophilia in the last twenty years has been both general and very specific, spanning many disciplines and its proven benefits impacting many sectors. Literature is has been published relating biophilia to the following sectors/disciplines:

1. Design of the Built Environment
2. Childhood Development
3. Education
4. General Health and Wellness
5. Medical (patient recovery)
6. Work Environment and Productivity
7. Mental Health- Psychology
8. Real estate- Property Value
9. Retail Design
10. Zoo Design
11. Environmental Psychology
12. Elderly and Dementia Care

Literature and publications on biophilia and biophilic design take, informational, advocacy or research positions, typically focusing on the broad concept or a specific aspect. The latter can focus on a perspective of the concept or a specific study that usually addresses a benefit associated with one aspect of biophilic elements like patient recovery associated with views to nature. Benefits generally fall into one of the following broader categories of health and improved wellbeing, productivity, or economics and evidence falls into the categories of anecdotal, theoretical or empirical.

From the time that an initial literature review was done on this thesis topic in autumn of 2013, several notable works have been added to significant published works on biophilic design, indicating the speed at which interest and research in this topic is occurring. Published or written works on the topic tend to fall into several categories in which the topic is the focus of the work, or featured as part of a larger discussion. In the form of books, the works are either a collection of writings on the topic, like the seminal work "Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life" (S. R. Kellert et al., 2008) or the topic is the focus of a chapter within a book addressing a larger related topic.

This is the case in the recently released "Designing for Hope: Pathways to regenerative sustainability,"(Hes & Du Plessis, 2015) in Lidwell's Universal Principles of Design as a section on the "biophilia effect" (Figure 2.20)(Lidwell, 2003) and in Jason McLennan's "The Philosophy of Sustainable Design" where the application of biophilia is discussed as applied to the "building habitat of the future" in a section on productivity and well-being (J. F. McLennan, 2004).

Amjad Almusaed's book "Biophilic and Bioclimatic Architecture: Analytical Therapy for the Next Generation of Passive Sustainable Design" is a unique third type where an entire comprehensive book is dedicated to biophilic and bioclimactic architecture as an answer to more "sustainable" design. While many discussions around the topic are fairly abstract and examples are more experience based, Almusaed's book offers a very technical and holistic approach to implementing biophilic design, making connections between biophilic design element, human systems and building performance, going into detail elements needed, giving designers and engineer's information to implement them more successfully.

For example, going beyond a discussion of vegetation and plants being important to looking at the specific relationship between plants, oxygen and human life benefits (One person needs 50 liters of oxygen per hour, one leaf produces 0.005 liters of oxygen per hour, meaning one person requires 10,000 leaves or 500 small plants, or approximately 5m² of vertical green area) or connecting shade trees and cool and green roofs through direct and indirect to lower air conditioning use and cost, lower ozone levels, and fewer health related health risk and asthma. (Almusaed, 2011)

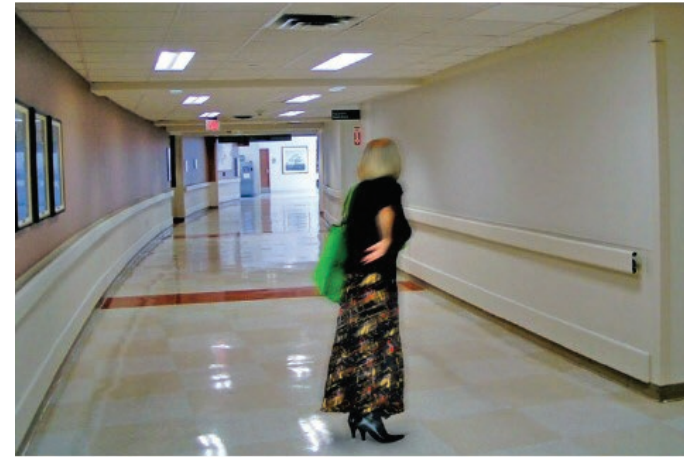


Figure 2.20 "Bamboo Forest" (Lidwell, 2003)

The "biophilia effect" as described in Lidwell's "Universal Principles of Design" is based on that description that environments rich in nature views and imagery reduce stress and enhance focus and concentration, citing that poets and philosophers have long stated that being in natural environments produces restorative benefits. The example used to demonstrate the application of the "biophilia effect" is the before and after photographs of the "Bamboo Forest" where vivid imagery along with nature sounds provide a coming element as well as assist in wayfinding within the hospital. (Lidwell, 2003)

As the seminal work on the topic, “Biophilic Design” is a collection of twenty-three writings by authors from various fields that resulted from a three day symposium on Biophilic Building Design in Rhode Island in 2006. The value in this volume is that it covers the topic from all multiple phase aspects and perspectives from various disciplines, divided into three parts:

Part One: The Theory of Biophilic Design

Part Two: The Science and Benefits of Biophilic Design

Part Three: The Practice of Biophilic Design

This body of work builds on Kellert’s previous book, “Building for Life: Designing and Understanding the Human-Nature Connection”(S. R. Kellert, 2005) and sets the foundation for any work related to Biophilic Design by encompassing critical parts of design research: theory/historical context, benefits and analysis of evidence, and applying the previous two to practice. In it, one of the main frameworks or methodologies, discussed in more specifics in the Established Frameworks section that defines two dimensions, six elements and 70 attributes that is commonly referenced is introduced. “Designing for Hope” introduces the topic using the approach to the topic outlined in “Biophilic Design”, exploring it through case studies and breaking down the six elements.

Another major category that the writings fall under are white papers and research reports that typically collect existing research and evidence of benefits and then build upon it either with a new study or perspective. A strength of these papers is that they are typically available online and again, biophilic design is either the focus of the entire document or a section of the report. “The Economics of Biophilia” by Terrapin Bright Green published in 2012 was one of the first significant documents in this category and it moved the discussion in the design-architecture industry forward. Along with beginning to redefine the structure used to look at the specifics of biophilic design as outlined in “Biophilic Design,” this document compiles the benefits of integrating biophilia into the built environment across many sectors and ties data derived from case studies to financial terms.

The studies are focused on the workplace, healthcare, retail spaces, schools, and community. This is important because it clearly correlates the benefits of biophilia into a quantifiable measure, speaking in a language that appeals to and is understood by a larger audience. Previously discussions were largely based in a language specific to that area of expertise, whether science, medical, psychology, or design. One could argue that sustainability became part of the mainstream of the built environment once there was an economic benefit for doing so.

This paper makes clear the economic return on investment created by the integration of biophilia into designs to the people in the positions to make those decisions, in a language they can understand. (TerrapinBrightGreen, 2012)

Several years later in 2014 the same group released “14 Patterns of Biophilic Design,” aiming to bridge the gap between biophilic design theory and research and practice with a focus on improving health and well-being in the built environment. Along with continuing to develop their approach to implementing biophilic design in practice and giving designers tools in which to do so, they pull data and evidence that specifically support their patterns, relating them to the benefits of stress reduction, cognitive performance, and emotion, mood and performance (see their Table 1 on page 12 of the report).

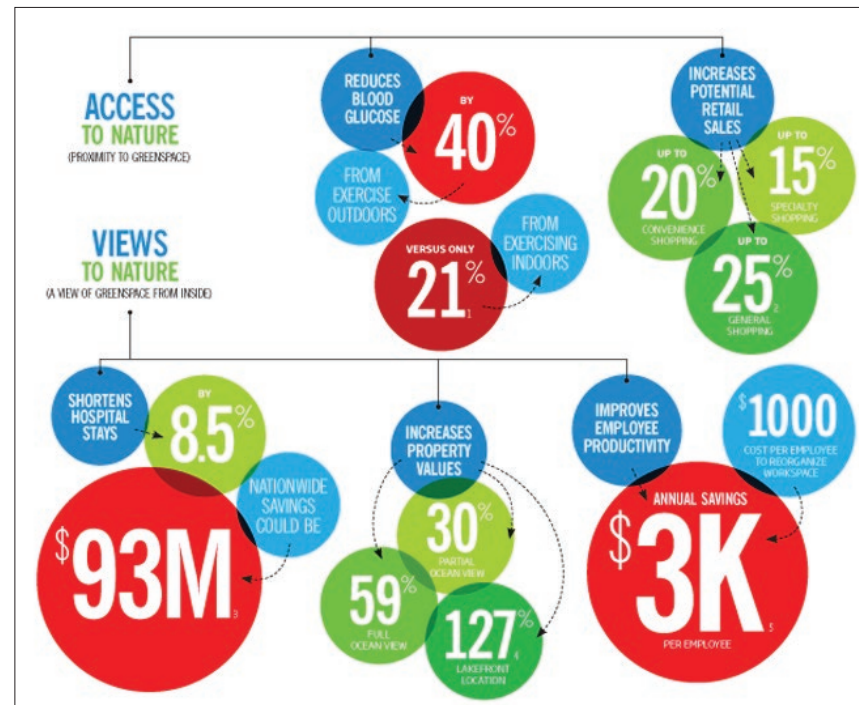


Figure 2.21 Numbers associated to Access to Nature and Views to Nature ((W. D. Browning, 2012) (Numbers are rounded to nearest whole. 1: Ohtsuka, 1998. 2: Wolf, 2005. 3: Machlin & Carper, 2007. 4: Heerwagen, 2006. 5: Heschong, 2003; Loftness, 2008.)



Figure 2.22 Urban Retreat collection by David Oakey
Designs for Interface (Oakey)

The discussion around biophilic design has been much more prevalent in the dialogue in the fields of Interior Design and material product manufacturers compared to Architecture. Interface, one of the world's largest global manufacturer of commercial carpet tiles has become a huge proponent of increasing conversation around biophilic design. They launched a website entitled "Reconnect: Inspired by a common desire to reconnect people and spaces with nature" (<http://www.interfacereconnect.com/>) along with their biophilia inspired product lines like "Urban Retreat", and sponsored global design competition "Reconnect your space" on the topic in 2013.

More recently, Interface sponsored and developed the "Human Spaces: Spaces Designed With the Human in Mind" website as a "biophilic design discussion hub" to generate a global perspective and discussion on the effect biophilic design has on "happiness, productivity and creativity in the workplace." Along with generating dialogue through their own blog posts and case studies, they pool information in all formats that is out there on biophilic design including reports, case studies, books and papers, and links. ("Human Spaces: Spaces Designed With the Human In Mind,") (<http://humanspaces.com/>).

They also published a report "Human Spaces: The Global Impact of Biophilic Design in the Workplace" summarizing existing research and evidence of benefits of biophilic design and build a specific study to quantify the benefits of biophilic design, focused on well-being and productivity in workplaces globally. This study as a follow up to an earlier 2014 study, which surveyed 3,600 employees from eight countries across Europe, Middle East, and Africa (EMEA) (Interface Europe, 2014), expanding the reach

to 16 countries and 7,600 employees, translating the conclusions to practical information to achieving these benefits. (Interface Europe, 2015) Although the scope of the study only includes the workplace environment, the indications of cultural preferences when comparing the survey results across the countries could be related to other building typologies. For example, in the UK light, wood and stone materials were natural elements positively linked to wellbeing at work, while in The Netherlands views of trees were preferred compared to the views of water such as the ocean, lakes or ponds in the United Arab Emirates. Some of the statistics listed in the report as well as represented in an infographic (Figure 2.24) the produced may surprise you- close to 50% of global offices have no natural light. Beyond the workplace, these reports offer interesting insights, data and references to anyone interested in the topic.

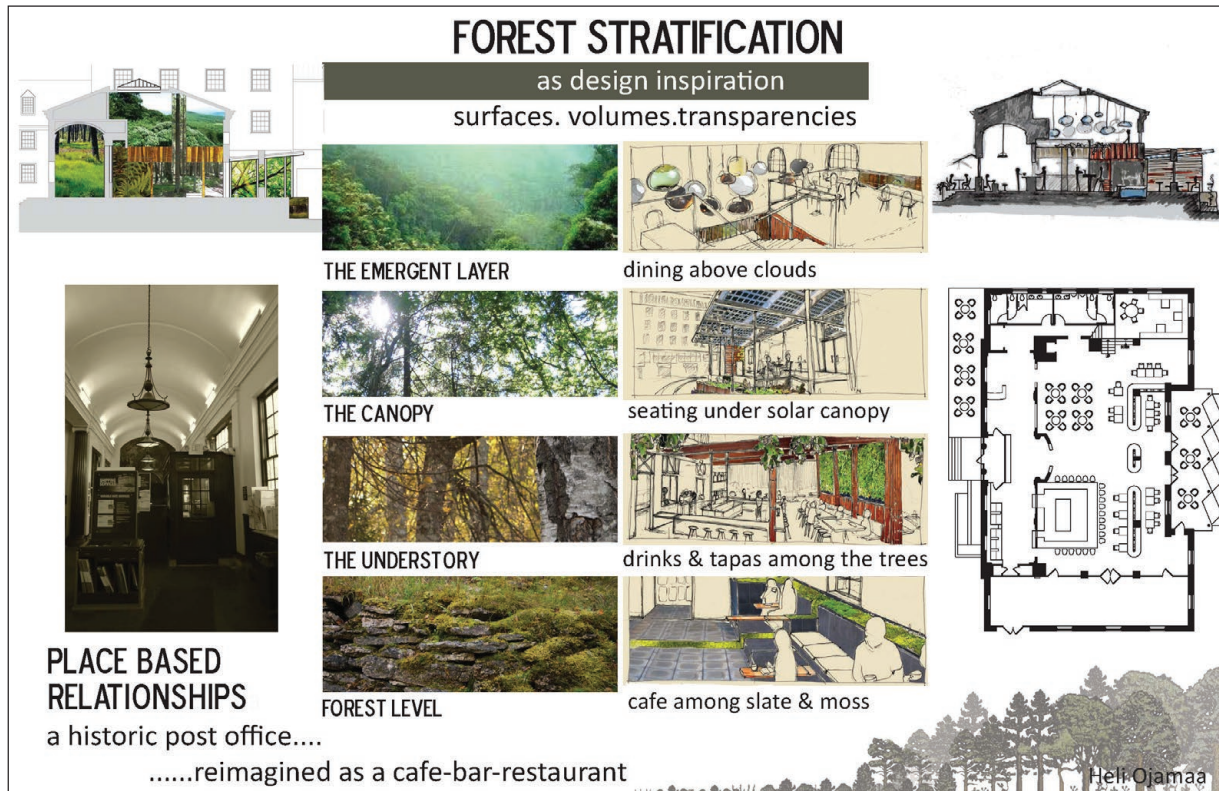


Figure 2.23 My “Reconnect with your space” competition entry for which I was given a commendation



Figure 2.24 Human Spaces: The Global Impact of Biophilic Design in the Workplace Infographic (Interface Europe, 2015)



Figure 2.25
Sky Ceiling Installation
in a hospital – an example
of representations of the
natural world being brought
into interior spaces that
otherwise don't have access
to it (Ward, 2010)

In a different type of report by the World Green Building Council, “Health, Wellbeing and Productivity in Offices, The Next Chapter For Green Building,” biophilia is included in the key findings summary of evidence building a case for the quality of the spaces we work in contributing to our health and productivity. The investigations of the benefits of biophilic design in an office setting gathered and reference in this study span the globe and over 20 years, citing that both views out to nature and plants in a space resulted in workers that were less frustrated, more patient and in better health than those that didn't have views or had views of only built elements. Similar to a section in “Designing for Hope”, specific types of “air cleanser” plants that remove chemical vapors and contribute to positive moisture levels are listed, providing specific information that can be used to help inform implementation of design integration that focuses on both visual benefits of plants and their contributions to the performance of the built environment. (Council, 2014)

Until recently where there has been a shift to workplace environments, the majority of evidence-based research related to the benefits of biophilic design has been in the healthcare industry, with over fifty studies published related to impacts of natural daylighting and views to nature on patient recovery rates, reduction of medication, reduced stress, and emotional wellness and a growing body of evidence looking at workplaces and productivity (T. B. G. LLC, 2012). Regardless, research on the topic faces several hurdles that ultimately become barriers to general acceptance of biophilia and its application in the design of the built environment.

The complexity of the concept and applications of biophilia are a virtue in that there is a broad range of applicability and interested parties, but a vice in creating too many variables to create comprehensive body of research on the benefits of biophilic design and biophilia as a whole. Discussions in medical fields are supporting a direction of this holistic approach; in a workshop of Green Healthcare Institutions, one participant stated that “researchers need to go beyond a simple dichotomy of bad and good. The research needs to define how these individual elements operate in combination and nuanced ways.” (Frumkin et al., 2007) This also means that multiple types of research

are needed for creating a general acceptance, not just because of the myriad of biophilic elements and attributes, but because each field has different procedures of accepting theories into practice. Vocabularies and perspectives between designers, engineers, health professionals, real estate developers, and environmental psychologists, all vary and for the right research questions to be asked and answered with evidence that can be used and understood by all fields requires collaboration and effort beyond the norm (Frumkin, 2003).

For example, the medical field relies on evidence-based research, while only a select group of architects read or produce research-based design. Trying to build a solid base of research that compiles evidence supporting all the various benefits of biophilic design as a whole is challenging because so many variables exist around the topic itself and in the ways to quantify the benefits, with results or evidence not always being instantaneous.

Many environmental factors play impact the human system responses as outlined, but one that has been documented to have major impacts is DAYLIGHT. As mentioned earlier, our exposure to daylight impacts our eye function, is inherent to circadian rhythms (daily cycle) that balance melatonin and serotonin in our systems. In turn, when there is an imbalance and sleep-wake pattern disturbed, neurological and immune system functions are inhibited. (TerrapinBrightGreen, 2012)

Although there may be various interpretation or associations added to the benefits of biophilia and biophilic design, they typically are related to one or several of the following human systems reactions and responses to our environment (as discussed related to environmental psychology earlier), these systems and responses can be impacted negatively or positively by the environment we are in:

PHYSIOLOGICAL RESPONSE (INCLUDING NEUROLOGICAL)

our systems and organs of the body and their function

-Impact is related to agility, alertness, musculoskeletal, respiratory, visual and aural acuity

PSYCHOLOGICAL RESPONSE

related to the mind, impacting our alertness, attention, concentration, and emotional response

COGNITIVE FUNCTIONS (as part of psychological response) mental functions and behaviors, an intellectual process by which one becomes aware of, perceives, or comprehends ideas involving all aspects of perception, thinking, reasoning, and remembering

RESTORATIVE RESPONSES to nature are focused on :

-**STRESS RECOVER THEORY** (Ulrich)

-**ATTENTION RESTORATION THEORY** (Kaplan and Kaplan)

Demonstrated through SHINKRIN-YOKU (FOREST BATHING) in Japan, resulting in reduced blood glucose levels, hormonal secretion and autonomic nervous functions stabilized because of phytonicides excreted by plants (TerrapinBrightGreen, 2012)



Figure 2.26 Maslow's Hierarchy of Needs (Health)

Primal survival need include access to :
 Clean Air, Water, Food, Shelter (Temperature),
 Sleep, Light, Safety and Security.

When introducing the topic of biophilia Environmental Evolutionary Adaption was mentioned, beginning the discussion on how a disconnect with nature or a “mismatch” can begin to have negative impacts referred to as “discords” in the form of stress to the system (Grinde & Patil, 2009). We can have stress responses, which are part of the natural body’s self-preservation system and a fundamental biological short-term safeguard to our environment, especially if our basic human needs are not met. With biophilia rooted in evolutionary theory, it also relates strongly to our primal survival needs. In 1954, psychologist Abraham Harold Maslow established a “Hierarchy of Needs” that is based on natural instincts present in all animals and proposes that until the fundamental needs (at the bottom of the pyramid) are met, one cannot move up the hierarchy of the pyramid. In “Psychosocial Value of Space” Judith Heerwagen similarly describes survival needs as “aspects of the environment that directly affect human health”, distinguishing them from “well-being needs” that are associated instead with “fulfillment, quality of life and psychological health”. She expands to a list of wellbeing needs that should be addressed in building design as supported by research by Biologist Stephen Boyden including “opportunities for learning and information sharing and making sense of the environment”. (Judith Heerwagen, 2008)

The built environment plays an important role in achieving all levels of the hierarchy of needs and a biophilic design approach should first ensure that all basic survival needs are met in order to not cause stress on the system. This must first be met, before being able to achieving the goal of architecture over functional building, allowing for higher levels of thought and inspiration. (Kopec, 2006) This may seem obvious, but with a statistic that 70% of buildings have indoor air quality worse than that of the outdoors

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Figure 2.27 Images from trail in Inari, Finland demonstrating some elements needed for survival and how a built environment can play a role in providing them.



Figure 2.28 Historic Photo of giraffes



Figure 2.29 Giraffes in “natural” zoo environment

statistic that 70% of buildings have indoor air quality worse than that of the outdoors one can begin to wonder how well we as a profession are doing (Barth, 2015). Judith Heerwagen spoke at the Bringing Buildings to Life Symposium of a connection between biophilia and an evolutionary need for survival stating that “biophilia evolved to guide functional behaviors associated with finding, using, and enjoying natural resources that aided survival and reproductive fitness- and avoiding those that are harmful”.(A. Wilson, 2006) Discussions of evolutionary theory and landscape preferences also link characteristics of particular natural environmental landscapes that we still have a preference for because they most likely “would have improved our chances of survival” and inform numerous elements of several of the published approaches to biophilic design (Hildebrand, 1999) .

To get a sense of how important some of these basic survival needs are (these of course are extreme cases but interesting to note nonetheless), people begin to experience brain damage after five minutes without oxygen, we cannot survive more than 3-4 days without water, and if a person’s core temperature drops below the normal temperature of 98.7 degrees F to 91.4, a body will go unconscious, at 86 degrees the body loses the ability to control internal temperature, at 82.4 there is complete muscle failure, and at 10.6 degrees there is a breakdown of the central nervous system and at over 111 the brain overheats causing death(Sleight, 2014).

In many cases, people’s general daily survival needs are met- they fairly easy access to food water and shelter and their “survival” is more dependent on earning a living through cognitive functions and performance. From the statistics quoted earlier related to stress an illness, for many reducing stress and more mental rather than physical challenges become key in their survival. Roger Ulrich discusses that a contact with nature should foster a restoration from stress through the biophilia theory in the “Biophilic Design” collection of works. In the discussion through citing evidence,

he links stress to having psychological- (fear or anxiety, sadness, sense of helplessness), physiological (elevated blood pressure and heart rate), and neuroendocrine (increased levels of steroid (cortisol) and stress hormones (epinephrine) impacting immune system functioning) impacts on our system as well as impacting behavioral changes (Ulrich, 2008).

The larger question posed with this section of the discussion is whether we are designing for survival or for thriving—and how the intentional design directly allows for the second by making sure the first is addressed, moving from what Heerwagen calls “Do No Harm- Survival Needs” to “Do Good Well-Being Needs.”.

We as humans have not only shaped, designed and built most of the habitat in which we now live through our buildings, infrastructure, agriculture, but through zoos and parks have created new built environments for the plant and animal species. The development of zoo design offers an important lesson for us, and should perhaps be even seen as a canary in a coal mine. Zoo design historically was focused on containment and show, with no consideration of the natural environment of the actual species. Over the last several decades zoo design transformed around creating ecological and ethological themes that more closely replicated the natural habitats of the animals. The importance of environment evolutionary adaptedness as discussed earlier in this paper is also relevant in this case. This transformation was led by zoos’ realization that animals kept in cages having harsh, unnatural environments kept animals alive, but did not allow animals to prosper and reproduce. Caged animals exhibited neurotic behavior, in one case as a result of what turned out to be as a caused by boredom in a dull environment. (Grinde & Patil, 2009; Judith Heerwagen, 2008) If there has been such a radical transformation in the philosophy and design of zoos, one can hope for the same of our human environments.



Figure 2.30 Call Center



Figure 2.31 Improved office work environment

EXISTING FRAMEWORKS AND METHODOLOGIES

There have been several approaches to how to break down the transition from the theory of biophilia to application in the built environment through biophilic design, but currently there is no universally accepted definition of the elements of biophilic design or established strategies as to how to achieve them. This section presents a survey of existing frameworks, methodologies, and clearly defined and structured approaches to translating biophilic design to the built environment. This was done to offer a more comprehensive understanding of the topic and to identify different approaches that exist and to evaluate them critically. The approaches generally varied in how they were organized, how complex or simple they are, what they were defining (be it goals, strategies, elements, qualities, resulting connections, or relation to benefits), and whether they included topophilia, or a connection to place directly in their approach. Although I came across several more frameworks, there were about five major groupings that seemed to be the most comprehensive and relevant to architectural applications that I evaluated in greater depth (Figure 2.32) In several cases, authors have developed or been a part of developing more than one approach, or released new approaches over time.

As part of the seminal book on Biophilic Design, “Biophilic Design: The Theory, Science and Practice of Building Buildings to Life “, Stephen Kellert et al published a framework of “Dimensions, Elements and Attributes of Biophilic Design” to address a need for a detailed understanding of biophilic

		Includes adaption-evolution	Includes topophilia-connection to place	Connection Reaction	Form of Connection	Relates to Benefits	Element Object Features	Value Based	Strategies	Qualities	Processes	Connection to building systems	Connection to Other Descriptive Systems
Kellert et al	Biophilic Range of Values	x		x		x		X					
	Two Dimensions, 6 biophilic design elements, 70 design elements attributes	x	x	x			x		x (some in elements and attributes)	x	x		
	Restorative Environmental Design		x		x		x				x		x
Terrapin	three Pillars	x			x		x						
	14 Patterns			x	x		x		o		x		
Alex Wilson		o	x	x		x	x	X			X	x	
Judith Heerwagen	Characteristics and Attributes	x	x	x	x		x		x	x	x		
	Restorative Commons	x	x	x		x	x		x	x	x		
Rocky Mountain Institute	Qualities of Biophilic Buildings	x	x (through materials)		x		x			x	x (ventilation)		

Figure 2.32 Simplified Table comparing existing approaches to biophilic design

design that would assist in the practical application of biophilic design to the built environment (S. R. Kellert et al., 2008). In 2012, the environmental consulting and strategy planning firm Terrapin Bright Green, published a white paper, “The Economics of Biophilia: Why Designing with Nature in Mind Makes Financial Sense” following which they published a newly defined organization of 14 Patterns that inform design in the built environment based on research focused on cognitive, psychological and physiological responses to different environments. These 14 Patterns were then developed and rereleased in a new report, “14 Patterns of Biophilic Design: Improving Health and Well-Being in the Built Environment”(W. Browning et al., 2014).

Although these two approaches of “Biophilic Design” and “14 Patterns” in some ways become the most significant because they are the most widely referenced, several other frameworks and organizations of note have been established with varied approaches depending on the perspectives and goals of the author. For example Alex Wilson, founder of BuildingGreen, organizes biophilic design strategies by design scales (general, landscape and site design, building design, and interior design) while environmental psychologist Judith Heerwagen who has published extensively on biophilia in the built environment and was part of developing the “Dimensions, Elements and Attributes of Biophilic Design” has also published approaches that are more focused on the human response to our environment and related health benefits from psychosocial and psychological perspectives.

The main approaches I identified were:

“Range of Biophilic Values” (S. R. Kellert, 1997, 2005)

“Dimensions, Elements and Attributes of Biophilic Design” as part of “Biophilic Design : The Theory, Science, and Practice of Bringing Buildings to Life” (S. R. Kellert et al., 2008)

“Principles, Experiences and Attributes of Biophilic Design” by Stephen Kellert (S. Kellert, 2015)

“14 Patterns of Biophilic Design” by Terrapin Bright Green (W. Browning et al., 2014; TerrapinBrightGreen, 2012)

“Characteristics of Biophilic Buildings” by Judith Heerwagen and Betty Hase (Judith Heerwagen & Hase, 2001)

“Qualities and Attributes of Nature in Biophilic Design” by Judith Heerwagen (Judith Heerwagen, 2009)

“Qualities and Attributes of Biophilic Buildings” by the Rocky Mountain Institute (Griffin, 2004; Lovins, 2004)

“A Sampling of Biophilic Design Strategies” by Alex Wilson (A. Wilson, 2006)

Stephen Kellert, a social ecologist and senior research scholar at Yale University's School of Forestry and Environmental Studies, has been one of the leading forces in publication and discussion around biophilia and biophilic design. One of the initial approaches he had to discussing biophilia was in defining the way people attach meaning and derive benefit from nature as a series of nine values with associated adaptive benefits as outlined in Figure 2.31. By defining these constructs, the symbiotic relationship that we have with nature is broken down in a way that allows us to not only better understand the manner of and benefits to our relationship to nature as a whole, but creates terminology and a framework to analyze and analyze the specific elements, attributes, principles, etc. that begin to be developed as part of discussing and implementing

“RANGE OF BIOPHILIC VALUES” Kellert

VALUE	DEFINITION	ADAPTIVE BENEFITS
Aesthetic	Physical appeal and beauty	Inspiration, harmony, security
Dominionistic	Mastery and physical control	Physical prowess, self-confidence, mastery skills
Humanistic	Emotional attachment to aspects of nature	Bonding, cooperation, companionship
Moralistic	Spiritual reverence and ethical concern	Order, meaning, kinship
Naturalistic	Direct experience and exploration	Curiosity, discovery
Negativistic	Fear and aversion	Security, protection, awe
Scientific	Systematic and empirical study	Knowledge, understanding, critical thinking skills
Symbolic	Nature in language and expressive thought	Communication, mental development
Utilitarian	Practical and material exploitation	Physical sustenance and security

Figure 2.33 Range of Biophilic Values reformatted from original source (S. R. Kellert, 1997, 2005)

“DIMENSIONS, ELEMENTS AND ATTRIBUTES OF BIOPHILIC DESIGN” Kellert, Heerwagen, Mador, et al

TWO MAIN DIMENSIONS OF BIOPHILIC DESIGN:

1. Organic Or Naturalistic 2. Place-Based Or Vernacular

SIX ELEMENTS AND 70 ATTRIBUTES TO BIOPHILIC DESIGN:

ENVIRONMENTAL FEATURES

Color
Water
Air
Sunlight
Plants
Animals
Natural Materials
Views and Vistas
Façade Greening
Geology and Landscape
Habitats and ecosystems
Fire

NATURAL PATTERNS + PROCESSES

Sensory Variability
Information Richness
Age, Change and the Patina of Time
Growth and Efflorescence
Central Focal Point
Patterned Wholes
Bounded Spaces
Transitional Spaces
Linked Series and Chains
Integration of Parts to Wholes
Complementary Contrasts
Dynamic Balance and Tension
Fractals
Hierarchically organized ratios and scales

PLACE-BASED RELATIONSHIPS

Geographical connection to place
Historic connection to place
Ecological connection to place
Cultural connection to place
Indigenous materials
Landscape orientation
Landscape features that define building form
Landscape ecology
Integration of culture and ecology
Spirit of Place
Avoiding placelessness

NATURAL SHAPES + FORMS

Botanical Motifs
Tree and Columnar Supports
Animal (mainly vertebrate) motifs
Shells and Spirals
Egg, Oval, and Tubular Forms
Arches, Vaults, Domes
Shapes resisting straight lines and right angles
Simulation of Natural Features
Biomorphy

LIGHT + SPACE

Natural Light
Filtered and Diffused Light
Light and Shadow
Reflected Light
Light Pools
Warm Light
Light as Shape and Form
Spaciousness
Spatial Variability
Space as Shape and Form
Spatial Harmony
Inside-Outside Spaces

EVOLVED HUMAN-NATURE RELATIONSHIPS

Prospect and Refuge
Order and Complexity
Curiosity and Enticement
Change and metamorphosis
Security and Protection
Mastery and Control
Affection and Attachment
Attraction and Beauty
Exploration and Discovery
Information and Cognition
Fear and Awe
Reverence and Spirituality

Figure 2.34 Dimensions, Elements and Attributes of Biophilic Design, reformatted from original source (S. R. Kellert et al., 2008)

GOALS, PRINCIPLES + EXPERIENCES AND ATTRIBUTES OF BIOPHILIC DESIGN Stephen Kellert

GOALS:

Seeks to “create good habitat for people as a biological organism in the modern built environment that advances people’s health, fitness and wellbeing” ..

to “sustain the productivity, functioning and resilience of natural systems over time”

“the application of biophilic design can alter the environmental conditions of a building or landscape in the short term, but over the long run, it should support and ecological robust and sustainable natural community”

PRINCIPLES:

Consistently adhering to the following principles that represent fundamental conditions for the effective practice of biophilic design:

1. Requires repeated and sustained engagement with nature.
2. Focuses on human adaptations to the natural world that over evolutionary time have advanced people’s health, fitness and wellbeing.
3. Encourages an emotional attachment to particular settings and places.
4. Promotes positive interactions between people and nature that encourage an expanded sense of relationship and responsibility for the human and natural communities.
5. Encourages mutual reinforcing, interconnected, and integrated architectural solutions.

ELEMENTS AND ATTRIBUTES TO BIOPHILIC DESIGN:

DIRECT EXPERIENCE WITH NATURE

Light
Air
Water
Plants
Animals
Weather
Natural Landscapes and ecosystems
Fire

INDIRECT EXPERIENCE WITH NATURE

Images of Nature
Natural Materials
Natural Colors Simulating Natural Light and Air
Naturalistic Shapes and Forms
Evoking Nature
Information Richness
Age, Change, and the Patina of Time
Natural Geometries
Biomimicry

EXPERIENCE OF SPACE AND PLACE

Prospect and Refuge
Organized Complexity
Integration of Parts and Wholes
Transitional Spaces
Mobility and Wayfinding
Cultural and Ecological Attachment to Place

Figure 2.35 Goals, Principles, Experiences and Attributes of Biophilic Design reformatted from original source (S. Kellert, 2015)

biophilic design to practice. Together with Judith H. Heerwagen and Martin L. Mador, he edited the seminal book on biophilic design, in 2008. This book coined the term “biophilic design” and that established the concept of biophilia in the realm of the built environment. In it, they define the term as an approach to designing the built environment in a way that emphasizes the necessity of “maintaining, enhancing, and restoring beneficial experience of nature” and establish two main dimensions of biophilic design (organic or place-based) that then can be applied to six biophilic design elements that are continued to be broken down to more than 70 attributes as seen in Figure 2.32. Within the text, each element and attribute is broken down in more detail, describing why each element is important including examples. Even though the list is formatted in a way that you can focus on the large categories or delve deeper into specifics, as an overall list it can be a bit overwhelming. Focused on more individual elements, it doesn’t provide a good overall strategy for implementing the elements and attributes through design. It is stated in the book that this classification should be viewed as a work in progress and will be further developed as it has, both by these authors and others.

Most recently, since the writing of this document, Kellert released an updated list of elements and attributes where instead of the six elements originally listed, attributes were categorized under three kinds of experience with nature- Direct, Indirect and an Experience of Space and Place, see Figure 2.33. In many ways this classification of distinction of experiences with nature mirrors research that indicates that even though direct contact with nature provides the most benefit, representations of nature are more beneficial than none at all ¹ (Kahn, Severson, & Ruckert, 2009; Roger S. Ulrich, 1984; Ulrich, 2008; A. Wilson, 2006). This becomes an important consideration as we will have to continue to redefine and understand our relationship with nature in an ever changing and urbanizing world. As part of this “Practice of Biophilic Design”, he also establishes goals that biophilic design should have and basic principles that represent conditions for the effective practice of biophilic design. This was released towards the end of this thesis process and I found that these broader defined descriptions and principles began to address some of the pieces I found to be missing in the dialogue of biophilic design practice and assist in clarifying the “bigger picture” along with more detailed individual element

¹ Several studies have been done looking at this topic, a group of which have had a very technological nature in its representation of “nature” either through plasma screens, robotic dogs, or telegardens. One study in an office setting compared responses of 90 participants looking at either 1. A window with a natural scene 2. A plasma window with a real-time HDTV view of essentially the same scene or 3. A blank wall. Combined with a previous similar study looking at participants responses, results indicated that a plasma nature window was not as good as the direct view to nature, but better than none at all, for example there was a more rapid heart rate recovery in the glass window compared to the blank wall condition and a plasma screen of nature resulted in increased psychological well-being and cognitive functioning of participants who also preferred the plasma screen office to a windowless office.

“14 PATTERNS OF BIOPHILIC DESIGN”

Terrapin Bright Green, LLC

GOAL:

“create spaces that are inspirational, restorative, healthy, as well as integrative with the functionality of the place and the (urban) ecosystem to which it is applied. Above all, biophilic design must nurture a love of place”

DESIGN CONSIDERATIONS:

WHAT IS GOOD BIOPHILIC DESIGN?

- “design for people as biological organism”
- “understand mind-body systems as indicators of health and well-being in context of what is locally appropriate and responsive”
- “draws from influential perspectives (health conditions, socio-cultural norms and expectations, past experiences, frequency and duration of the user experience, the many speeds at which it may be encountered, and user perception and processing of the experience”

PLANNING FOR IMPLEMENTATION

- Identify desired responses and outcomes
- Design strategies and interventions:
 - based on needs of a specific population in a particular space
- Diversity of design strategies
- Quality vs Quantity of Intervention
- Duration of Exposure and Frequency of Access

LOCALLY APPROPRIATE DESIGN

- Climate, ecology and the vernacular
- Character and density: rural, suburban and urban environments
- Scale and Feasibility
- Culture and demographics

DESIGN INTEGRATION

- Interdisciplinary planning and design
- Biophilia as an environmental quality
- Multi-platform solutions
- Controlling for effectiveness
- Tracking and measuring efficacy

“14 Patterns of Biophilic Design” provides a context of biophilia and biophilic design along with providing “14 Patterns” or a “series of tools” (Figure 2.34) to implement biophilic design, also providing the science and research behind each. A series of Design Considerations (Figure 2.35) discuss various factors that designers should consider for successful implementation of biophilic design patterns. A major distinction from the “Biophilic Design Elements and Attributes” and Kellert’s “Experiences and Attributes” is that the “sense of place” or reference to topophilia is described as a result of biophilic design application and not considered an element or pattern of itself. Based on a discussion with Catie Ryan of Terrapin Bright Green, it does not seem that this distinction is as much of a response to a formal definition of biophilia as discussed earlier in the section defining biophilic design. Rather it is trying to simplify the approach of the patterns while keeping a reference to the importance of context (Ryan, 2014).

The significance of this work is that it in an accessible manner provides a “toolkit” that is beginning to translate research to design application, balancing between research, benefits and evidence of them and ways in which to apply them successfully in an appropriate design approach. While their first white paper focused on the economic benefits, “14 Patterns” has a much more health benefit related focus, breaking down how each of the 14 Patterns relates to evidence of Stress Reduction, Cognitive Performance, and Emotion, Mood and Performance”(W. Browning et al., 2014).

Figure 2.36 “14 Patterns of Biophilic Design” reformatted from original source (W. Browning et al., 2014)

“14 PATTERNS OF BIOPHILIC DESIGN” Terrapin Bright Green, LLC

THREE PILLARS, TENANTS OR CATEGORIES :

Nature in the Space: incorporation of plants, water and animals into the built environment

Natural Analogues: materials and patterns that evoke nature

Nature of the Space: psychological and physiological responses to spatial configurations

14 PATTERNS OF BIOPHILIC DESIGN:

NATURE IN THE SPACE

1. Visual Connection with Nature

A view to elements of nature, living systems and natural processes.

2. Non-visual Connection with Nature

Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems or natural processes.

3. Non-rhythmic Sensory Stimuli

Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely.

4. Access to Thermal & Airflow Variability

Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.

5. Presence of Water

A condition that enhances the experience of place through the seeing, hearing, or touching of water.

6. Dynamic & Diffuse Daylight

Leveraging varying intensities of light and shadow that change over time to create conditions that occur in nature.

7. Connection with Natural Systems

Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.

NATURAL ANALOGUES

8. Biomorphic Forms & Patterns

Symbiotic references to contoured, patterned, textured or numerical arrangements that persist in nature.

9. Material Connection with Nature

Material and elements from nature that, through minimal processing reflect the local ecology or geology to create a distinct sense of place.

10. Complexity & Order

Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.

NATURE OF THE SPACE

11. Prospect

An unimpeded view over a distance for surveillance and planning.

12. Refuge

A place for withdrawal, from environmental conditions or the main flow of activity in which the individual is protected from behind and overhead.

13. Mystery

The promise of more information achieved through partially obscured views of other sensory devices that entice the individual to travel deeper into the environment.

14. Risk/Peril

An identifiable threat coupled with a reliable safeguard.

Figure 2.37 Goals and Design considerations of “14 Patterns” reformatted from original source (W. Browning et al., 2014)

“We derive these features from research on habitability, natural processes and the geometry of nature.

We also draw on research on playfulness and humor, topics that have been largely neglected in building design.

Yet research on humor and playfulness shows positive impacts on emotional functioning with far reaching benefits on social relationships, stress reduction and creative problem solving’ (Judith Heerwagen & Hase, 2001)

Over the years, whether independently or together with designers and other professionals has published several works that included unique approaches to understanding and applying biophilia to the design of our built environment.

Of course, as is with many of these frameworks and approaches there are crossovers between them as a result of developing in parallel, but each is driven by unique perspectives of the same dialogue.

“CHARACTERISTICS OF BIOPHILIC BUILDINGS”

Heerwagen and Hase

GOAL :

Recognize buildings as “habitats for people”, integrate into buildings the positive biophilic features of our evolved relationship with nature while avoiding biophobic connections” .

KEY DIMENSION/ FEATURE Attributes/Qualities

PROSPECT : Ability to see into distance

Brightness in the field of view (window, bright walls)
Visual distance
Ability to get a distant point for a better view
Horizon/Sky imagery (sun, mountains, clouds)
Strategic viewing conditions
View corridors

REFUGE: Sense of enclosure of shelter

Canopy effects (lowered ceilings, screenings, branchlike forms overhead)
Variation in light levels (darkness suggests refuge)
Enclosing surfaces (walls, partitions, screens)
Penetrable barriers and surfaces for views out

WATER: Indoors or in views

Glimmer or reflective surfaces (suggests clean water)
Moving water (also suggests clean, aerated water)
Symbolic forms of water

BIODIVERSITY

Varied vegetation indoors and out
(large trees, plants, flowers)
Windows designed and placed to incorporated nature views
Outdoor natural areas with rich vegetation and animals

SENSORY VARIABILITY

Changes and variability in environmental color, temperature, air movement, textures, and light over time and spaces
Natural rhythms and processes (natural ventilation and lighting)

BIOMIMICRY

Designs derived from nature
Use of natural patterns, forms and textures
Fractal characteristics (self-similarity at different levels of scale with random variation in key features rather than exact repetition)

SENSE OF PLAYFULNESS

Incorporation of décor, natural materials, artifacts, objects and spaces whose primary purpose is to delight, surprise and amuse

ENTICEMENT

Discovered complexity
Information richness that encourages exploration
Curvilinear surfaces that gradually open information to view

Figure 2.38 “Characteristics of Biophilic Buildings” reformatted from original source (Judith Heerwagen & Hase, 2001)

EVOKING QUALITIES OF NATURE Heerwagen and Gregory

How can architecture, structured around 7 Attributes of Nature, evoke qualities of nature through :

“light, air, materials, color, spatial definition, movement patterns, openings and enclosures, and connections to nature”

7 ATTRIBUTES OF NATURE

1. Sensory Richness
2. Motion
3. Serendipity
4. Variations on a theme
5. Resilience
6. Sense of Freeness
7. Prospect and Refuge

Figure 2.39 ”Evoking Qualities of Nature” reformatted from original source (J. H. Heerwagen & Gregory, 2008)

LINKING NATURE TO HUMAN HEALTH AND WELL-BEING

MAJOR BENEFITS OF NATURE AND NATURAL PROCESSES:

Sunlight
Outdoor Green Space
Gardens and Gardening
Nature and Childhood Development

QUALITIES AND ATTRIBUTES OF NATURE IN BIOPHILIC DESIGN:

Heraclitean Motion
Change and Resilience
Variations on a Theme
Discovered Complexity
Mult-Sensory
Transformability

Figure 2.40 “Linking Nature to Human Health and Wellbeing reformatted from original source (Judith Heerwagen, 2009)

This collection of approaches by Heerwagen and respective co-authors discusses the “essence” of the natural environment and what has been positive in elements, qualities and characteristics that create a good habitat and how to translate that into a design.

Paralleling discussions of E.O Wilson, Heerwagen points out that just as we have a love of nature, there is also a fear of nature it or “biophobia” that instead of relieving stress can cause it. (Judith Heerwagen & Hase, 2001) Also, one must acknowledge that not all nature is beneficial or “equally attractive”(Judith Heerwagen, 2009).

The writings from which these lists (Figure 2.38-Figure 2.40) are pulled also offer a depth of references for research and benefits related to the elements or features discussed.

The Rocky Mountain Institute (RMI), a non-profit organization dedicated to the research, publication, consulting, and lecturing on the general field of sustainability published their take on the Qualities of Biophilic Buildings (Figure 2.41) and Biophilic Design Attributes (Figure 2.42) in a 2004 article discussing biophilia in the Built Environment (Griffin, 2004) and in a presentation looking at the Economics of Daylight an Occupant Productivity(Lovins, 2004).

A distinction in their approach in is a clear separation between a physical or visual connection to nature. Even though at first glance it may seem that this distinction exists, however in Kellert and Terrapin's approaches it is more of a visual or non-visual connection (W. Browning et al., 2014) or direct-indirect experience (S. Kellert, 2015) : these are more about a distinction of representation of nature, not necessarily whether you have direct access to nature. This is an important, yet simple, distinction and a point to consider when designing, since the experience and benefits of being in direct contact with elements is very different than seeing them either at a distance or through glazing. Even though the article stated RMI's goal is to build this list of biophilic design attributes into a usable format, they have not independently published this other than these two lists in 2004.

QUALITIES OF BIOPHILIC BUILDINGS Rocky Mountain Institute

1. Peril
2. Enticement
3. Access to Water
4. Natural Ventilation
5. Prospect and Refuge
6. Complexity and Order
7. Local, Natural Materials
8. Dynamic and Diffuse Light
9. Educational about Biophilic Aspects
10. Visual connection between interior and nature
11. Physical connection between interior and nature
12. Material connection between interior and exterior

Figure 2.41 Qualities of Biophilic Buildings reformatted from original source(Lovins, 2004)

Biophilic Design Attributes that reintegrate natural systems into the Built Environment:

1. Use of dynamic and diffuse daylight
2. Ability to have frequent, spontaneous and repeated contact with nature throughout and between buildings
3. The use of local, natural materials
4. A connection between interior and exterior surfaces
5. Natural ventilation
6. A direct physical connection to nature from interior spaces
7. Direct visual access to nature from interior spaces

Figure 2.42 Biophilic Design Attributes reformatted from original source (Griffin, 2004)

Alex Wilson's "Biophilic Design Strategies" (Figure 2.43-Figure 2.45) are one of the few frameworks focused on specific strategies for design implementation, broken into general and more specific disciplines of landscape and site, building design, and interior design. Although published on the popular Building Green website (A. Wilson, 2006) and within in "Biophilic Design"(A. Wilson, 2008), it does not seem to be widely referenced. His approach is helpful when thinking of application strategies and within the articles he discusses how to balance biophilia with other green design priorities and project costs, important realities not often discussed. His strategies range between general specific and the table in general is fairly wordy, potentially deterring those looking for a quick overview. In his 2008 ending of his chapter in "Biophilic Design", Wilson outlines three efforts needed to move the concept of biophilic design forward:

1. Research into biophilia and human health and performance
2. Education about biophilic design
3. Incentives to spur the implementation of these concepts

In the eight years since this writing, research and publication has really spread in the field, but education and incentives to spur implementation are lagging behind. Although topics related to biophilia and biophilic design like daylighting or benefits of architecture-landscape integration, may be discussed in architecture schools and the design community, discussion on the specific topic of biophilic design are limited. Wilson believes that the LEED Rating system could be a way to spur the integration of biophilic design into buildings. To date no references specifically to biophilia or biophilic design seem to exist within LEED , though it has been included in other building certifications has will be discussed (A. Wilson, 2006, 2008).

“BIOPHILIC DESIGN STRATEGIES” Alex Wilson, Building Green

GENERAL

Address biophilia early in the design and planning process	By considering biophilic design strategies very early in the design process, opportunities relating to building siting, architectural form, internal layout, interior design, and landscaping can more easily be achieved
Address biophilic design with all buildings, but especially those for children, the elderly and the infirm.	Views of natural scenes are particularly important for calming children and instilling in them an appreciation of nature; for the elderly and infirm, natural scenes can ease discomfort and promote healing
Integrate teaching of ecology into buildings	Interpretive signage and displays about natural features can help people understand and appreciate what they see
Seek ways to integrate biophilic design into existing as well as new buildings	Many of the biophilic design strategies from this list can easily be incorporated into existing buildings, though not always to the extent possible in new buildings
Help to get the message out.	Conveying the importance of biophilic design to the design community and specific market segments, such as education and healthcare, will take concerted effort by the green building community
Design landscapes and buildings for a sense of mystery.	This strategy encourages building occupants to explore, discover and learn from the complexities of nature. This is especially important for spaces designed for children
Foster attachment to place	Visually, ecologically, historically and culturally connecting a building to the locale helps connect occupants to a place and in doing so, inspires them to protect that area

Figure 2.43 "Biophilic Design Strategies" reformatted from original source (A. Wilson, 2006, 2008)

“BIOPHILIC DESIGN STRATEGIES” Alex Wilson, Building Green *cont.*

LANDSCAPE AND SITE DESIGN

Provide open space around buildings	Enough cannot be said of the importance of open, naturalized or planted space around buildings—spaces that put building occupants in closer touch with nature. Native plantings are preferred to support diverse ecosystems
Maintain existing trees and native landscapes	Protecting trees and native landscapes during land development and construction is often the most cost-effective way to achieve natural landscaping. Preserving natural ecosystems is almost always preferable to creating new landscapes.
Provide plantings and pleasing natural settings around buildings	Well-designed landscaping should be visible from occupied spaces in buildings. As many windows as possible should look out over plantings, water elements and other natural features.
Build pathways through naturalized and landscaped areas.	Walking and biking pathways can be provided along restored native landscapes within both residential and commercial developments; pathways can connect these developments with the larger community. Push beyond the swaths of Kentucky bluegrass to provide ecologically rich landscapes.
Replace impervious landscapes surfaces with diverse native plantings.	Vegetated, naturalized areas that allow rainwater and snowmelt to infiltrate the ground are both more environmentally responsible and more pleasant to view and explore.
Provide living walls on building exteriors.	Bringing nature closer to building occupants is one of the features of living walls- typically vines that climb on screening held away from building walls or on the walls themselves. Such vegetation can save energy by providing shade but may also block sunlight.

BUILDING DESIGN

Provide views to nature	Windows should be designed and placed to afford easy viewing of natural, outdoor scenes
Blur the transition between interior and exterior spaces	Where feasible, extend living and working space into the surrounding landscapes through terraces, courtyards, balconies, covered porches, gazebos, and benches situated along pathways. Create transitions to these spaces that invite their use
Avoid interference with key sightlines	In designing glazing systems, deck railings and other features that could interfere with views of nature, carefully plan the sightlines and avoid interference wherever possible
Provide high levels of daylighting	Where practical, glazing should be vision glass, offering views to the outdoors and creating rhythmic patterns of living light, shadows, and sparkle that vary throughout the day. Even skylights should be vision glass so that clouds and weather patterns can be seen; to avoid glare, consider tintable glass for skylights—see review of Sage Glass in EBN Vol.5 No.6
Provide operable windows	Providing building occupants with control over their own immediate environments can expose them to the smells, temperature fluctuations and feel of nature, including the smells of flowers in the spring and summer.

Figure 2.44”Biophilic Design Strategies”cont. reformatted from original source (A. Wilson, 2006, 2008)

“BIOPHILIC DESIGN STRATEGIES” Alex Wilson, *Building Green cont.*

BUILDING DESIGN cont.

Provide green roofs	Incorporate vegetated (green) roofs onto low-slope roofs and provide both visual and physical access to those roofs.
Incorporate vegetated atria and interior planting beds	Bringing nature inside buildings is the idea behind atria and planting beds. Open, vegetated areas within buildings sometimes extending several stories in large commercial buildings, provide building occupants with a respite from the typical indoor environment; in hospitals, such atria have been shown to promote healing and reduce stress. Provide pathways through planted areas to allow building occupants to experience close contact with nature.
Consider incorporating living walls and other living systems for air and water purification in buildings	Water features can provide both visual and acoustic benefits, reminding of a waterfall or spring rain.
Create a sense of complexity—yet order in building design	The relationship of variety and intricacy within an underlying natural pattern of order is an important element of biophilic design.
Address both spaciousness and refuge in building design.	As is demonstrated in many of Frank Lloyd Wright’s buildings, varying ceiling height can create space that mimic the outdoors (open, daylight space) an areas of refuge to provide a sense of security of containment (more contained spaces with lower ceilings)
Incorporate organic forms into buildings	A wide range of shapes and forms that mimic nature can be used to add depth and variety to spaces

INTERIOR DESIGN

Decorate with potted plants.	Using potted plants and small gardens as part of the interior design strategy will put building occupants in closer contact with natural features. With creativity, nature can be woven in throughout an interior space, even with furniture
Provide natural materials and nature art in buildings	Especially where actual views to nature are not feasible, natural building materials (wood grain, potted stone) and artwork of nature scenes can be used to elicit biophilic response.
Configure office spaces to enhance views of nature	Workstations should be positioned so that workers can see out windows and benefit the most from natural lighting, interior gardens and other biophilic features.
Provide interpretations as part of the interior design.	Use signage and other interpretive features to explain biophilic features and functions so that they will better appreciated, managed and understood.

Figure 2.45 ”Biophilic Design Strategies” cont. reformatted from original source (A. Wilson, 2006, 2008)

EVALUATION

“A great building must begin with the immeasurable, must go through measurable means when it is being designed, and in the end must be unmeasurable” – Louis Kahn

We live in a time where data drives much of what we do and how decisions are made- it can assist in making those decisions in a decisive, smart manner but it can cause gridlock if the information is not used smartly, or holistically looking at the whole picture and the core of what is important can be missed. Recently a former professor and colleague of mine had asked what the most important thing that I had learned while coming back to graduate school. I don't think I was able to articulate it well then, with no guarantee that I can do so here either, but simply stated it has been to not take anything at face value. We are inundated with information these days and with the speed at which things move and at which we are required to process them often we don't take the time to really understand it- we often rely on results, data, and evaluations without really knowing on what they are based, what assumptions have been made and critically thinking about them. For example the simple fact that most lighting level standards are based on illuminance- the amount of incident light striking a surface, not luminance, the amount of reflected light off the surface, or the human perception of brightness or what we actually see. But of course, human perception is much more difficult to quantify if one is looking for data and quantifiable results. Architecture, a combination of art and science, results in a combination of qualitative and quantitative elements that can result in a combination of objective and subjective evaluations. This is also the case in trying to evaluate the implementation of biophilic design.

“The two areas of non-quantifiable qualities that have been discussed ..both rely on psychological and human abilities that are difficult to express in computationally convenient terms. This difficulty, however, must not be confused with inability to evaluate.”
Yehuda E. Kalay

As discussed in the previous section, no clear industry accepted framework or list of prescriptive measures exists for biophilic design, yet we often look for standards to follow as guidelines in order to properly implement and evaluate its application. It is not the argument of this thesis that this is necessary or even the proper approach to the topic, but it does cause difficulty in having to evaluate the application of biophilic design. While the

benefits of biophilic design can have quantifiable outcomes, the principal itself and its individual elements and attributes are not as simple to define and measure.

Even though LEED is the most generally accepted standard, clear baselines have not even been clearly established for sustainable design, and even less so for biophilic design. The emergence of biophilic design in part is addressing experientially and aesthetically lacking buildings that have resulted as a result of the primary focus of a sustainable design's performance being evaluated through its efficiency, without as much consideration of human factors. Experience and aesthetics rooted in human factors perception, are influenced by many subjective variables and are non quantifiable and making them difficult to evaluate. This should not however be taken to mean that there is an inability to do so (Groat & Wang, 2013; Kalay, 2004).

Biophilic design should not be confused with an aesthetic, it is a methodology or patterned language that needs to be interpreted and applied appropriately on a case by case basis, and it is pretty certain that none of the authors of the approaches listed in the previous sections intended them to be used in a "checklist" manner. Fortunately or unfortunately, evaluation and verification has become an important part of sustainable design and at the forefront of much recent architectural dialogue.

Being able to clearly define, create a metric, and evaluate the application does not guarantee that it is successfully done, nor is it always necessary, but this a large part of the discussion that needs to be had. An interesting anecdote speaking to this and an example that prescriptive measured do not exclusively lead to the result is that the first LEED Platinum building outside of the United States, the Sohrabji Godrej Green Business Center, was not designed following the LEED matrix



Figure 2.46 Aerial View of the CII Sohrabji Godrej Green Business Centre Building at Hyderabad India,(GBC, 2004)

of requirements. Their creative process focused on a holistic dialogue of physical laws and spiritual principles to resonate architectural tradition and the natural world and then they found that the result met the requirements of a LEED Platinum rating. However, if looking to understand the benefits associated biophilia and planning to effectively and appropriately use of biophilic principles the comprehension of biophilia as a whole is important. Although the benefits of inclusion may not be directly impacted by whether or not the designer understands and is conscious of biophilic design, this understanding is important in the advancement and promotion of the biophilic design in practice. Understanding the pieces to the whole, regardless of the scale, enriches a design and adds to its integrity (Berkebile, Fox, & Hartley, 2008).

“Experience has shown us that it is often the so-called “immeasurable” things that have the biggest impact and that it is folly to ignore something simply because we haven’t figured out the best way to measure it. Pretending that good design and aesthetics are separate from performance is a fatal error.” -Jason McLennan

So how does one the implementation of evaluate biophilic design? For architect Bill Maclay a definition of biophilia in a building is when they “feel like they’re a live” and the evaluation could be simple: “one measure of that is people will say they just want to hang out there” (BAIRD, 2015). Currently there are two certifications that have Biophilic Design as part of their requirements, which implies having to have some manner in place to evaluate its implementation, that begin answering this question and could also be driving which Biophilic Design Approaches become more broadly accepted.

The Living Building Challenge, a building certification program, advocacy tool and philosophy is managed and certified through the International Living Future Institute. The Challenge consists of seven performance categories called Petals: Place, Water, Energy, Health and Happiness, Materials, Equity and Beauty, that are then divided into twenty Imperatives or requirements. Imperative 09, under the petal of Health and Happiness, is Biophilic Environment. The current Version 3.0 and previous 2.0 both reference the six Biophilic Design Elements as established by “Biophilic Design” (S. R. Kellert et al., 2008)but have taken slightly different approaches to the evaluation and verification. In Version 2.0, instead of defining specifically what elements needs to be applied, its prescriptive measure is that each of the established biophilic design elements (Figure 2.32) must be represented for every 2,000 m² of the project (I. L. B. Institute, 2010).

Documentation requirements included a two page illustrative narrative describing the biophilic design elements within the project, including references to locations within the drawing set and photographs(I. L. B. Institute, 2010b). In the current Version 3.0, the Biophilic Design Elements (Figure 2.32) are used as a reference but the approach to implementation has changed slightly. The Standard (I. L. F. Institute, 2014) requires the project team to have a day long exploration of the biophilic design potential of the project resulting in a “biophilic framework and plan for the project” that contains methods for tracking biophilia at each design phase and outlines the following:

How the project approach is “transformed by deliberately incorporating” nature through the specific elements of “Environmental Features, Light and Space, and Natural Shapes and Forms” and nature’s patterns through “Natural Patterns and Processes and Evolved Human-Nature Relationship”

“How the project will be uniquely connected to the place, climate, and culture through Place-based Relationships”

And the “Provision of sufficient and frequent human- nature interactions in both the interior and exterior of the project to connect the majority of occupants with nature directly”.

The plan is to also include “historical, cultural, ecological, and climatic studies that thoroughly examine the site and context for the project”.(I. L. F. Institute, 2014) In many ways, much interpretation is left up to project teams which can be good leading to projects specific and appropriate approaches as is the case in the example of the Berteschi School (Figure 2.45 Figure 2.46) but it does not necessarily assist in giving guidance on a clear understanding of the topic and how to implement it.



Figure 2.47 Image of a biophilic design approach at the Berteschi School Science Wing in Seattle, Washington, one of the first projects to achieve Living Building Certification



Figure 2.48 A “stream” running through the Science Wing brings rainwater off the roof before being treated, making the hydrological cycle a design element and visible to the students.

A second building certification program including biophilia is The Well Building Standard, which hit the market in 2013. It is a building standard that uses a “performance-focused system for measuring, certifying, and monitoring features of the built environment that impact human health and wellbeing” and more recently began a formal collaboration with the Green Building Certification Institute (GBCI), the certification provider for the LEED Green Building Rating System, as a third-party certifier for the WELL Building Standard (Anonymous, 2014). (D. L. LLC, 2013)

The Standard identifies seven categories relevant to occupant health in the built environment- “Air, Water, Nourishment, Light, Fitness, Comfort and Mind” with biophilia being addressed under the “Mind” category and being associated with our Nervous System. Within the “Mind Certification Matrix” Biophilia is evaluated through two forms “Biophilia I- Qualitative” and “Biophilila II- Quantitative”. Within the “Biophilia I- Qualitative” it’s biophilia requirements are partially modeled after those of the Living Building Challenge (with a clear reference under the Qualitative section), citing the same requirements of a “Biophilia Plan” as described under LBC’s 3.0 Standard and directly making correlations between the two standard’s requirements. Continuing to reference the LBC, it simplifies their breakdown of requirements into three parts:

- Part 1: Nature Incorporation
- Part 2: Pattern Incorporation
- Part 3: Nature Interaction

These begin to follow the organization offered by Terrapin and the 14 Patterns, but not entirely. Specific Elements are highlighted including: Environmental elements, lighting, space layout, Nature’s patterns, human-nature interaction within the building and in the “site space external to the building”. The “Biophilia II: Quantitative” requirements are once again broken into three parts, but this time Part 1: Outdoor Biophilia, Part 2: Indoor Biophilia and Part 3: Water Feature, defining quantities of each related to an area, referencing Sach’s book “ Therapeutic Landscapes: An Evidence-based Approach to Designing Healing”, for example that under Outdoor Biophilia, “at least 25% of the project site size meets the following requirements: a. features either landscaped grounds or rooftop gardens accessible to building occupants and b. consists of, at minimum, 70% plantings including tree canopies (within the 25%)” (D. L. LLC, 2014).

Inclusion of biophilia in both of these certifications makes important strides to moving the discussion around biophilic design forward, yet there is still lack of clear direction within the field on defining, implementing, and evaluating biophilic design.

CONCLUSIONS

“We shape out buildings; thereafter they shape us”

This quote by Winston Churchill has often been used, including in association with the Tartu Nature Building by Karisma Architects in Estonia, yet I am not sure how well we have really understood the seriousness of it. Given the truth behind this quote it is surprising that architects do not get more training on human nature. If as the biophilia hypothesis states, a connection to nature is important, then it becomes increasingly important for designers, planners, policy makers and everyone involved in creating our built environment to have working understandings of the topic and how to incorporate it into their decisions and practices, biophilic design addresses this.

As the previous definition states, biophilic design is an approach to designing and does not necessarily result in a “biophilic building”. This is an important distinction to make in a world crowded with labels, certifications and titles. Biophilic Design is not something new- designers and architects have been practicing it and exploring the theories behind it since the primitive dwelling and I would argue these practices have and always will also be rooted in good design practice.

What is new, besides a more refined definition of patterns, is the growing body of empirical evidence supporting the principles of biophilic design and emphasizing its importance in our health and well being. This is something architects need to pay attention to and design having an understanding of, being tasked with ensuring “health, safety and welfare” of building occupants. Although many designers practice biophilic design intuitively, the strength behind understanding the cross disciplinary research results in better application through knowledge and understanding of the topic. Although concepts may be old, developing a formal language around the topic creates a platform for dialogue between disciplines, in the academic and professional realms and also with clients- the importance of this should not be underestimated.

We have moved from a “less is more” to a “doing more with less” approach to architecture. When expecting to do more with less, you cannot look at elements in isolation, but in how they relate to each other and how symbiotic relationships can be enhanced and supported- a core principle to systems thinking. This should exist both in the project elements and design process, requiring cross disciplinary work and true collaboration. This is something that research of biophilic design has done and encourages. Through research into the topics of biophilia and biophilic design and gaining a base understanding of how they have been applied, a second contradiction of sorts became evident to me—

I found that a design approach to biophilic design needs to have an understanding of the human- how we function, how we respond to our environment and how we have evolved. So a design that is human centered.

Yet the same time we need to approach this from a non-anthropocentric world view, recognizing that we are not at the center, but connected.

I, however argue that a combination of a human centered design approach, coming from a non-anthropocentric world view has always been at the root of good design and could also provide design solutions that contribute to both building and human performance, health and well-being, while creating symbiotic relationships with the systems to which they are connected.

This means acknowledging and understanding that we as humans are biological organisms, consisting of natural systems and processes, that function and rely on the natural systems and processes around us. What began as simple huts for shelter and protection have now developed into the complex built environments we live in become an important part of this equation. The design of these built environments not only directly impacts both our human systems and the natural systems in which they are set, but begin to also impact the relationship between the two. Biophilia and Biophilic Design begin to give a framework around which to have and develop this conversation.

03 | EXPERIENCE + ANALYSIS : Lessons Learned for Design Implementation

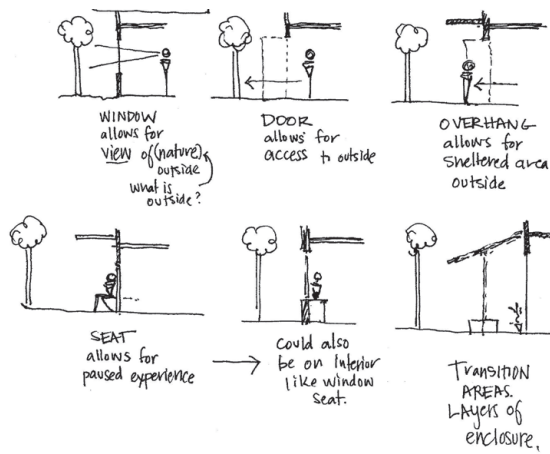


Figure 3.1 Architectural Elements and Scenarios encouraging a connection to the living environment

OVERVIEW

Following a series of literature reviews, research and investigations that lead to the majority of the content in the 02|Research + Foundations section of this thesis, I began preparing for an extended period of study in the Nordic and Baltic countries from June - December 2014 as a two month combination group study and travel through the University of Washington Architecture in Scandinavia program and four month independent study and research through the Valle Scandinavian Exchange Program.

During that time I also met up with the Gehl Master's Studio in Copenhagen, of which had I had partaken the year before, and with other Valle scholars studying in Denmark and Iceland. A large part of my study to further my understanding of biophilic design and its application was through the experience and analysis of built projects that embodied elements and principles of biophilic design, whether intentionally or not.

Having some kind of framework of analysis that would create a lens of biophilic design through which to experience the places on my travels, along establishing a more formalized manner to have a discussion on the topic with fellow students I was travelling with and establishing and setting up a website to host the required blog for the Valle Exchange became the main tools for implementing and documenting this experiential research before departure.

METHODS: CASE STUDY FRAMEWORK

In setting up a type of analysis framework I outlined elements or considerations that I thought were missing or not developed in the research I had done. For example, what specific architectural elements and combinations can contribute to more successful applications of biophilic design? (Figure 3.1). Through this experience and analysis, building on the research done, I was looking to explore the questions:

What architectural elements and scenarios encourage and enhance this connection to the living environment?

How can concepts and terminology of Simon Unwin’s “Analyzing Architecture Principals”(Unwin, 1997) and Christopher Alexander’s “A Pattern Language” (Alexander, Ishikawa, & Silverstein, 1977), be applied to biophilic design?

What is the artifact? What is its connection to? What synergies are created? What is the resultant experience? What patterns can be identified?

Given the release of “The 14 Patterns” by Terrapin, I decided to use their approach and classification for the base of my analysis and also for the “Biophilic Design Pattern Collection” on my website (<http://heli-ojamaa.squarespace.com/>). Through a combination of elements, aspects, considerations or approaches to the topic of biophilia or biophilic design that I came across in my research as well as thinking about what aspects of the “natural environment” don’t often exist in our “built environment” I added some additional items to the “14 Patterns” including some continuums to consider. Some of these may exist within the 14 Patterns in some way, but in order to better start identifying connections I had decided to break them out on their own.

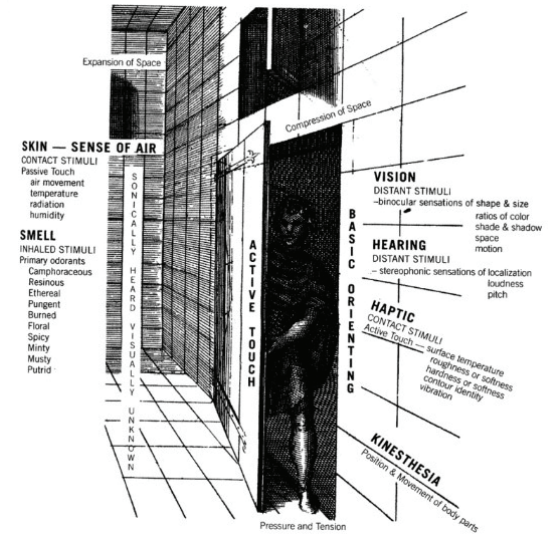


Figure 3.2 Range of Senses by Malnar and Vodvarka (Malnar & Vodvarka, 2004)

The main categories that I added where:

A CONNECTION TO CONTEXT:

PLACE (recognizing bioclimactic impacts on the project, what are existing systems? What were predevelopment conditions? How do systems respond to localized conditions? How does the project connect to surroundings, connecting and creating community)

TIME (How is the element of time reflected, both looking back to history and forward to the future and various cycles (daily, seasonal, annual) represented?)

PROCESSES AND SYSTEMS: How are various connections made and made evident both within the building and to a larger network

DYNAMIC (elements or space):

How is the dynamic (vs static) nature of nature reflected in the architecture also through adaptability and resilience

MULTI-SENSORY ENGAGEMENT:

The majority of how we perceive the world is through our senses- I felt that breaking down each of them on the framework was an important way to remind myself to be cognizant of all my senses while experiencing a space. I found Monice Malnar and Frank Vodvarka’s diagram of “Range of Senses” (Figure 3.2) extremely helpful in beginning to look at identifying architectural elements, how they are joined and how our senses respond to them.

CONTROL AND SELECTION

- Comfort control
- Spatial Options
- Clear Spatial orientation and circulation

PROJECT:		Location	
PROGRAM:		Date	
SITE DESCRIPTION/CONNECTIONS		Time	
Major Form of Connection to Nature		Weather Conditions	
Details, relationships that enhance			

TYPE OF ENGAGEMENT		TYPE OF NATURE			LENGTH OF EXPOSURE		QUALITY	
ACTIVE	PASSIVE	WILD	DOMESTIC	PERVERSE	PASSING	EMERSON	POOR	THRIVING
							QUANTITY	
							MIN	SCATTERED
								FULL

	N	M	Y	D/H/A	ELEMENTS	SYNTAX/LINKS	MEANING/REACTION/EFFECT
NATURE IN THE SPACE							
Plants, water and animals in built environment							
Visual connection with Nature							
Direct Connection with Nature							
Non-rhythmic sensory stimuli							
Natural Ventilation							
Access to Water							
Connection with Natural Systems							
Dynamic and Diffuse Light							
NATURAL ANALOGUES							
Objects, materials and patterns that evoke nature							
Biomorphic forms and Patterns							
Material Connection with Nature							
Complexity and Order							
NATURE OF THE SPACE							
Differing spatial configurations of the built environment							
Prospect							
Refuge							
Mystery							
Risk/Peril							
CONNECTION TO CONTEXT							
Place							
Time							
Processes-Systems							
DYNAMIC (elements or space)							
Adaptability and Resilience							
MULTI-SENSORY ENGAGEMENT							
sight							
sound							
touch							
taste							
odor							
CONTROL AND SELECTION							
comfort control							
spatial options							
clear spatial orientation circulation							

PEOPLE OBSERVATIONS	CEILING- SKYPLANE
EXTRA LIGHTING NOTES	WALL-VERTICAL PLANE
electric	GROUND PLANE
daylighting	

Figure 3.3 My Framework used for analysis of projects and places during travels

Each of these then had categories of whether they existed in the project (yes-no-maybe), if they existed in a Direct (D), Indirect (I) or Abstract (A) manner, what elements, syntaxes or links, and meanings, reactions or effects were associated with each.

The continuums I decided to include were:

Type of Engagement (active-passive)

Type of Nature (Wild, Domestic, Perverse) (Kahn, Ruckert, & Hasbach, 2012)

Length of Exposure (Passing, Full Emersion)

Quality (Poor, Thriving)

Quantity (Minimum, Scattered, Full)

The “types of nature” were taken from Kahn, Ruckert and Hasbach’s “A Nature Language” through which they are generating a “way of speaking about patterns of interactions between humans and nature, their wide range of instantiations, and the deeply meaningful and often joyful feelings they engender” as part of a new agenda for the field of ecopsychology. As part of establishing this language, the authors identified that “interaction patterns” and their “instantiations” can be characterized along the continuum of wild (which they define as an “intricately sensorial” experience), domestic (thinking of moving from hunter-gatherer to societies of agriculture and domestication of animals), and perverse (a serious deviation from what is considered normal- more of nature in captivity or representation of nature in a removed way. They distinguish a way to distinguish between domestic and perverse is if “another entity is being physically or psychologically harmed through the interaction”. I would also add that if something, be it plant, animal, natural element, etc is taken completely out of context and isolated in a way that survival is unlikely except for completely artificial means). Looking at an interaction pattern of “sitting by fire” they breakdown the Instantiations to be:

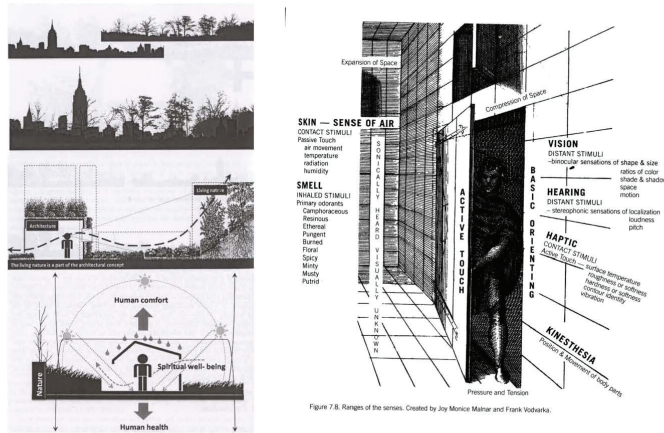
“Wild: Sitting around a campfire under the night sky

Domestic: Sitting by a fireplace in a family room

Perverse: Sitting by a digital fireplace”

Especially as our relationship with nature, forms of nature and the natural environment are changing I found these distinctions extremely important to think about. I think we can all relate to seeing what could be termed “captive trees” either along the street edge or within buildings where like animals in zoos they are almost caged and on display and most likely not thriving depending on completely outside sources to survive.

Finally I also included an area for notes of people observations, some additional lighting (electric and daylighting), and for comments on the ceilings-skyplane, wall-vertical plane, and ground plane.



(diagrams by Amjad Almusaed (left) and Malnar and Vodvarka (right))

In discussing the Nordic Classicism, Jen and Peter mentioned a secular salvation in Nature instead of the Church and the belief that nature speaks to us—it is up to the architect to interpret.

As part of my thesis research I have been exploring the connection between our built environment and nature (natural elements and systems in the natural occurring environment) and how the designed relationships impact the human experience and sensory response. The Nordic cultures are known for their close connection to nature that is reflected in their design sensibility—so what better place to explore how this translates to design application!

We have the great opportunity on this trip to experience the buildings and spaces, engaging our senses and going beyond the static two dimensional representations that we have looked in the field guide and become cognizant of how the design approaches relate to and shape they dynamic natural ly occurring environment in which the buildings are sited. We can each bring an individual perception and interpretation of the space, and so with a group coming from various backgrounds (cultural and discipline) I was hoping to generate some dialogue from this perspective of analysis in visiting the projects .

If you are willing, getting some written and photographic feedback documenting your experiences and sensory responses while in some of the projects we visit would assist me in getting various perspectives related to my thesis research and hopefully create some good conversations about how our perceptions and reactions may vary. Thank you in advance for your participation if you decide to contribute please fill out the following information and I will collect, compile and return your responses at the end of the trip that could make a great addition to your sketchbooks. Heli

Name (If you want to include or create number or code)
 Age:
 Sex:
 Current Discipline and/or previous :
 (for example if you are studying architecture but previously were a biologist or artist)
 What is your cultural background/where are you from:

Figure 3.4 Introduction and background to Architecture in Scandinavia group dialogue

Name/Identifier:

Project: Date:

(use the plan to mark the location of a photo that you share or to key any references to your answers below)

Question 1: NATURE CONNECTION

How do you feel this building relates to or interacts with nature and the natural occurring environment that it is set?

Do you interpret a clear “environmental vision” for the space/building?
 (for example Fallingwater engages with the water of Bear Run Creek)

Question 2: SENSORY RESPONSE

Does this building/space engage any of or a combination of your senses (sight, smell, taste, touch, hearing) in a way that enhances your experience of the space?

Question 3: DESIGN ELEMENT

Was there a specific design element or detail that enhanced or engaged your connection to nature or your senses? (for example a specific type/form of aperture, level of enclosure, the heat from a radiating wall, or a seat that changed or fostered your experience of the space)

Figure 3.5 Questions to generate group dialogue

GROUP DIALOGUE

Being that for the beginning part of my studies was travelling with a group of just over 20 students from various cultural backgrounds and disciplines (within in UW architecture, landscape architecture, urban design and planning and also various undergraduate studies) it afforded a unique opportunity to generate dialogue and get feedback on how we all might experience the same places and interpret their relationships to nature differently. To begin to generate that dialogue I created a sheet to distribute to the group with a description of my research interest and created a list of broad questions, not specific to biophilic design on Nature Connections, Sensory Response and Design Elements to be distributed at select places we visited.

WEBSITE STRUCTURE

As part of the Valle Exchange Program, you are required to keep a blog during your studies and travels. To host that blog and to create an interface through which to communicate and log my travel and experience research I created a website (<http://heli-ojamaa.squarespace.com/>) to host information on the project's background, a Biophilic Design Pattern Collection based on Terrapin's 14 Patterns, the Blog, and Links, Resources to Biophilia and Biophilic Design in the News.



Figure 3.6 Website “Heli’s Nordic and Baltic Adventures: Valle Scholarship Documentation and Blog. Looking for a reconnect. Enhancing our built environment through a connection to nature” structure.

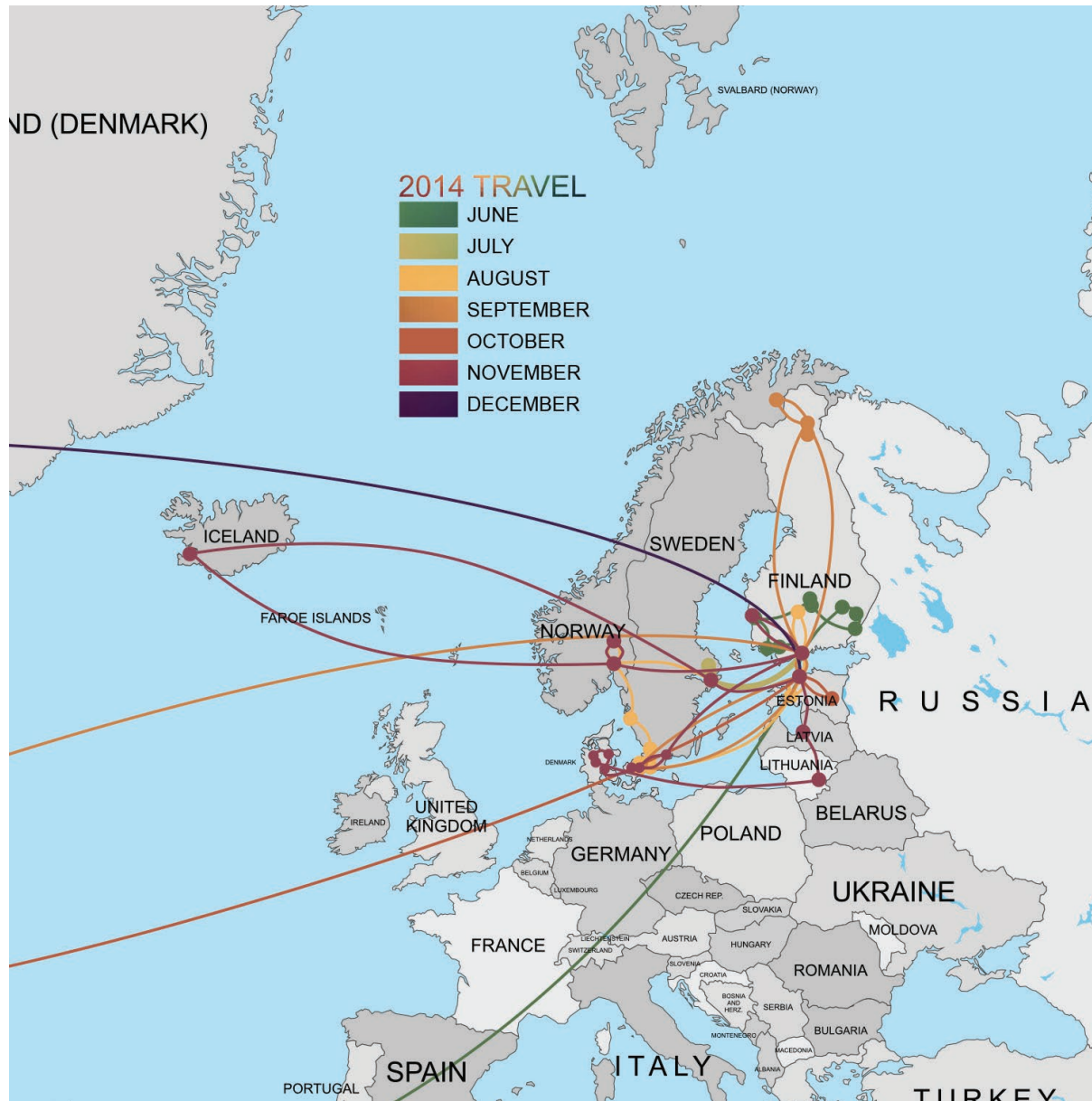


Figure 3.7 Month by Month locations traveled

OVERVIEW

During the seven month study, from June 2014- December 2014 I visited projects in all Nordic and Baltic countries, with the exception of making it to the autonomous regions of Greenland, the Aland Islands and the Faroe Islands, intentionally trying to visit some projects multiple times in different seasons. How does a building design or element that allows for a summery sunny interaction compare in a dark cold winter? Before departure I had identified some specific projects of interest but tried to also keep the itinerary a bit open ended to allow for exploration. I was not looking at any program specific projects, planning on looking at both whole building at single elements, paying particular attention to lighting (natural and electric) and a connection to water and the waterfront, with a focus on what lessons learned could ultimately be translated to a design project in Seattle. The interest in lighting, both natural and artificial, was driven not only my general interest in the topic which has also deepened through the department's Lighting Design Certificate program, but identifying and understanding of light in as being critical in biophilic design.

“A patch of sunlight marks the passage of time, a diffuse daylight swells as the vapor of an overhead cloud dissipates. These phenomena connect us to the authentic nature of place and to the rhythm of light and dark that shapes our being in the world. Daylight breathes light and life into our buildings. Daylight and sunlight are perhaps the last refuge of true wildness in our modern cities”

-Christopher Meek and Kevin Van Den Wymelenberg (Meek & Van Den Wymelenberg, 2012)

I set out with my framework analysis, cameras, sketchbooks, and curiosity ready to explore, interpret and analyze.

I found that it was difficult to analyze an entire building using these specific elements and what became more interesting was common themes and elements that I began seeing between projects that when they were present, the biophilic design elements seemed to have a more impactful effect. Also in creating a website that organized photos from the projects I visited categorized by the 14 Patterns, some of which you see throughout my presentation, I found that often specific architectural elements could be associated with a biophilic design pattern. For example stairs and mystery.

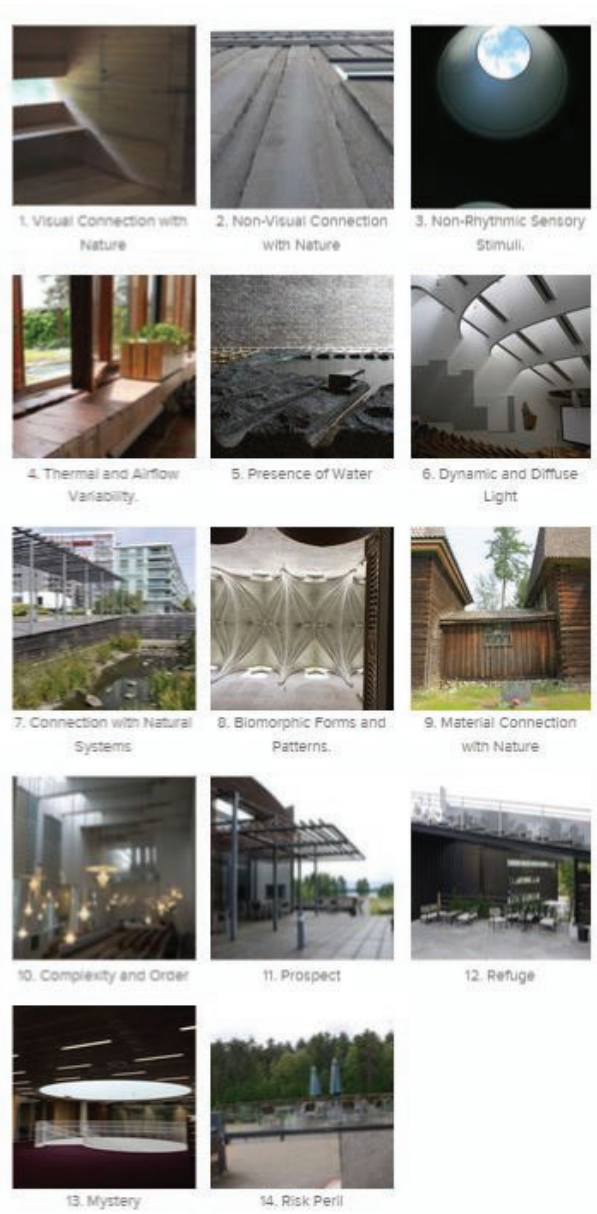


Figure 3.8 Biophilic Design Pattern Collection opening page

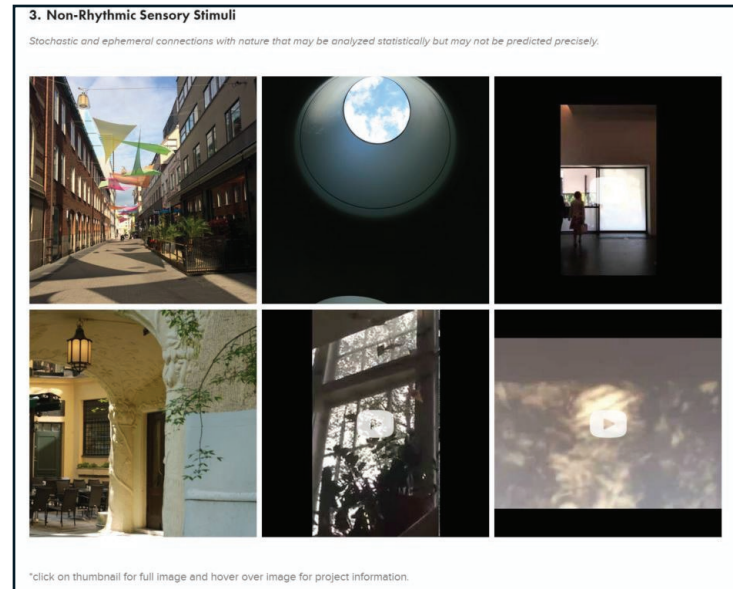


Figure 3.9 Example of Pattern Collection- here for Non-Rhythmic Sensory Stimuli

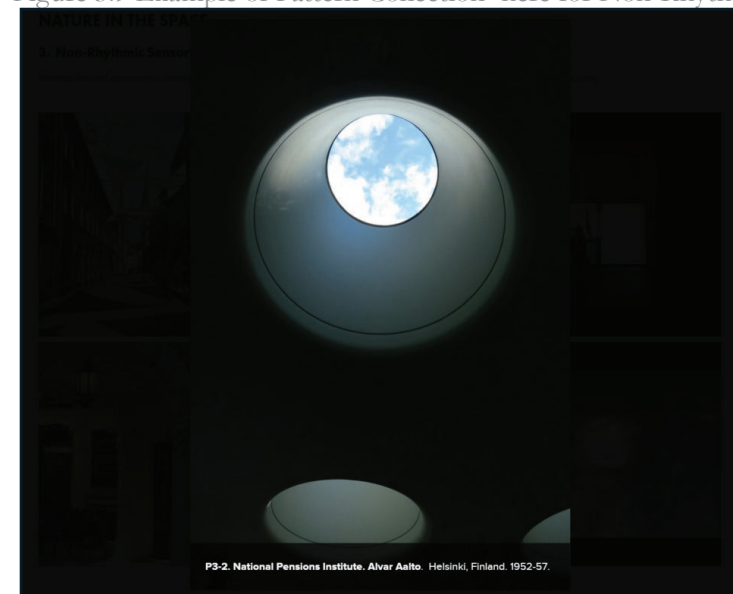


Figure 3.10 Example of Individual Pattern with project information

METHODS USED

The predominant methods for my explorations during this time were photographic and video documentation, group dialogue and interviews, my framework analysis, sketching, reading and continued research, blogging and the pattern collections, and trying to really experience places- trying to balance being analytical and trying to really experience a place as it is intended and watching others experience them. I found this to be a tough balance sometimes and realized, especially travelling as a group visiting numerous projects daily that architects can be a funny species and how we visit and analyze projects on our “pilgrimages” could be a thesis on its own.

PHOTOGRAPHING AND VIDEOS|WEBSITE AND BLOG

In digitally documenting the places I visited I did so using a couple techniques, and was doing so for a couple reasons:

- 1 Images become a powerful tool to communicate ideas (I wanted to begin to create, or add to a library of my own- both good and bad examples)
2. They are a good way to document and remember changing characteristics of a place
3. Panoramas, although sometimes distorted, begin to capture a larger context
4. Videos can become more reflective of the actual experience of a place- capturing sounds and movement and in filming zoomed in looking down and then out can also more closely mimic our focus and experience with the ability to convey it to others

Categorizing photos and videos in the “Biophilic Design Pattern Collection”, using the Terrapin’s 14 Patterns as a base, became a good way to analyze and look at elements as individual incidences and as a whole. The collections are a combination of photos taken intentionally with a pattern or element in mind, or one that I may have identified later on. Looking at the collection for “Mystery”, it became clear the characteristic of light and the element of stairs or ramps where something that often created this pattern to exist.

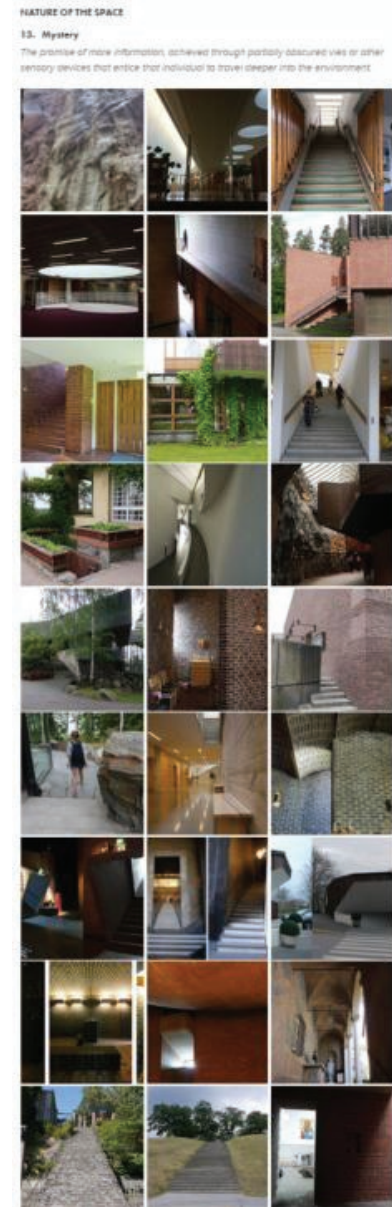


Figure 3.11Mystery Pattern Collection



Figure 3.12 Incident of mystery at the LUSTO Museum in Finland

GROUP DIALOGUE

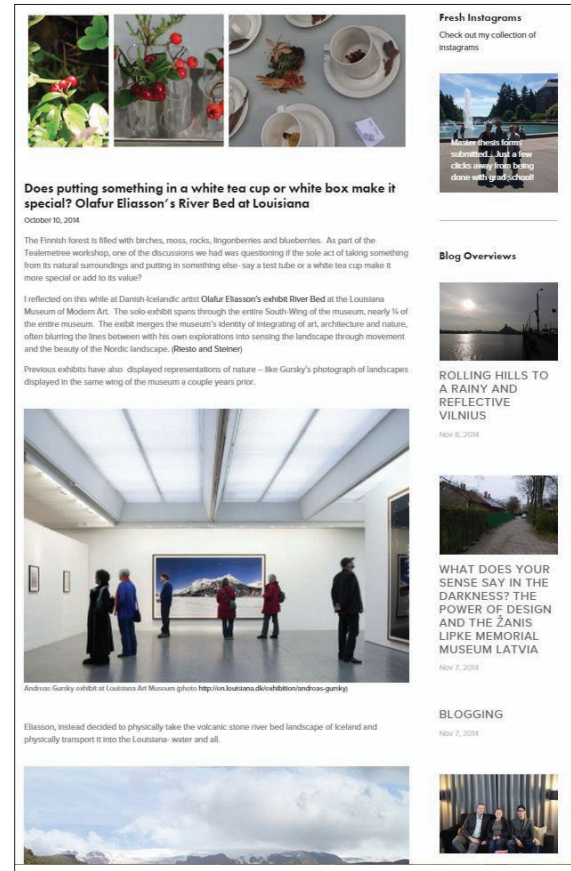
Much of the group dialogue and responses supported or mirrored much of the research on biophilia and biophilic design. Three conversations stuck out to me—One was in Oslo discussing the “Barcode Buildings” and development- the student said that they liked the buildings, but thought there was not enough green space, that they liked green spaces and they make spaces feel better- here there was too much building. In the Goteborg Law Courts, another student said they really liked the interior- the wood paneling was a feature that they really responded to and they found that buildings with wood interiors made them and others feel happier. Another student at one point discussed how they didn’t actually like being in nature, or coming in contact with bugs and insects and preferred to be more removed from it.

ANALYSIS FRAMEWORKS

The analysis frameworks and series of questions became a good reference and reminder while visiting places as well as a place to document reactions and elements in a more formalized manner. I don’t believe that comparing the forms overall would be extremely informative but they did create a record for me to be able to reference, and more importantly helped shape my awareness while at projects. I often found that the analysis framework was difficult to fill out or document in thinking of a whole building, partially because even though I tried to set it up to identify relationships and links, the patterns and elements seemed to be focused or easier to define in terms of individual elements or an experience that wasn’t reflective of a whole building approach. I also began sensing while filling them out that there were larger elements or characteristics becoming evident between projects that helped shape how I responded to or raised the impact fullness of the individual elements.

BLOGGING

Blog writing (posted on the website (<http://heli-ojamaa.squarespace.com/>)) became an informative part of the process, having to summarize and relate experience through words and images often through which I had realizations I most likely would not have had otherwise. Following my visit to Riga I wrote “What does your sense say in the darkness? The power of design and the Zanis Lipke Memorial Museum Latvia” exploring sensory response within a very intense and emotional context. It also allowed for a way to connect some of the experiences I was having like my experiences as part of the Climate Whirl project in the forests of Finland and a discussion of Olafur Eliasson’s River Bed installation at the Louisiana Museum in Denmark in “Does putting something in a white tea cup or white box make it special? Olafur Eliasson’s River Bed at Louisiana”. Though not always directly related to biophilic design almost all of the blog posts in some way pulled on experiences that were shaping my understanding on the topic and beginning to inform my attitude and approach.



The screenshot shows a blog post layout. At the top left, there are three small images: a close-up of red berries, a glass vase with red flowers, and a white tea cup with a saucer. The main title is "Does putting something in a white tea cup or white box make it special? Olafur Eliasson's River Bed at Louisiana" dated October 10, 2014. The text discusses a workshop and the artist's installation. A large image shows a gallery space with people viewing a large landscape painting. Below this is a caption about the artist's decision to transport volcanic stone. At the bottom left is a wide landscape photo of a river valley. On the right side, there are several smaller article teasers: "Fresh Instagrams", "Blog Overviews", "ROLLING HILLS TO A RAINY AND REFLECTIVE VILNIUS", and "BLOGGING".

Does putting something in a white tea cup or white box make it special? Olafur Eliasson's River Bed at Louisiana
October 10, 2014

The Finnish forest is filled with birches, moss, rocks, lingonberries and blueberries. As part of the Telemetree workshop, one of the discussions we had was questioning if the sole act of taking something from its natural surroundings and putting in something else- say a test tube or a white tea cup make it more special or add to its value?

I reflected on this while at Danish-Icelandic artist Olafur Eliasson's exhibit River Bed at the Louisiana Museum of Modern Art. The solo-exhibit spans through the entire South-Wing of the museum, nearly 1/3 of the entire museum. The exhibit merges the museum's identity of integrating of art, architecture and nature, often blurring the lines between with his own explorations into sensing the landscape through movement and the beauty of the Nordic landscape. (Resto and Steiner)

Previous exhibits have also displayed representations of nature - like Gursky's photograph of landscapes displayed in the same wing of the museum a couple years prior.

Andrew Gursky exhibit at Louisiana Art Museum photo <http://en.louisiana.dk/en/aktuelle/andrew-gursky>

Eliasson, instead decided to physically take the volcanic stone river bed landscape of Iceland and physically transport it into the Louisiana- water and all.

Fresh Instagrams
Check out my collection of Instagrams

Blog Overviews

ROLLING HILLS TO A RAINY AND REFLECTIVE VILNIUS
Nov 8, 2014

WHAT DOES YOUR SENSE SAY IN THE DARKNESS? THE POWER OF DESIGN AND THE ŽANIS LIPKE MEMORIAL MUSEUM LATVIA
Nov 7, 2014

BLOGGING
Nov 7, 2014

Figure 3.13 Screen capture of blog post on website (<http://heli-ojamaa.squarespace.com/>)



Figure 3.14 Finnish Sauna and Grillikota at Hyytiälä Forestry Field Station, Hyytiälä, Finland

NORDIC-BALTIC TRAVELOGUE: CASE STUDIES IN BIOPHILIA

How can our built environment enhance our connection to nature?

The image above is an answer, and one that is extremely Nordic-Baltic, Finnish in this specific example, but similar location specific examples can be found in the hot springs of Iceland. The complex of a sauna and a grillikota along wooden decking on the side of a lake directly engages you with natural elements- water, fire, stone, wood, air. Although for me going to saunas and jumping in lakes has been part of my upbringing, it was not until jumping in this lake that I experienced the wind being knocked out of me. From one day to the next the water had become significantly colder and without checking I was bold and jumped in.. it was exhilarating. The experiences and bonds that two small structures- one to heat yourself and one to heat your food with wood planking between the two and into the water are so simple... yet create an experience that is so memorable and pure, that it is hard to put into words. You are engaged, fully present. There is a ritual, connections to what and who is around you.



This ritual of the sauna is largely culturally specific- not something that everybody can initially or ever really relate, but through these investigation I did begin to identify some patterns of architectural elements and scenarios that have international translations applications that support an enhancement of a connection to nature through the design of our built environment that are summarized here through a representative image.



Figure 3.15 School in Tartu, Estonia.

STAIRS

providing access and mystery



Figure 3.18 Rooftop farm Copenhagen, Denmark

ROOFTOPS,

often underutilized become important, dynamic spaces, especially in cities



Figure 3.16 LUSTO Museum Finland

BRIDGES

providing access, making connections, affording unique perspective and views



Figure 3.19 Oslo Opera House. Oslo, Norway.

Access to ROOFTOPS and getting up high for VIEWS is something that people are drawn to



Figure 3.17 Church of St Mark. Stockholm, Sweden

CANOPIES provide shelter, SEATS and TABLES invite you to stay WATER engages the senses and enables life and interaction, for humans and plants and animals- especially birds



Figure 3.20 Mortensrud Church, Oslo Norway.

COURTYARDS and L and U shaped building forms allow for indoor-outdoor relationships



Figure 3.21 Saajos Cultural Center Inari, Finland

VOLUMES

within spaces create interesting dynamic environments and the ability to separately condition spaces.



Figure 3.22 Church in Iceland

APPROPRIATENESS and PROGRAM.

In the landscape of Iceland, it was important for the white church to contrast the landscape and stand out as a beacon, yet the support building could blend in with the grass roof. Priorities and function of spaces need to be kept in mind for proper execution.



Figure 3.23 Rooftop access as part of the MOOD shopping mall in Stockholm, Sweden.



Figure 3.24 Tempeliaukio Church. Helsinki, Finland.

Though these connections and relationships may be seen to be easier to achieve in rural settings, there were plenty of good urban examples to be had, both of the following examples being in the center of major cities- Stockholm and Helsinki.

CASE STUDY: ARTIPELAG ART MUSEUM Nyréns Arkitektkontor. Stockholm, Sweden. 2010.

One of the buildings that began pull many of the pieces together, while giving me a good overall picture in broad design approaches was the Artipelag Museum in Stockholm, Sweden. Visiting this project left a significant impact on me, first in the summer and then again in late fall. What was is about this project that was so significant?



Figure 3.25 Artipelag. Entry court from land

Image . Figure 3.26 Artipelag, Approach to museum from water



Regenerative and “net-positive” design as often described by Bill Reed takes a “do more good” approach with the goal being that a buildings “adds value” to a place and ecological system.(Mang & Reed, 2015) My experience to Artipelag translated this to a similar way of thinking in how a project through its clear vision and integration of architecture, context and program can create a building that affords a unique and positive interaction with nature that wouldn’t exist if the building was not there.

“Allemansrätten” or the Right of Public Access of Freedom to Roam grants the general public a right to enjoy nature without the laws of trespassing in Sweden. However, the beauty of the archipelago was something that many still did not have access to. Artipelag and the supported infrastructure to get there create this opportunity and one can enjoy the nature, sculptures and art surrounding the museum without paying admission. Architectural elements and forms also create views and perspectives that one could not otherwise achieve.

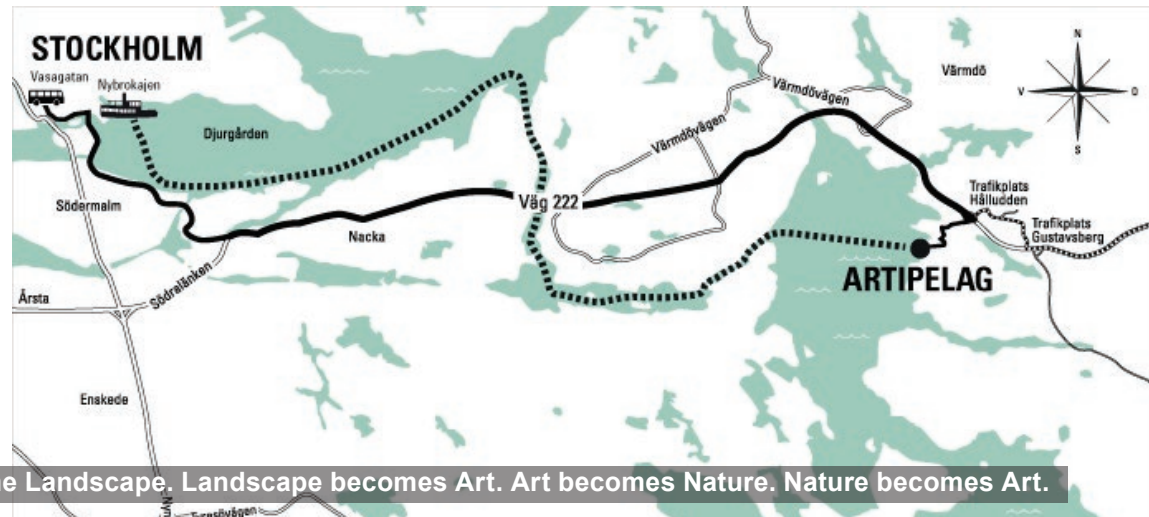
Figure 3.27 Artipelag. Arriving by water on boat from Stockholm.



Figure 3.28 Artipelag. Boardwalk along water from pier to museum.



Located on Värmdö in the Stockholm Archipelago, just 20 minutes from the city center by car or bus (there is also a free Artipelag bus) or 1.5 hours by boat, Artipelag is more an art museum, it is a nature and sculpture park, classroom and venue for performances and good food. Whether arriving by water or by land the approach is unique and immersed in beauty of the surrounding nature.



Boundaries are blurred. Architecture become Landscape. Landscape becomes Art. Art becomes Nature. Nature becomes Art.

Figure 3.29 Artipelag. Arrival from Stockholm via bus or boat. ("Artipelag,")



Figure 3.30 Artipelag. The Boardwalk-wooden nature trail from Parking



Figure 3.31 Artipelag. Approach to museum from land.

"OUR OLDEST WORK OF ART

The Café's huge rock, or "båda" in local archipelago speak, was eroded to its current form by land glaciers about 11 thousand years ago. When the ice masses melted and retreated, the earth's compressed surface began to slowly rise and bådan could emerge from the sea in the beginning of 1,000 BC. We are happy to have it as a permanent part of our exhibition.

The candelabra, "The Power of Nature", is designed by Siri Seger."

-Text from café wall.



Figure 3.32 Artipelag. View of "båda" and "the Power of Nature"



Figure 3.33 Artipelag. Approaching museum entrance from seaside



Figure 3.34 Artipelag. “Milkyway” inclined walking path to roof



Figure 3.35 Artipelag. Sculpture perching on rooftop

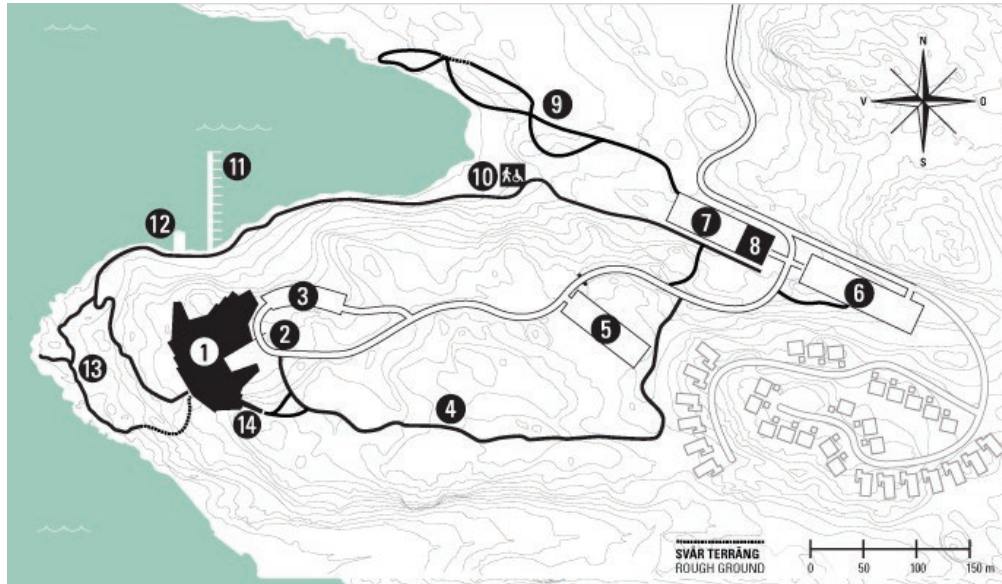


Figure 3.40 Artipelag. Site Plan and key. (“Artipelag,”)

1. MAIN SITE
2. BUS STOP
3. TONY - PAY PARKING **P**
4. FOREST TRAIL - NATURE PATH
5. JOSEFIN - PAY PARKING
6. BJÖRN - PAY PARKING
7. LILLEMOR - PAY PARKING **P**
8. SERVICE BUILDING
9. SEASIDE TRAIL - NATURE PATH
10. THE BOARDWALK - WOODEN FOOTBRIDGE
11. GUEST PIER
12. PIER FOR PASSENGER BOATS
13. HEAD OFFICE TRAIL - NATURE PATH
14. MILKY WAY - FOOTBRIDGE TO THE ROOF TERRACE



Figure 3.36 Artipelag. Open main entry space.



Figure 3.37 Artipelag. Tarred wooden facade



Figure 3.38 Artipelag. Rock forming wall of restrooms

Throughout the project you have beacons and elements to relate to as you move through the spaces- like the sculpture perching on the edge of the roof, by Maria Miesenberger, creating sense of curiosity as you approach the building making you want to explore (Figure 3.28). As it turns out stairs with lights forming the stars of the milkway will bring you up to the roof, where you can look down and see where you can previously come from, along the trail and out to the water (Figure 3.30).

Throughout visiting the project, all of your senses are engaged.



Figure 3.39 Artipelag. Herring lunch.

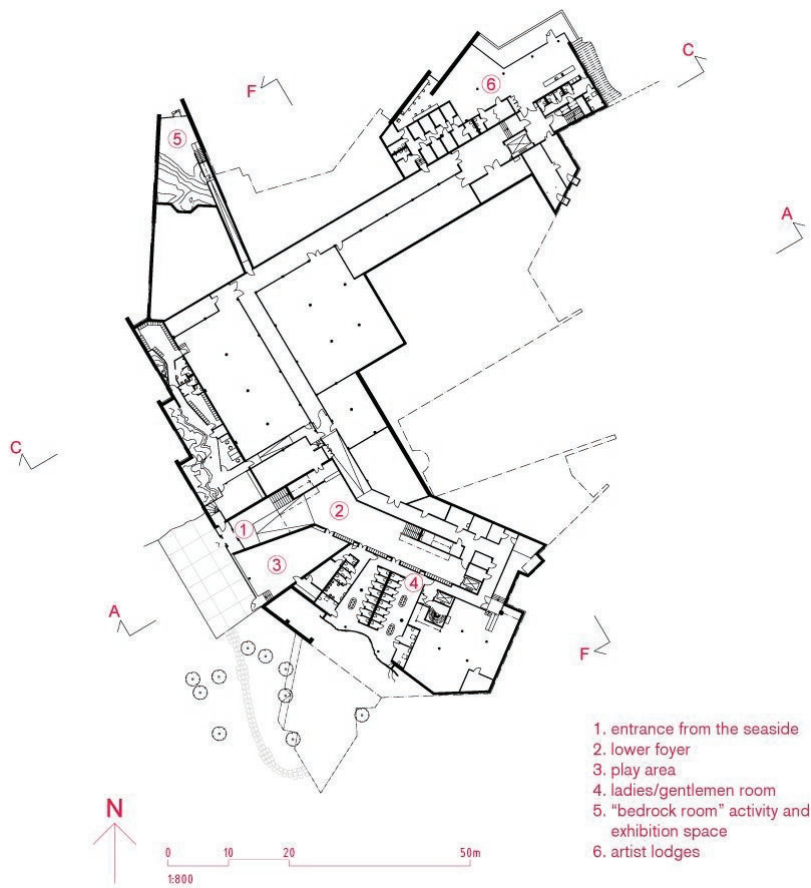


Figure 3.41 Artipelag. Lower Level Plan



Figure 3.42 Artipelag. Ground Level Plan

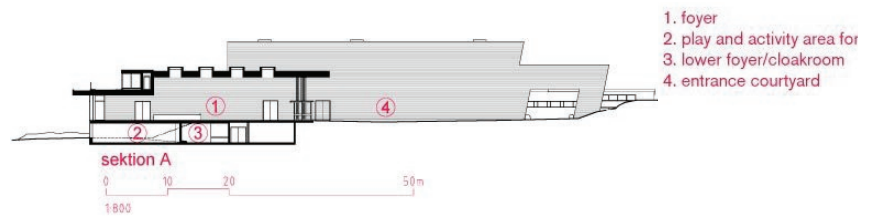


Figure 3.43 Artipelag. Section through ground level entry

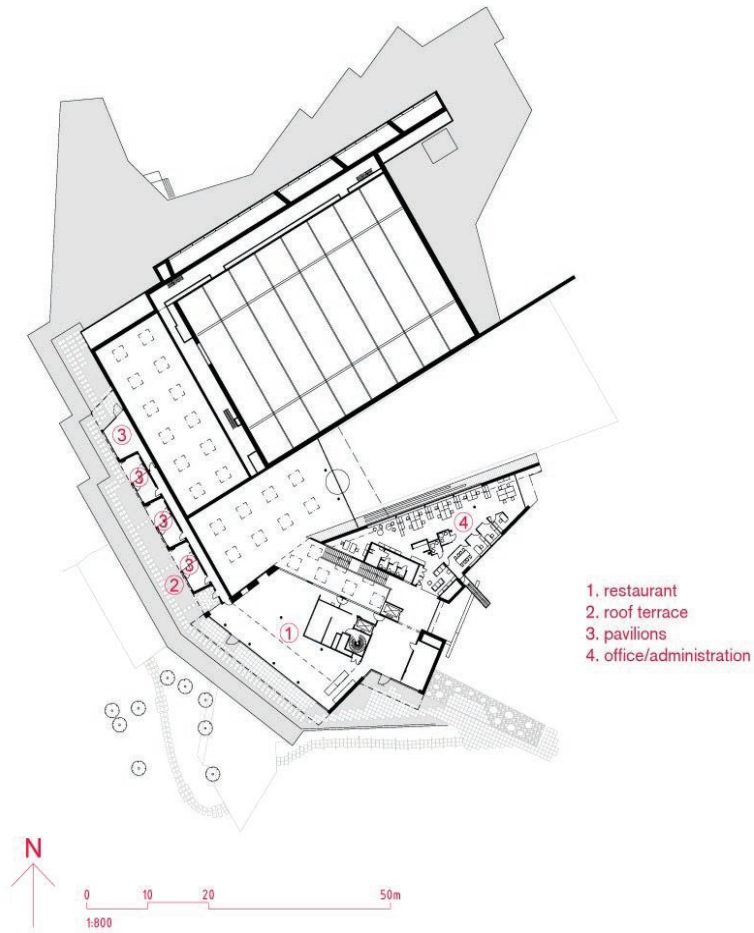


Figure 3.44 Artipelag. Second Level Plan



Figure 3.45 Artipelag. Roof Plan



Figure 3.46 Artipelag. Section through Exhibit Hall

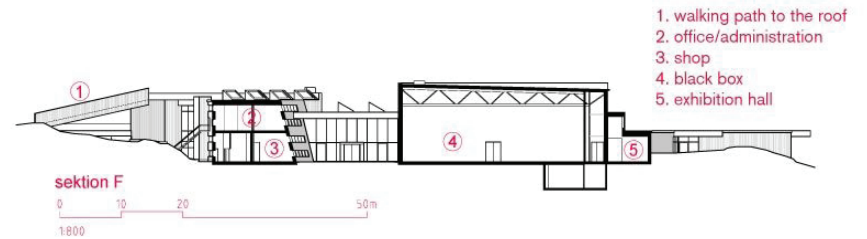


Figure 3.47 Artipelag. Section showing roof access and entry court



LESSONS LEARNED TO BE APPLIED

Humanized design with non-anthropocentric worldview

NEED FOR LARGE OVERARCHING PATTERNS THAT SHAPE ARCHITECTURE AND ARCHITECTURAL DESIGN APPROACH

BIOPHILIC DESIGN PATTERNS APPLIED TO ARCHITECTURAL DESIGN THROUGH:

1. Designing with patterns to support and unify project program, vision and mission, context and site relationships, building and architectural systems and user experience
2. Enabling and encouraging an engagement of and perspective of context that didn't otherwise exist
 - occupiable roofs, bridges, piers, towers
3. Responding to, engaging and enhancing existing site elements, natural systems and processes
4. Varied levels of enclosure and nested volumes within large spaces
5. Variation of defined boundaries and transitional zones
6. Building form allows for views to, awareness and engagement of natural elements, systems and processes
 - courtyards, patios, U shaped buildings, balconies, amphitheaters
7. Engaging all senses



Figure 3.48 My Lessons Learn to be Applied

LESSONS LEARNED

In returning from my travels I began to synthesize from all the projects what stood out in the projects that I investigated, I defined larger overarching patterns that shape the architecture and architectural approach through which the biophilic design patterns or elements could be applied to an architectural design. Successful projects seemed to have patterns that supported and unified project program, vision and mission, context and site relationships, building and architectural systems and user experience.

I realized the application of biophilic design patterns could support and enhance the program of a project was something I hadn't really come across too much in discussions in my research. This list and how it was organized developed and was refined as part of the processes, through referencing it as a design tool and through discussions with my committee. Figure 3.48 represents one of the initial lists, developed early on in the design process, with additional lists included in the appendix. One significant shift was when the organization and structuring was shaped by MAJOR PRINCIPLES, methods to implement and SUPPORTING PRINCIPLES, which lead to the more final version (Figure 3.49).

In the refinement of a biophilic design approach, or identifying larger overarching principles or elements that when they existed in a project, any biophilic design elements seemed to be executed more successfully, I found that a key element was that the buildings encouraged and gave opportunities for engagement that didn't otherwise exist. That they reminded you of what you are a part of—and did so in a memorable way that fostered that connection. Because our body remembers more than our mind, the projects where your body and senses were actively engaged became more memorable.



RESPONDING TO CONTEXT

Weaving it together

COMMON THREADS Designing with patterns to support and unify project program, vision and mission, context and site relationships, building and architectural systems and user experience at various scales.

SITE|SITING Responding to, engaging and enhancing site elements, natural systems and processes through design responses at various scales and degrees of visibility through the architecture.

CONNECTIONS|WHAT YOU ARE A PART OF

Fosters an understanding, awareness and comprehension of what you are a part of, making connections and laying framework for connections to be made and affording opportunities for engagement that didn't otherwise exist.

PERSPECTIVE: Enabling and encouraging engagement with, and giving a perspective that didn't otherwise exist.

PHYSICAL PERSPECTIVE: through access

VISUAL PERSPECTIVE: through unique views

CONCEPTUAL PERSPECTIVE: Natural systems and processes + historical and contextual references

ORIENTING PERSPECTIVE: through passages, connections and views of where you are going and back to where you came from

TIME|CYCLES|RITUALS Dynamic not Static. Element of time, natural cycles and changes evident in building

MEMORABLE WAY OF FOSTERING THAT CONNECTION

Our body remembers more than our mind

SENSES Engaging and responding to all senses in experience of building

ARCHITECTURAL TERRAIN Seeing architecture and architectural form as a landscape and habitat. Above, below, within.

VARIED ENCLOSURE Varied levels and degrees of enclosure and nested volumes within spaces

TRANSITIONS|GRADIENTS|EDGES Combination of defined boundaries and transitional zones inside and outside

Architecture that encourages and gives opportunities for engagement that didn't otherwise exist, reminding you what you are a part of and doing so in a memorable way that fosters that connection.

Design knowing our body remembers more than our mind—design in a way where body/senses are actively engaged.

Figure 3.49 My architectural framework for a biophilic design approach

04 | DESIGN IMPLEMENTATION: Project Specific Translation

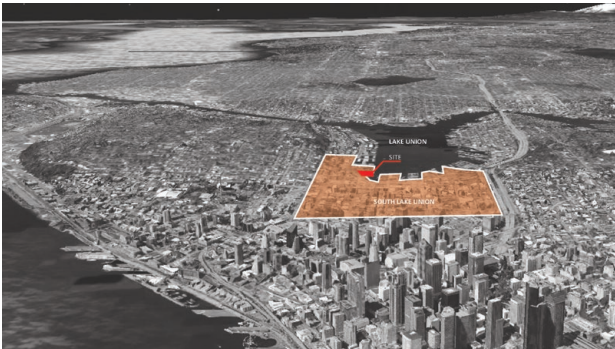


Figure 4.1 Birdseye view of Seattle with South Lake Union Urban Center and site location highlighted



Figure 4.2 Birdseye view of Lake Union with site location and connections highlighted



Figure 4.3 Site boundary

PROJECT OVERVIEW

As a way to develop and test the approaches to implementing biophilic design that I had been refining following the Valle on a specific program and context, I developed a general schematic for the Lake Union Branch Public Library located on the banks of Lake Union in Seattle, Washington.

Located on the southwest corner of Lake Union, the site is currently occupied by a parking lot, office building and seaplane terminal of Kenmore Air. Of the 60,000 sf site boundary, about 1/3 is land (18,000) and 2/3 water is water.

The proposed 26,000 square foot two story building functions as a neighborhood branch library of the Seattle Public Library network with typical operating hours of 10 am - 8pm Monday-Thursday, 10 am - 6pm Friday-Saturday, 1pm – 5pm Sunday, with community rooms and facilities that could be separately accessed after hours for events.

The main users of the library fall in one of the following categories:

- VISITOR**
- LIBRARY/STAFF**
- COMMUNITY**
- RECREATIONAL READER**
- STUDENT OR RESEARCHER**

The general building program elements falls under the main categories functionally provided by the typology of a library, with some crossover of categories:

INFORMATION

- Periodicals Section
- Special Collections Library
- Media area with Computers

PROCESSING INFORMATION

- Reading Rooms
- Children's Library
- Quiet Rooms
- Outdoor Overlook and patio

COMMUNITY ELEMENTS

- Theater
- Gallery
- Meeting Rooms

LIBRARY SUPPORT

- Main Desk
- Reference, Circulation and Inter Library Loan (ILL) Checkout
- Staff Rooms and ILL Stacks
- Special Collections Librarian

BUILDING SUPPORT

- Restroom Facilities
- Utility Rooms

CIRCULATION

- Stairs and amphitheater seating
- Bridge and reading room

This project examined how biophilic design principles can help translate the Seattle Public Library's Vision for Seattle as

"a city where imagination and opportunity thrive",

their mission of bringing

"people, information and ideas together to enrich lives and build community"

and service priorities of

"youth and early learning, technology and access, community engagement, Seattle culture and history, and re-imagined spaces"

into a new branch library in South Lake Union that will meet the libraries service priorities while enhancing a connection with nature through referencing and developing the components of my Architectural Framework for a Biophilic Design Approach. ("My Library: the Next Generation, Strategic Plan 2011-2015," 2011)



Figure 4.4 The Magnolia Branch Library, part of the Seattle Public Library Systems offers good examples of biophilic design patterns integration



Figure 4.5 Site located on King County watershed map(edited map)

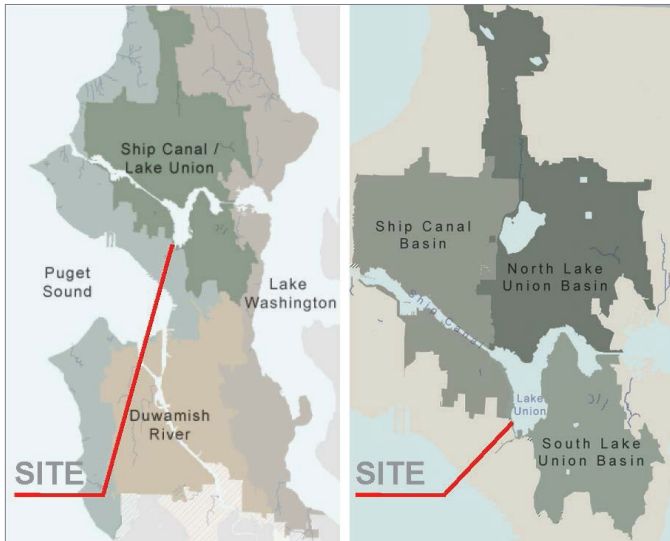


Figure 4.6 Site located on Seattle Urban Water Basins map. Edited maps from (“Seattle’s Urban Watersheds,”)

SITE AND PROGRAM : SELECTION RATIONALE + CONTEXT

In choosing a site, I wanted have the opportunity to explore a response to nature within an urban context. Lake Union, at the heart of Seattle is a unique historically and contextually rich, actively used natural feature of blue space- both water and air at the heart of one America’s fastest growing cities. The public green spaces along the Lake are mostly limited to the Gas Works Park to the north and Lake Union Park to the south, with the exception of some street end access and the remaining shoreline being taken up by private docks and industry. The identified site is in proximity to the quickly developing South Lake Union (SLU) Urban Center and would be accessible to many being close to the developing SLU Uptown Triangle Mobility Hub, and along the 6 mile Cheshiahud Lake Union Loop and Westlake Cycle Track. Potentials for the project include contributing to King County Shoreline Public Access, Restoration and Enhancement Plans and connecting to the city’s Blue Ring¹ open space strategy .

The site is at a critical location in terms of a larger watercycle, located in the Lake Washington/Cedar River Watershed, just at the edge of Seattle’s three urban basins or watersheds that contribute to Seattle’s four major receiving waters: Lake Washington, the Ship Canal and Lake Union, the Duwamish River and Puget Sound through stormwater drainage and combined sewer overflows(“Seattle’s Urban Watersheds,”). Whereas on

¹ The “Blue Ring” Plan is a open space strategy using water as its organizing theme for Seattle’s downtown, building on the Olmstead Brother’s “Green Ring” vision. The strategy creates a framework connecting private and public spaces to preserves and enhance open space in the city. They define open space as four dimensions: streets, light+ air, water, and time.(Seattle, 2002)

the northern side of Lake Union Salmon migration is an environmental consideration, the migration routes do not pass to the south of the lake. The larger environmental concern for site is instead that banks of the lake become the last buffer and filter for surface stormwater runoff into the lake, either impacting the water quality in a way that can either improve the habitats and ecosystems or damage them.

Often access to nature is looked as a luxury and not as a human need. As a counter, I wanted to explore the role that a public building can have in uniting and enhancing public green and blue spaces through the architectural design approach. “Open to all”, public libraries are one of the few remaining public buildings with regular hours and access to the general public. Historically public libraries also played an interesting and significant role in the establishment of environmental quality standards in buildings. Oriel Prizeman discusses this from the perspective of public libraries supported by Carnegie towards the end of the nineteenth century in the United States and Britain from which emerged the first standards of international environmental standards for public spaces and also methods through which to measure and compare both natural and electric lighting (Prizeman, 2011). Seattle has a thriving Public Library system with a mission to “bring people, information and ideas together to enrich lives and build community”.

Although South Lake Union is quickly developing, the closest libraries are in Queen Anne and Capitol Hill, both two miles away horizontally- 300 feet vertically. As can be seen from Figure 4.9 the new location for the proposed Lake Union Branch Library would fill a gap in Seattle Public Library network for a growing neighborhood.



Figure 4.7 “Philanthropy and Light: Carnegie Libraries and the Advent of Transatlantic Standards for Public Space” Book cover (Prizeman, 2011).



Figure 4.8 Entry at the Northgate Branch Public Library, Seattle, Washington.

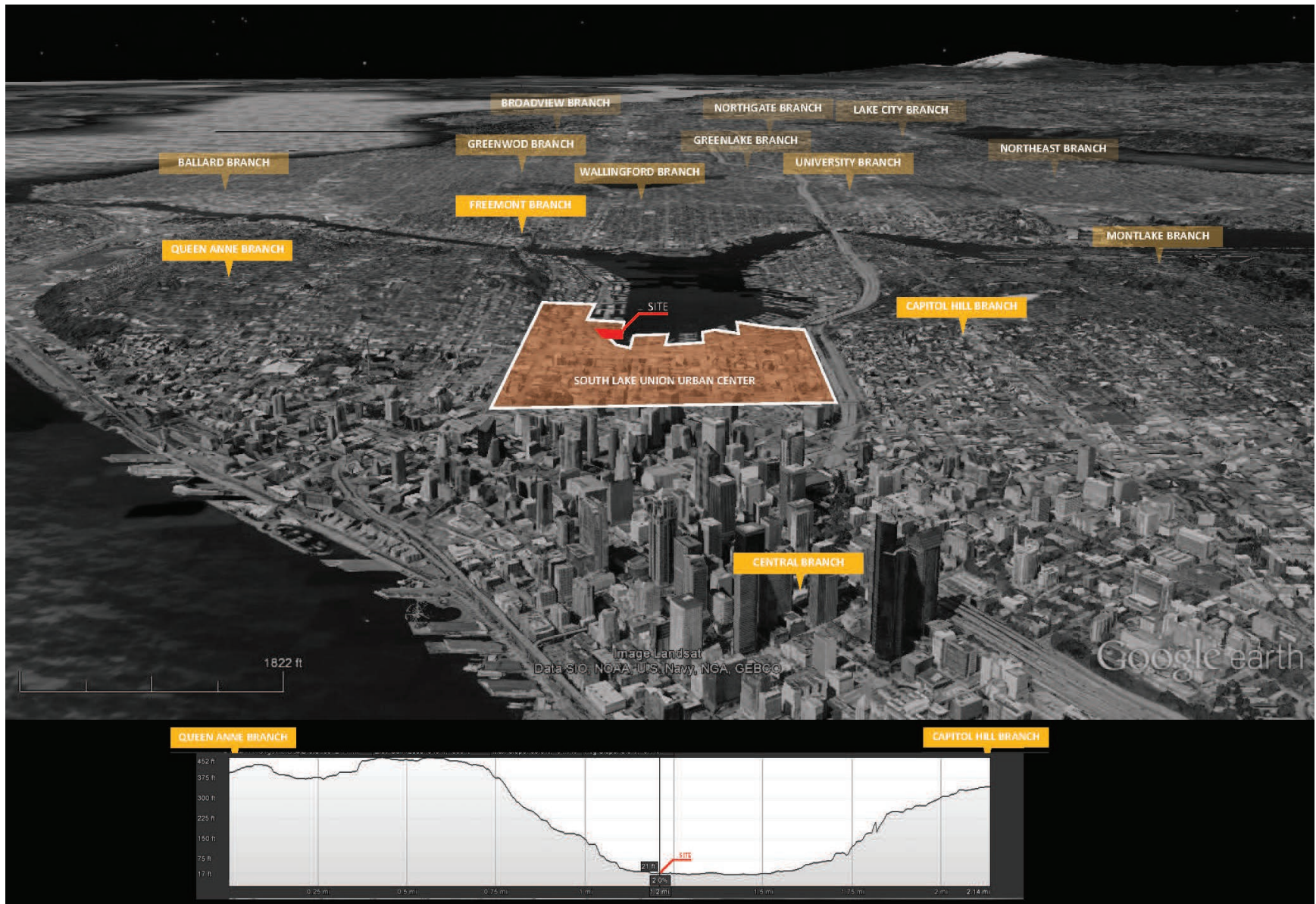
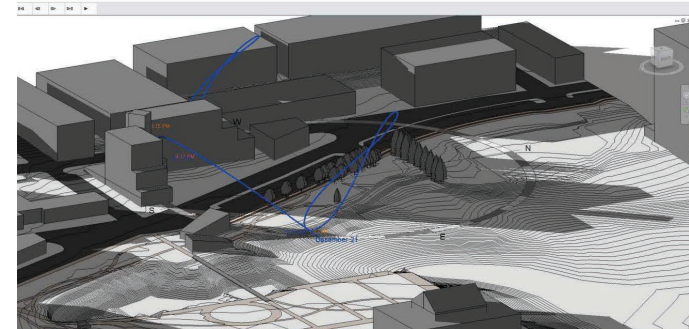


Figure 4.9 Birdseye view of site in context with surrounding Seattle Public Libraries and sectional drawing of site from Queen Anne Branch to Capitol Hill Branch

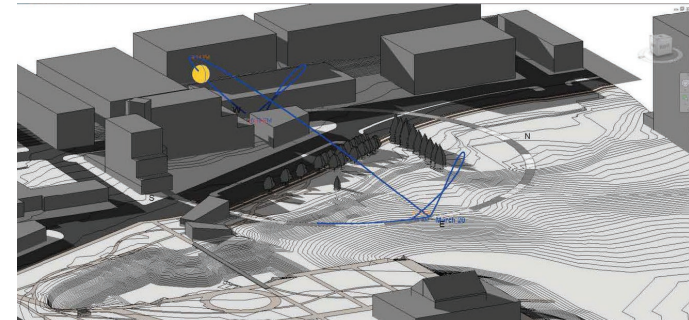
With its location on the water and with design intentions to create access to Lake Union, the library could not only service the South Lake Union neighborhood, but start to connect communities across Lake Union. As the forms in which we receive information change—so do our libraries. In some cases libraries have gone entirely digital and in some cases smaller and completely out in the open with the “Little Free Library” network (www.littlefreelibrary.org) as shown in Figure 4.11 at the location in Capitol Hill. The challenge of this thesis becomes rethinking and interpreting the program of a library and doing so through exploring and developing some the biophilic design approaches from the lessons learned of my research, travels and analysis, looking at how they could inform and connect a program: of a branch library, the context, in this case Lake Union and architectural response with the goal of reconnecting and enhancing a human-nature connection.



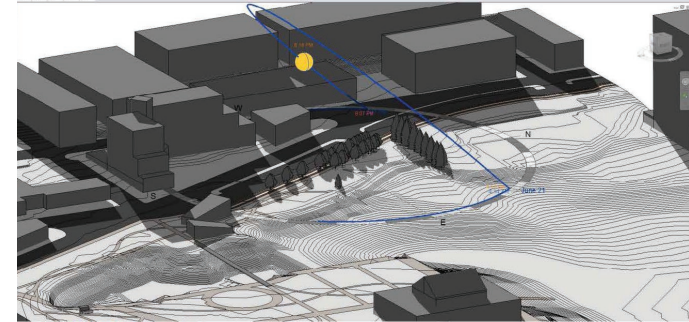
Figure 4.11 Little Free Library on Capitol Hill, Seattle, Washington.



DECEMBER 21 15:15



MARCH 20 16:15



JUNE 21 16:15

Figure 4.10 Sun Study looking at shading and low western sun angles



Figure 4.12 Site Context of Lake Union Park



Figure 4.13 View down axis from Lake Union Park to entrance of Library

SITE CONTEXT AND CONCEPTUAL PROJECT APPROACH

“a cultural district is understood to be a well-recognized and labeled, geographically defined, mixed-use area of a city in which a high concentration of cultural facilities acres as the anchor of attractions”(Park & Boats, 2009)

This particular context and program created the opportunity to apply biophilic design approaches and address a public access to nature in an urban setting that begin developing a conceptual project approach in two major ways:

1. Identifying that the conditions along the shoreline of Lake Union have significant impact on the local ecological cycles and also become important access point for a public amenity of the lake. Currently the site is an asphalt and gravel parking lot, the project proposes to improve and contribute to site conditions through programming that is lacking in the neighborhood community.
2. Exploring how through designed relationships public architecture, public green space and public blue space can be more integrated to create active public places that enhance a human-nature connection in an urban setting.

Attempts have been made to create enjoyable places along the water’s edge, but as is evident in Figure 4.15 two things seem to dominate- large boats and cars. This thesis project proposes that we can and should do better.

This site specifically offered an opportunity to extend the public space of Lake Union Park along existing axis, to include a public building that relates and enhances to existing site conditions and becomes part of the developing Cultural District in the park (Park & Boats, 2009). Currently MOHAI and the Center for Wooden Boats, with an expansion on the way, exist in the park with plans in the works to also add a Native Canoe Center just south of the site. The addition of a public building such as a library on the site is therefore timely and can become a connecting amenity and resource to the organizations in the Cultural District while fulfilling and supporting the mission of the Seattle Public Libraries.

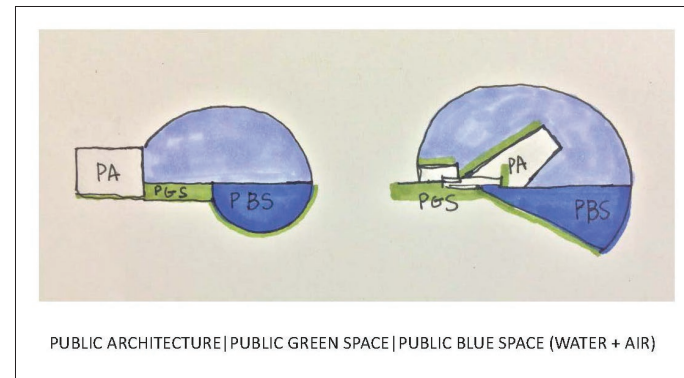


Figure 4.14 Diagram comparing a typical and proposed approach to relationships between public green space and blue space



Figure 4.15 View of edge condition along Lake Union just North of the site

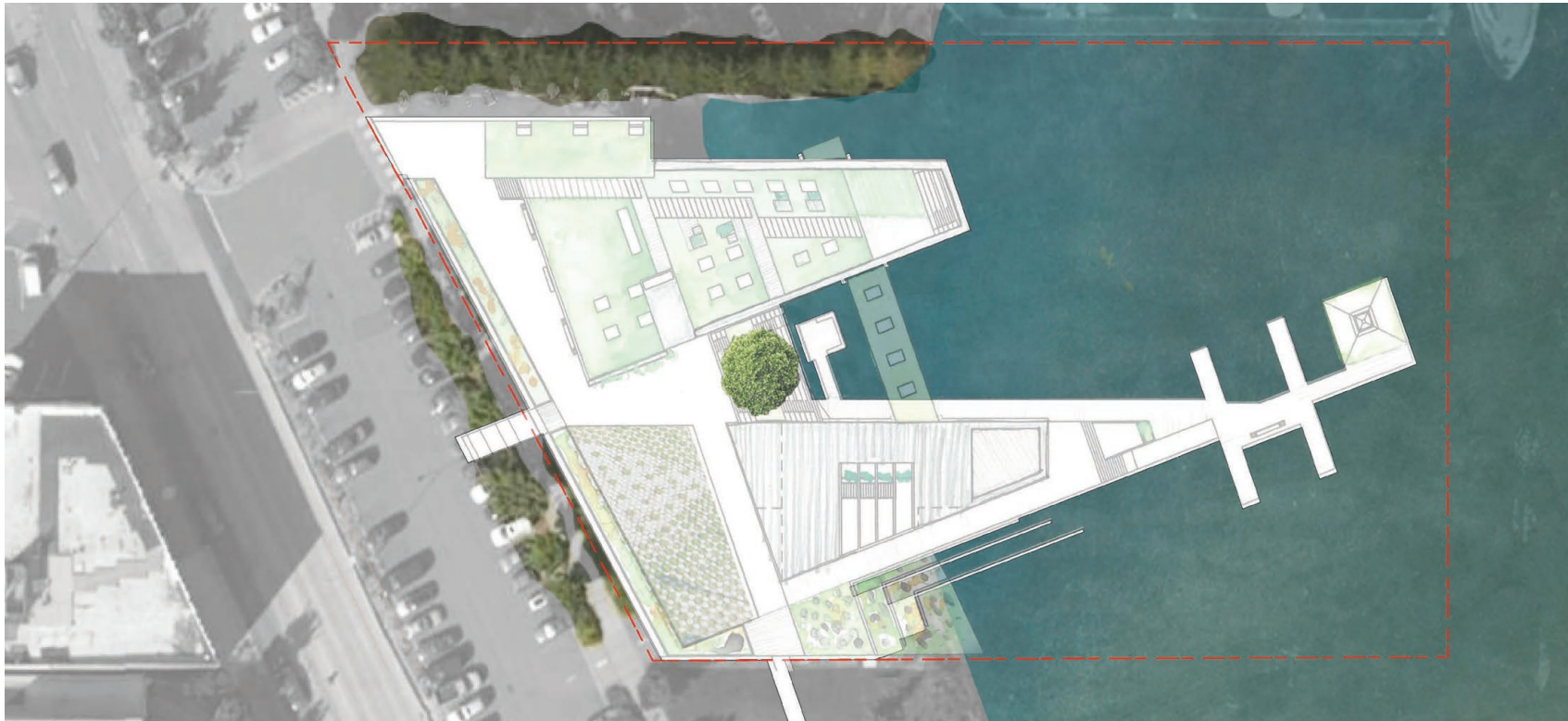


Figure 4.16 Library Roof and Site Plan with highlighted existing natural edges and elements: A row of firs to the North, Lake Union to the East, Lake Union Park to the South, A line of Deciduous Trees to the West and A Sweet Gum Tree in the middle of the site.



Figure 4.17 Panorama of existing site bank condition and view

As can be seen from site plan (Figure 4.16) and panorama (Figure 4.17), there is an approximate 30 foot wide bank with an elevation drop of approximately 7 feet to high water, typically during the summer when the locks are opened more for boat traffic and 12 feet at low waters. Besides the bank, water, and sky, other significant site elements creating site edges that the project design responds to include a row of fir trees to the north and an alle of deciduous trees along the public sidewalk and bike route between the site and the parking lot to the West. At the center of the site, just as the bank starts to slope is a thriving Sweet Gum tree (Figure 4.18).

As part of this process I also thought of what the program of a library is or could be. A library can be seen as the living room of the community and as source of information and knowledge. Typically you go to the library for one of those reasons. If you go for information there is the source information and then you process the information. This design tried to explore how various types of information and knowledge can be processed in different ways and in different environments and when possible enhanced through learning by experiencing. This proposal identifies people, community, and context as an important source of information and knowledge and explores what architectural elements and forms can create environments supportive of creating an exchange of that information through dialogue on a small or large scale. An example of an information-knowledge exchange that is extremely biophilic is this live feed of an apiary showing honey bees flying in and out on an Estonian college campus roof. Students can watch and learn about the honeybees, an important part of our ecosystem and later taste the honey produced from the honeycombs.



Figure 4.18 Image of Sweet Gum tree and current site conditions



Figure 4.19 Live image feed of apiary on rooftop at MEKTORY, Tallinn University of Technology, Estonia.

Figure 4.20 Conceptual project sketch

As shown by this gestural sketch, responding to the site this project began exploring how to connect the green space of the continued park to the blue space.....

up to the sky and down to the water



So the question becomes how do we bridge these elements of water, sky and ground?

What affords us the ability to have a different contact and engagement with them?

Figure 4.21 Dock at Aalto's Experimental House in Finland..



What role does the architecture play in affording the connection and creating an engagement with these natural elements and context? Picture here is another type of public building - a playhouse in Copenhagen that has large active indoor and outdoor public spaces along the water.

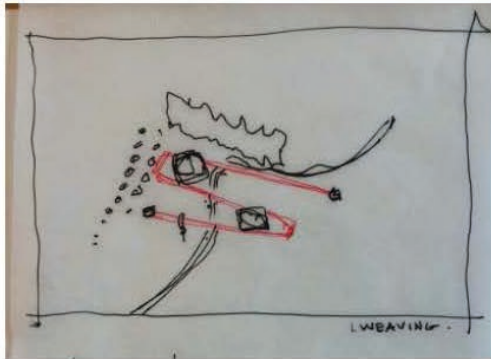


Figure 4.22 Royal Danish Playhouse, Copenhagen, Denmark.

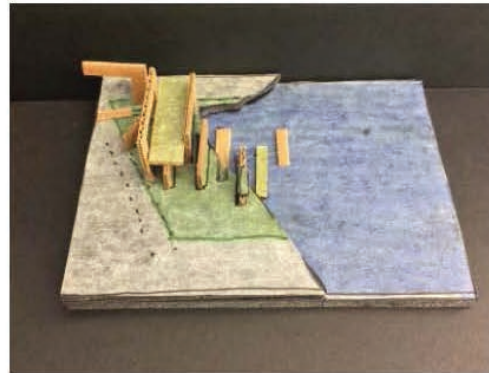
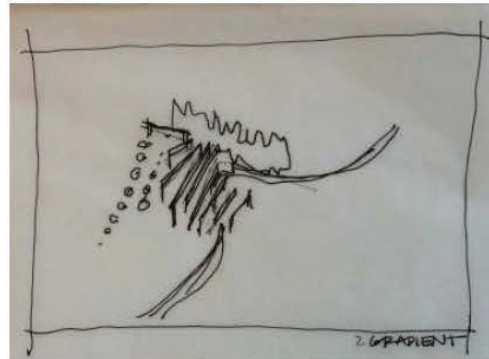
And how can the architecture give you a different and unique perspective- physically of the elements but also of your place in the world and what you are a part of.



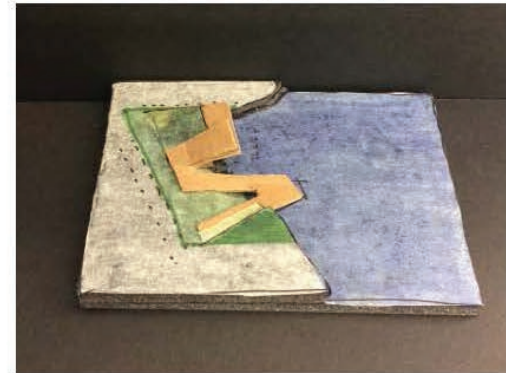
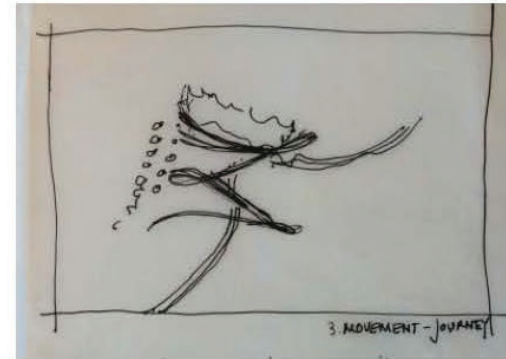
Figure 4.23 View down to water from actor's room in Royal Danish Playhouse



1. WEAVING
ARCHITECTURE IN THE LANDSCAPE



2. GRADIENT
MERGING ARCHITECTURE AND LANDSCAPE



3. MOVEMENT-JOURNEY
ARCHITECTURE AS LANDSCAPE

Figure 4.24 Project Concept Models

Early in the design process I developed three conceptual program and site response guided by different aspects of biophilic design approaches. Initially I defined them by a guiding theme:

Weaving, Gradient, and Movement-Journey

1. WEAVING:

consisting of a four distinct elements, of a Main or Folly either Grounded or Floating with a ribbon connecting element between all four

2. GRADIENT:

using frames of elements (glass, wood, vegetation, water, stone) that are pushed, pulled and staggered in all directions to create transitional and gradient spaces- creating a gateway entry to the site and creating a gradient from city speed to nature speed.

3.MOVEMENT-JOURNEY:

developed while sitting on the site this approach was responding to the movements on the and around the site to create a journey and experience through the architecture.

It became clear following a discussion with my committee that these three concepts took very clear attitudes and approaches towards the relationship between architecture and landscape.

1. ARCHITECTURE IN THE LANDSCAPE

2. MERGING ARCHITECTURE AND THE LANDSCAPE

3. ARCHITECTURE AS LANDSCAPE

Moving forward I decided to design under the approach of architecture as landscape, feeling this gave the most clear and appropriate opportunities to explore and develop my architectural biophilic design approaches in response to this program and context.

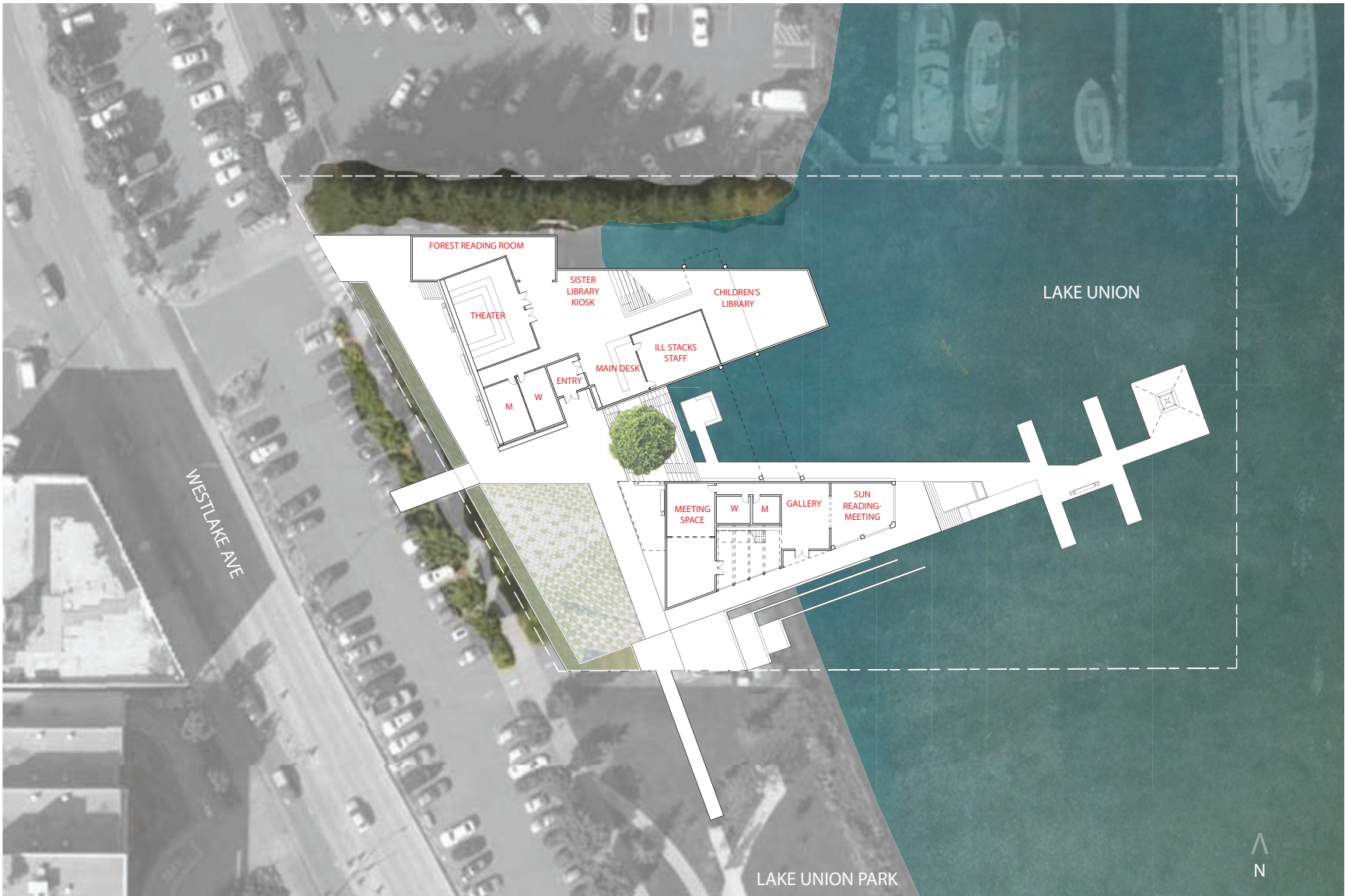


Figure 4.25 First Floor Plan with Site Context

DESIGN PROPOSAL

Through visiting several libraries in Seattle I noticed they often have separate yet connected community room elements. Using that programmatic concept, I took that as an opportunity to separate the building into the forms connected through a bridge, under which one would pass if you were arriving to the library via the lake. The main entry to the library is on the south of the northern wing, on axis with the existing path connecting to the park. A separate entry to spaces that can be separately secured and used after library hours is on the south side of the southern wing. After entering through the main entrance, one is face with the information and circulation desk. Instead of seeing the library as having a large general stack collection, the program is planned on interlibrary loans that could be requested online at home or at the library and then picked up here at the circulation desk.

In interpreting the program I saw people, dialogue and community as sources of knowledge and information. Architectural elements like the enclosed theater to the west and amphitheater like stairs going to the second floor off the entry afford that engagement. Directly north after entering you are faced with a monthly changing local and international “sister library” display that would have a special collection of information on the specific site for the month along with an electronic display or feed of the location. Facing the row of coniferous trees to the north is the “forest reading room” and periodical section. Looking out into the water and underneath the stairs is a large children’s area.

On the first floor of the south wing are meeting spaces, a gallery space and sun reading room and meeting space looking out to the outdoor seating and floating pavilion in the distance.

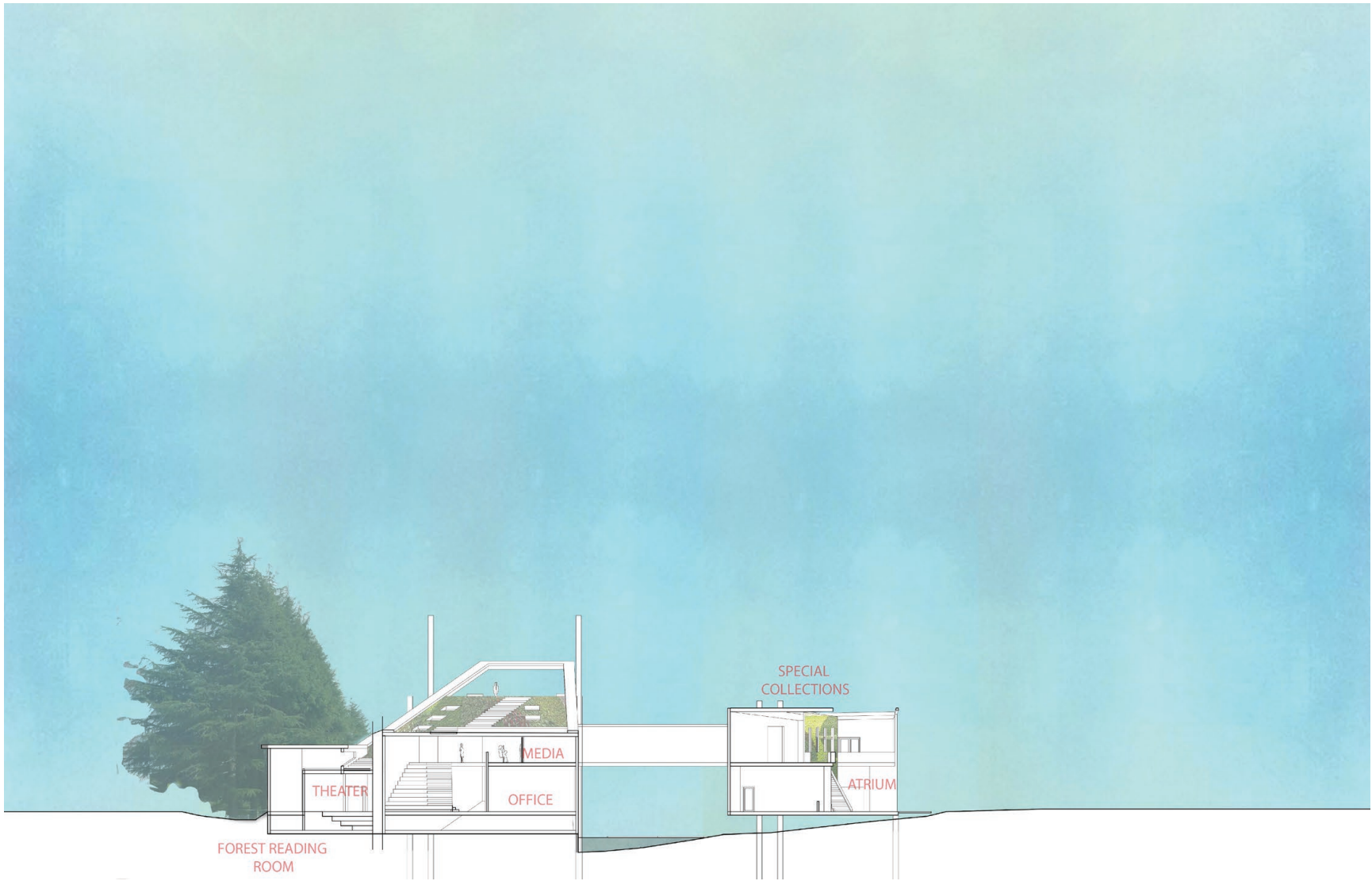


Figure 4.26 Building Section showing circulation

Circulation between the floors and the north and south wings become open architectural elements tied to functional program pieces.



Figure 4.27 Building Section through amphitheater and bridge
The bridge becomes a reading room that affords views down to the entry and out onto the lake.

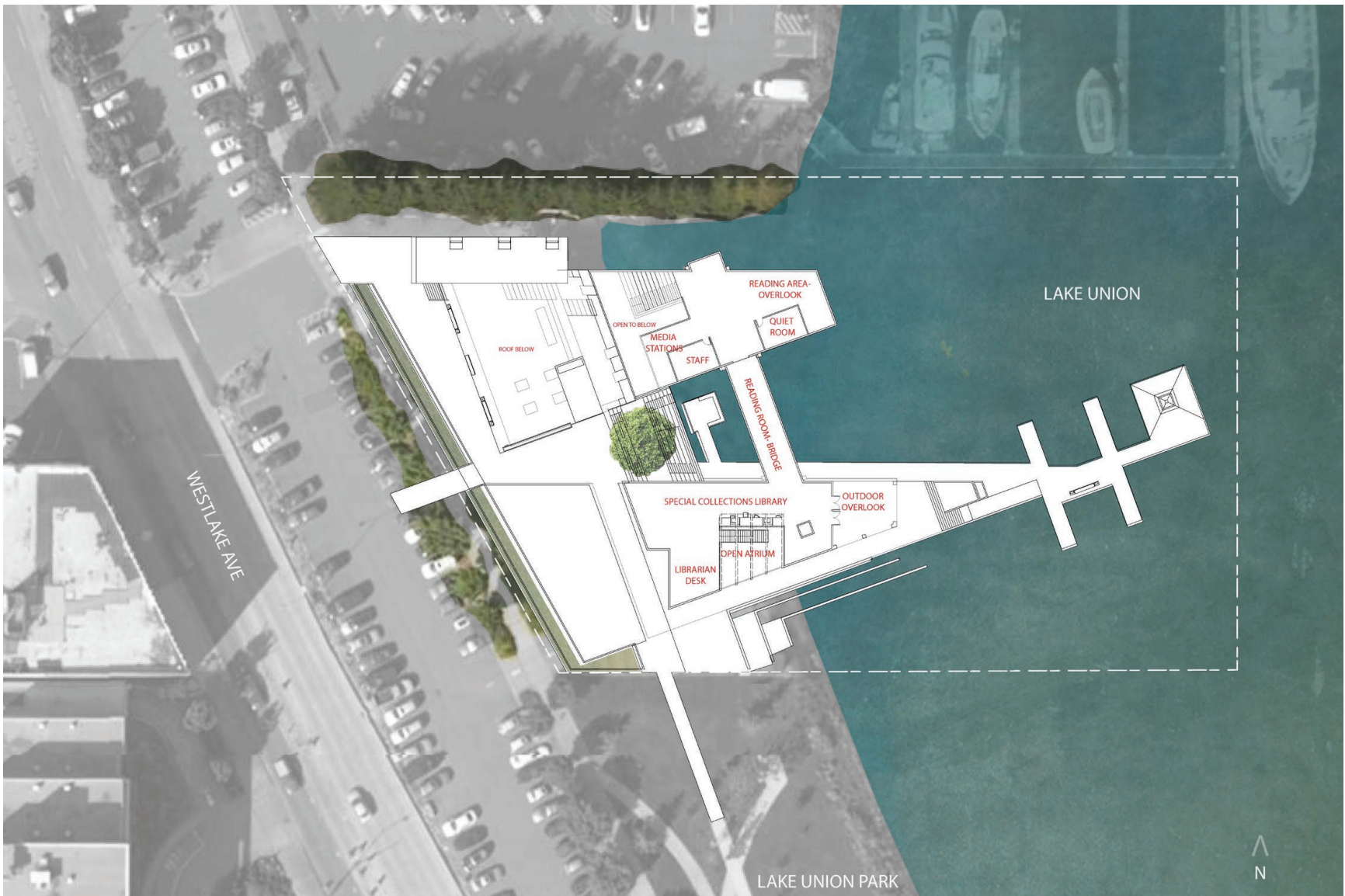


Figure 4.28 Second Floor Plan

On the second floor north wing is the main collection of computer stations, quiet study and rooms and administration office with a reading and work area to the east. In the south wing is the large special collections library dedicated to context of Lake Union.

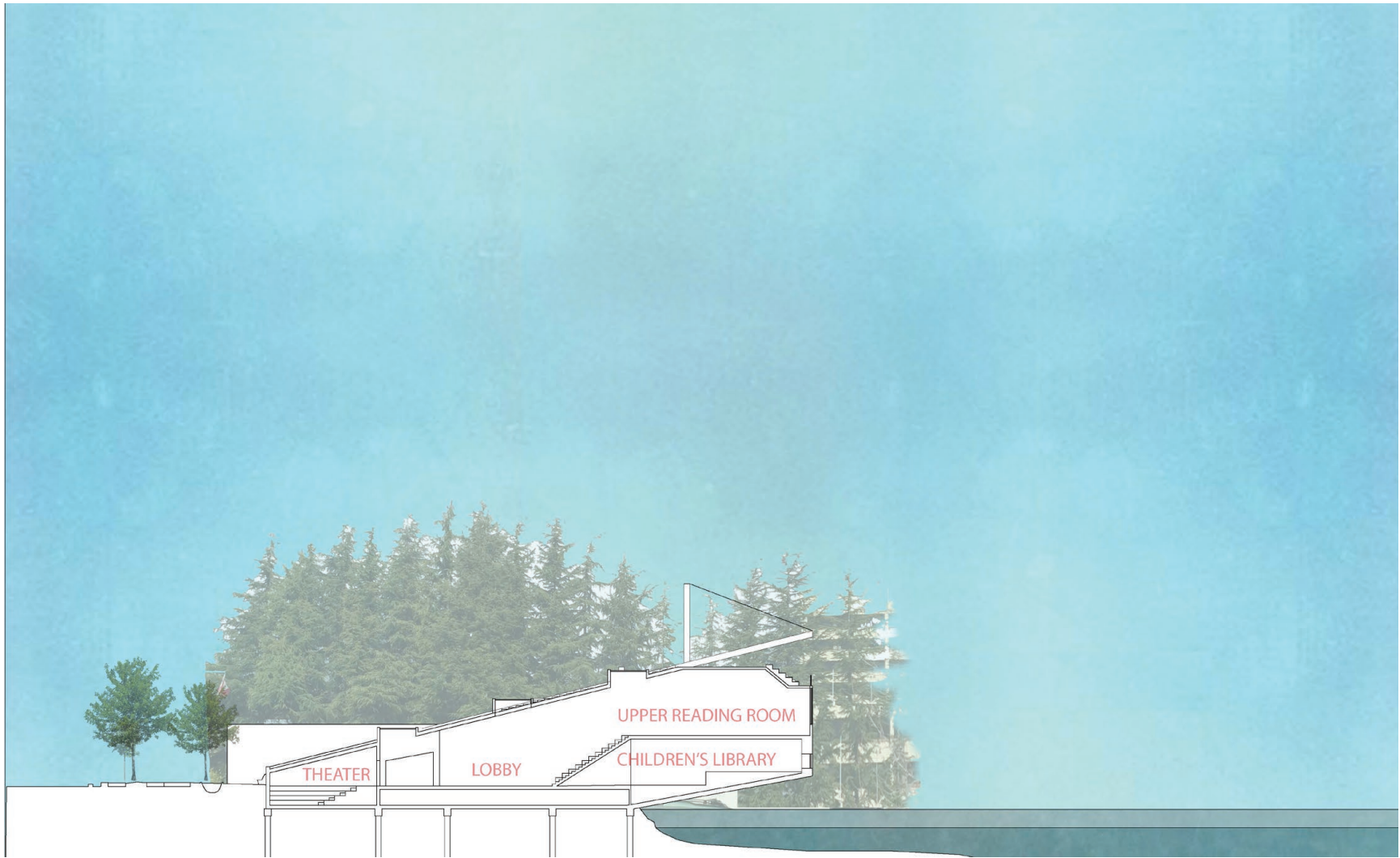


Figure 4.29 Building Section of North Wing

The northern wing volumes and relationships are much about reaching up and out burrowing down. Here you see the theater, buried under the lifted green roof that offers thermal and acoustic separation from what can be a noisy Westlake Ave.



Figure 4.30 Building Section of South Wing

In turn, the southern wing is more about opening out and down to the water with a green wall in the atrium facing south that has potential to be integrated with the grey and blackwater systems of the library.

IMPLEMENTATION OF BIOPHILIC DESIGN APPROACHES WITHIN PROJECT DESIGN

The components in the architectural framework for a biophilic design approach that I compiled and introduced at the end of the last section, and listed in Figure 4.4 below influenced and informed design decisions and were explored in several locations throughout the design schematic, often times overlapping. On the following pages, each component of my architectural biophilic design approach are individually discussed alongside an image from my Nordic-Baltic travels that embodies the essence or an element of that approach, followed by a vignette or design drawing of how it was the implemented or explored in this particular design exercise.

<p>RESPONDING TO CONTEXT <i>Weaving it together</i></p> <p>COMMON THREADS Designing with patterns to support and unify project program, vision and mission, context and site relationships, building and architectural systems and user experience at various scales.</p> <p>SITE SITING Responding to, engaging and enhancing site elements, natural systems and processes through design responses at various scales and degrees of visibility through the architecture.</p>	<p>CONNECTIONS WHAT YOU ARE A PART OF <i>Fosters an understanding, awareness and comprehension of what you are a part of, making connections and laying framework for connections to be made and affording opportunities for engagement that didn't otherwise exist.</i></p> <p>PERSPECTIVE: Enabling and encouraging engagement with, and giving a perspective that didn't otherwise exist.</p> <p>PHYSICAL PERSPECTIVE: through access</p> <p>VISUAL PERSPECTIVE: through unique views</p> <p>CONCEPTUAL PERSPECTIVE: Natural systems and processes + historical and contextual references</p> <p>ORIENTING PERSPECTIVE: through passages, connections and views of where you are going and back to where you came from</p> <p>TIME CYCLES RITUALS Dynamic not Static. Element of time, natural cycles and changes evident in building</p>	<p>MEMORABLE WAY OF FOSTERING THAT CONNECTION <i>Our body remembers more than our mind</i></p> <p>SENSES Engaging and responding to all senses in experience of building</p> <p>ARCHITECTURAL TERRAIN Seeing architecture and architectural form as a landscape and habitat. Above, below, within.</p> <p>VARIED ENCLOSURE Varied levels and degrees of enclosure and nested volumes within spaces</p> <p>TRANSITIONS GRADIENTS EDGES Combination of defined boundaries and transitional zones inside and outside</p>
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Architecture that encourages and gives opportunities for engagement that didn't otherwise exist, reminding you what you are a part of and doing so in a memorable way that fosters that connection.

Design knowing our body remembers more than our mind—design in a way where body/senses are actively engaged.

Figure 4.31 Components of an Architectural Framework for a Biophilic Design Approach

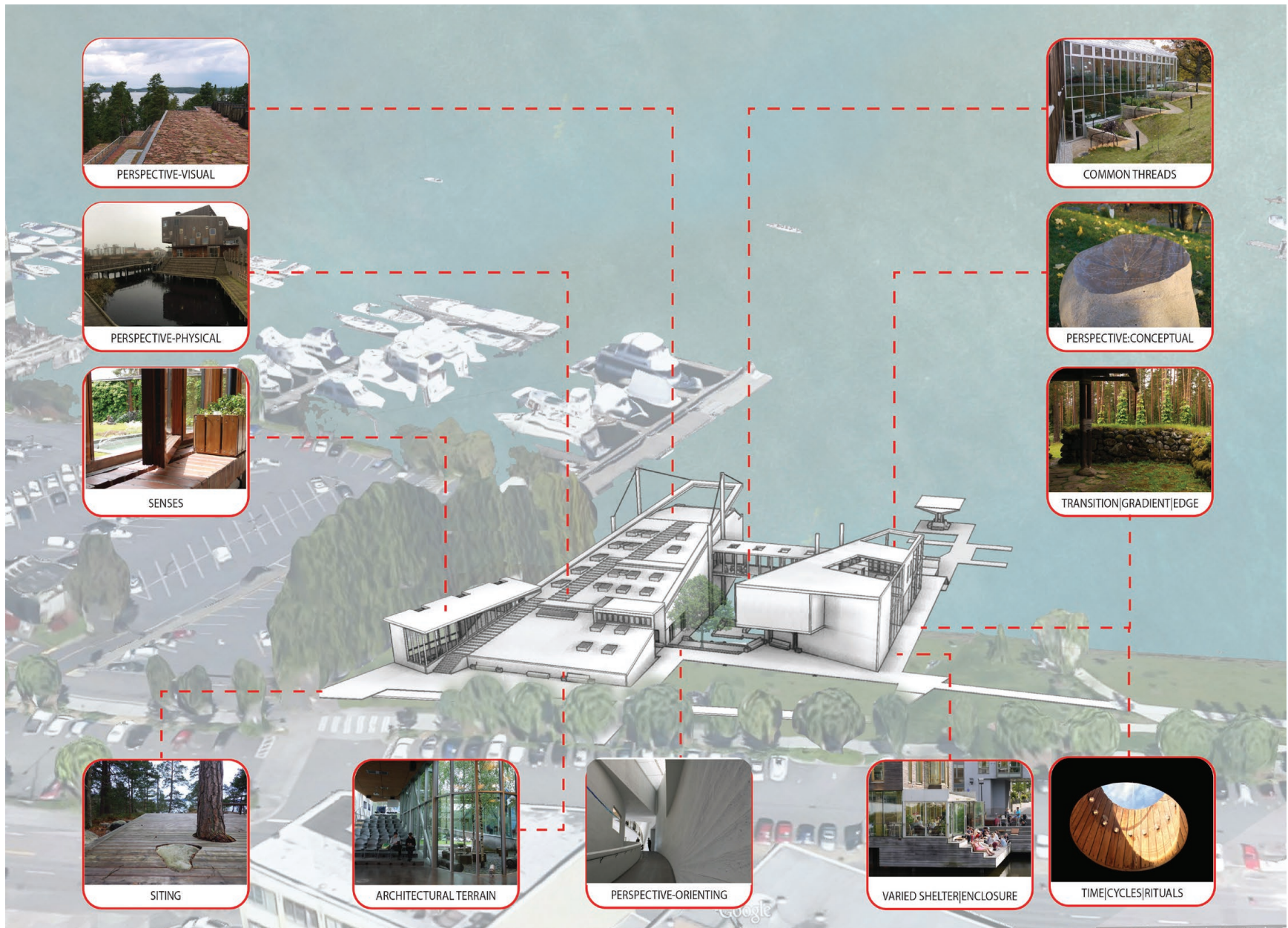


Figure 4.32 Project overview with components of biophilic design approaches references highlighted

SITE | SITING

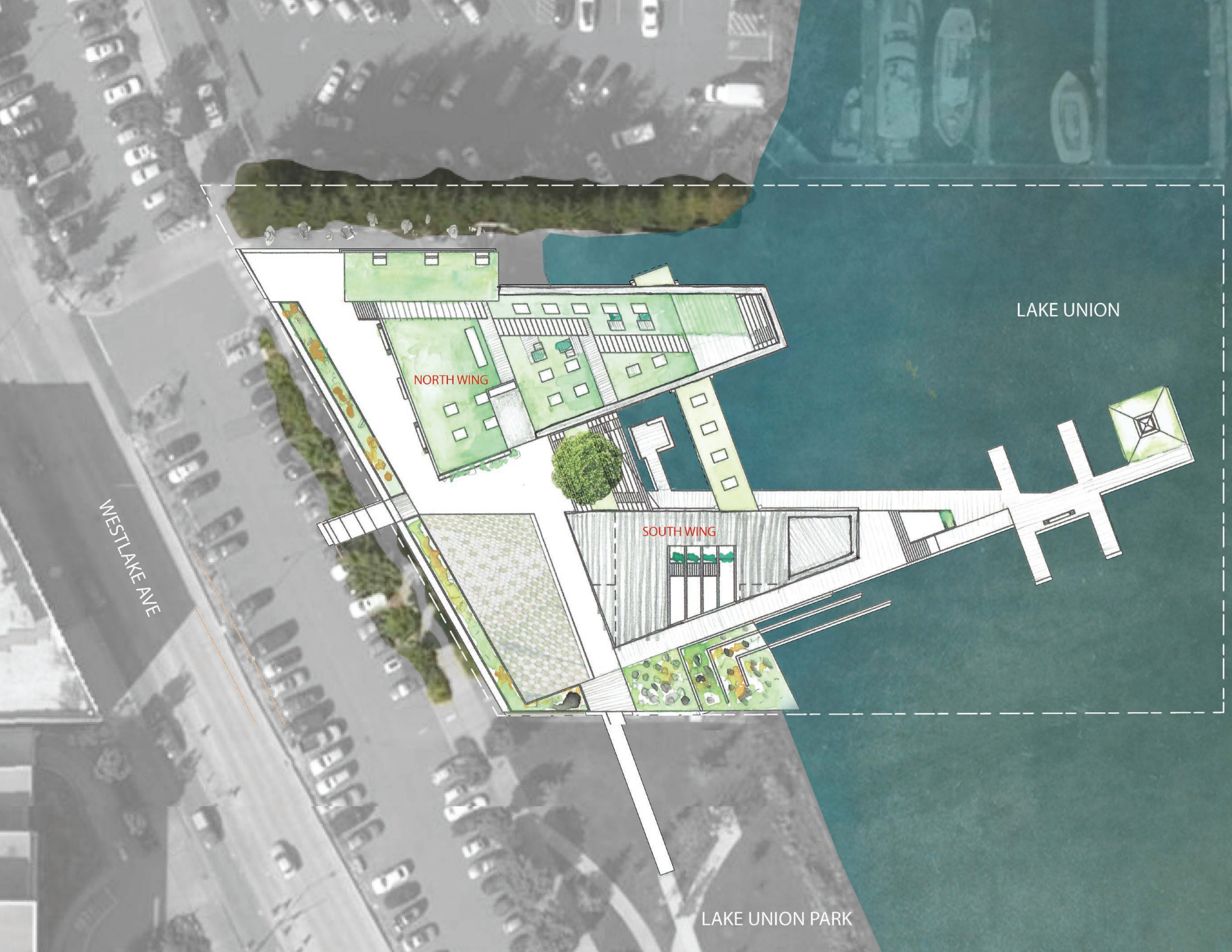
Responding to context- weaving it all together. During one point in this process I tried to define what our connection to nature is. The Sami people of the northern territory of Sampi that spans the countries of Norway, Sweden, Finland and Russia, similarly to many other indigenous cultures, would most likely not understand the very premise of this definition. Defining a “connection” implies a separation that we are separate, yet their worldview is such that we are one and the same. One way this translates to architecture is the response to the site, looking at elements are present, identifying symbiotic relationships and exploring how the architecture engages them instead of either removing or working against them.

Figure 4.33 Wooden deck at Artipelag, Stockholm Sweden.



Several existing natural elements on the site impacted the design form and orientation. Looking at this site, there is an obvious connection to the water. Yet surprisingly there are not many opportunities available, other than walking through the Center for Wooden Boats, for direct engagement with the water or for opportunities that get you closer to the level of the water, inviting you to sit and stay a while. One of the ways the project addressed this is through extending programmed areas and access out to the water. Under one of the covered areas out on the pier, you could go and read your book instead of inside once checking it out. The sweet gum tree became a focal point for the entry, creating a plaza and amphitheater seating down to the water around it. The first to the north of the site are unique in such an urban setting and something that you really want to be able to enjoy whether inside in the reading room or on one of the benches along the stony path along them.

Figure 4.34 Roof Plan showing site relationships



LAKE UNION

NORTH WING

SOUTH WING

WESTLAKE AVE


LAKE UNION PARK

COMMON THREADS

Projects that looked to enhance the experience of the place through uniting it with the program, weaving it with the site and context had a stronger framework to implement biophilic design patterns well. For example, a nature center that tied the indoor and outdoor education through architectural and site moves or the art museum that has installations throughout the site- inviting you to spend time in the landscape.

Figure 4.35 Tartu Nature Building, Tartu , Estonia.





The amphitheater with floating stage and sitting area wraps down around the sweet gum tree down to the water's edge providing access to those coming from Lake Union or those going out to spend time on the water side. One could sit here by themselves reading or eating lunch, with a group discussing or while listening to a poetry reading or watching a small performance.

Figure 4.54 View of outdoor amphitheater and entry from Lake Union



PERSPECTIVE : PHYSICAL

Creating perspective, an understanding, awareness, and comprehension of what you are a part of is something that I found could be accomplished and implemented in architectural responses through a couple different methods:

Physical, Visual, Orienting and Conceptual Perspective.

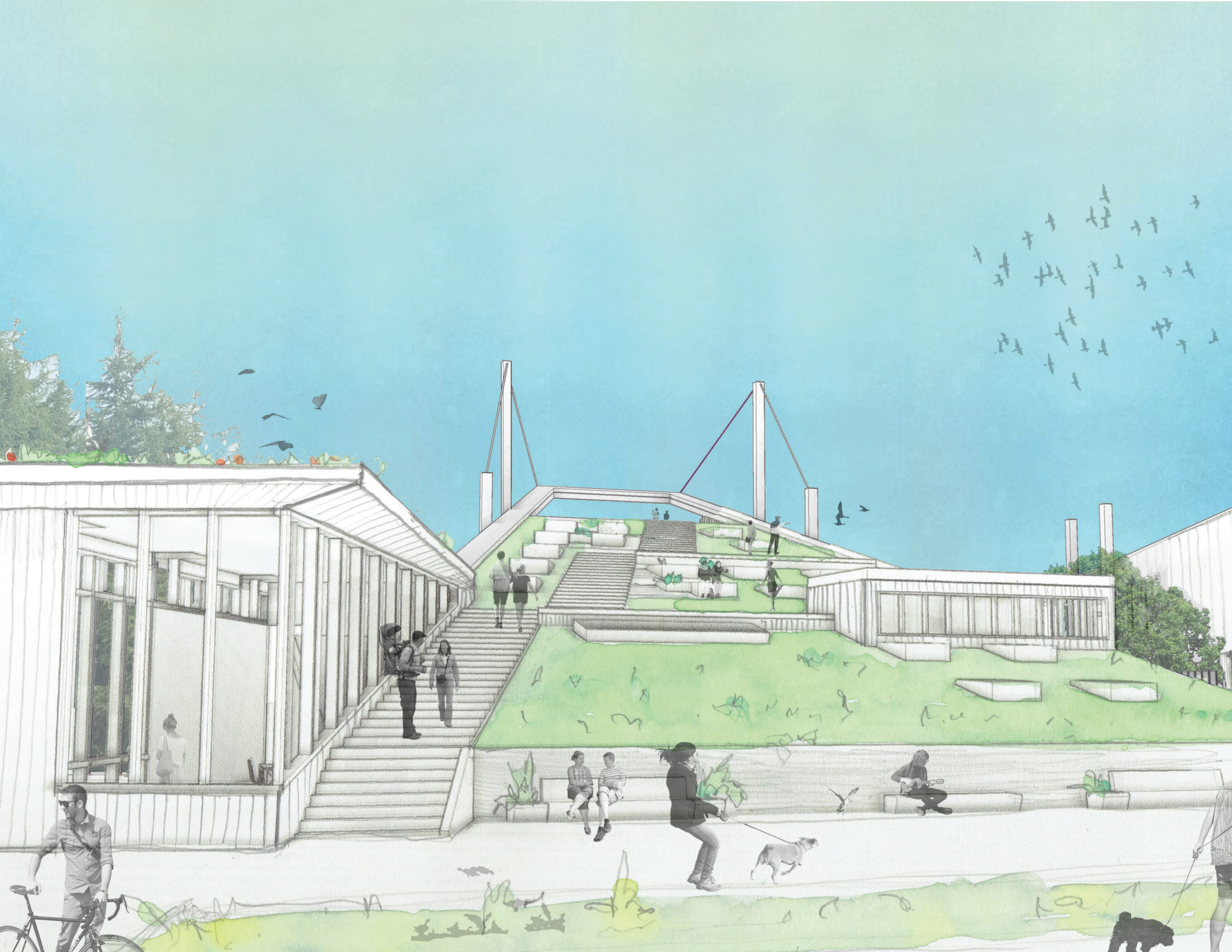
Physical access through stairs, ramps, bridges, and other elements where you are physically afforded a different perspective- affording opportunities of engagement that would not exist if the building was not there and designed the way it was. A considerations for this to be successfully integrated are once a unique physical perspective is what is the experience like granting the access- is it integrated into other building and program elements? In this example of the Nature Center in Kristianstad, Sweden, the building itself being located in the wetlands allows access, exploration and education about a naturally significant area. Various levels of access- up to the roof for views out into the wetlands or down to the water by the amphitheater steps, also creating programmed space.

Figure 4.36 Nature Center in Kristianstad, Sweden.



Roofs that could be accessed and occupied became a trend I noticed that were effective in affording a unique physical perspective as well as utilizing a level of a building that is often not programmed. In this case, the green roof also provides larger ecosystem benefits, including helping treat and mitigate rainwater falling on the building before it flow into the lake. Access to the roof through stairs allows for one to sit next to one of the planters of wildflowers inviting butterflies or pollenating bees, with a quick peak down into the library through one of the skylights. With the many runners and exercise enthusiasts I can see the stairs becoming part of an exercise routine, keeping the building and area surrounding it an active public space.

Figure 4.37 View up accessible sloped green roof with lightwells, seating and planters.




PERSPECTIVE : VISUAL

A visual perspective as Ibrahim Abdul Matin said at the 2015 Living Future Conference, is not just about “*what I am looking at- but what I am a part of*”. Buildings that afford this are ones that become memorable and that people want to return to. Often the journey is much about the visual perspective at the end.

Figure 4.38 View out to Swedish archipelago from rooftop at Artipelag.





Once reaching the top of the stairs you have an opportunity for just that. Not just to stand and look out, but stepped seating after the edge gives you an opportunity sit and to take it all in. From here you can look out over the lake to University Tower and Gasworks Park, slow down watching the sailboats dance around on a windy day as the rush of I5 passes by.

Figure 4.39 View out over Lake Union from library rooftop overlook at top of the stairs.



PERSPECTIVE : CONCEPTUAL

Beyond the opportunity to reflect or understand what you are a part of through a visual perspective, a conceptual perspective can be achieved through unifying design, the architecture, programming and context in a way to make connections or creating the framework for those connections to be made. The simple design of a sundial on a stone becomes a beacon on the hill at the Tartu Nature Building also orienting you to the sun's location telling you time of day and year. While heavily grounded in a specific context, it makes connections that take you much further than the simple stone on the ground by combining it with elements that while themselves fixed give you dynamic constantly changing information.

Figure 4.40 Stone with sundial at Tartu Nature Building, Tartu, Estonia.

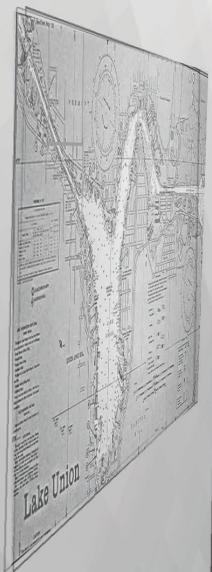


N 58° 22' 28" E 26° 43' 37"

SUVEAJAL LIIDA 1 TUND

The special collections library creates a place for connecting varied sources of knowledge specific to the context with a direct opportunity for experience. You can read about a type of bird specific to the region or look up information on the history of the geological formation of Lake Union on the interactive touch screen and then go out onto the outdoor balcony, passing a large model of the region, to look at current lake conditions and try to spot the various wildlife. While sitting at one of the work tables you can look up see either the birds or seaplanes as they fly over through the skylight that floods the space and the green wall on the other side of the wall with natural light.

Figure 4.41 Lake Union Special Collections Library



PERSPECTIVE : ORIENTING

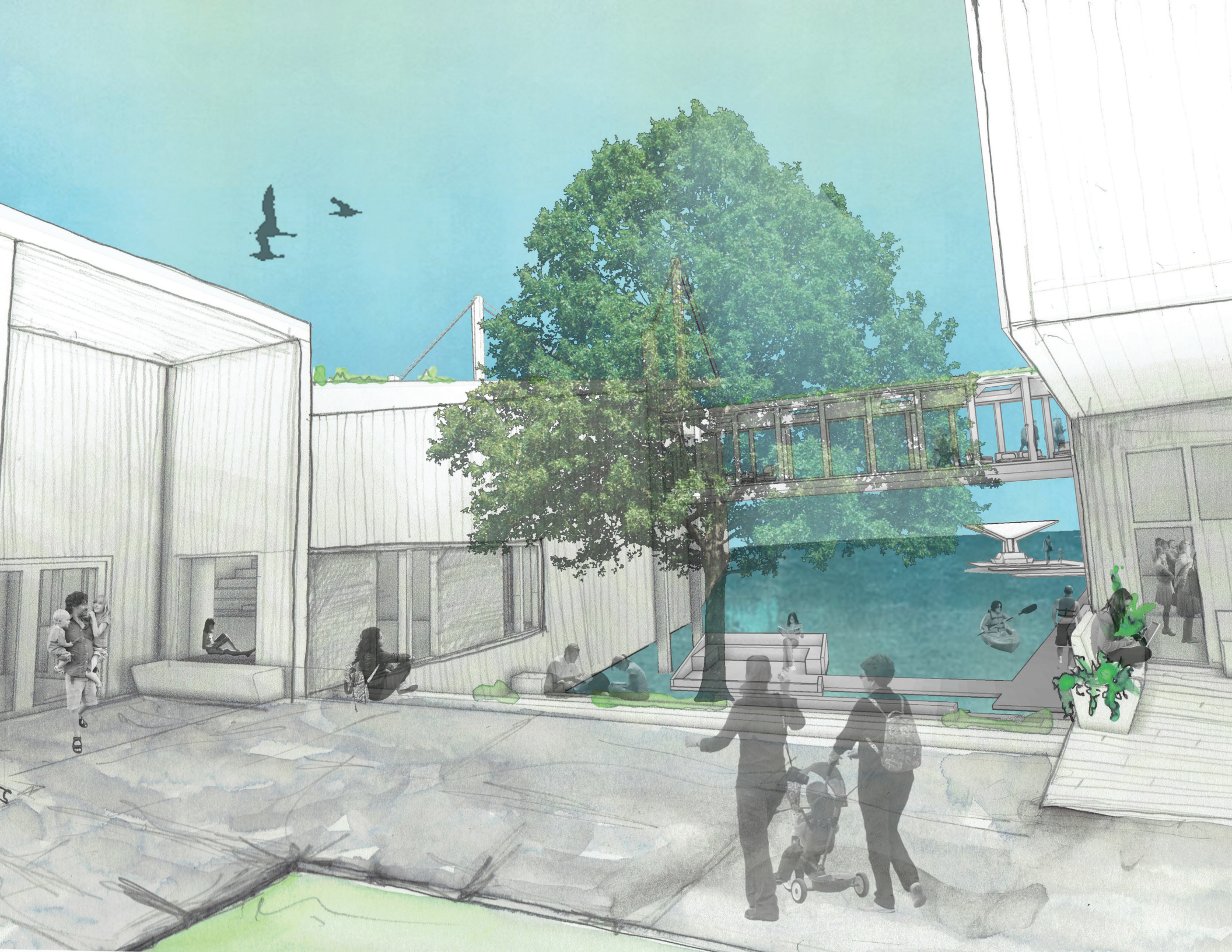
Biophilia and biophilic design is strongly rooted in our human survival needs. A sense of security through orientation and seeing where you are going to and views back to where you came from, not only is something that has contributed to our survival, it can create interesting design elements and spaces.

Figure 4.42 View up ramp in Kiasma Museum, Helsinki, Finland



At the entry of the library, after leaving your kayak at dock and coming up the amphitheater steps, you get a peak into the lobby area through a deep window seat where someone may be peaking back at you. You see up to the bridge connection from the North Wing to the special collections library to where you are headed to ask the librarian about a flower you saw while out on the edge of the lake that you had never seen before. A friend sees you through the community room window, and waves. Now you know to stop in there on your way out.

Figure 4.43 Perspective of library entry and amphitheater




SENSES

Our body remembers more than our mind, so engaging our senses is not important to our health as demonstrated and cited in examples of biophilic design research, but it also creates more memorable architecture.

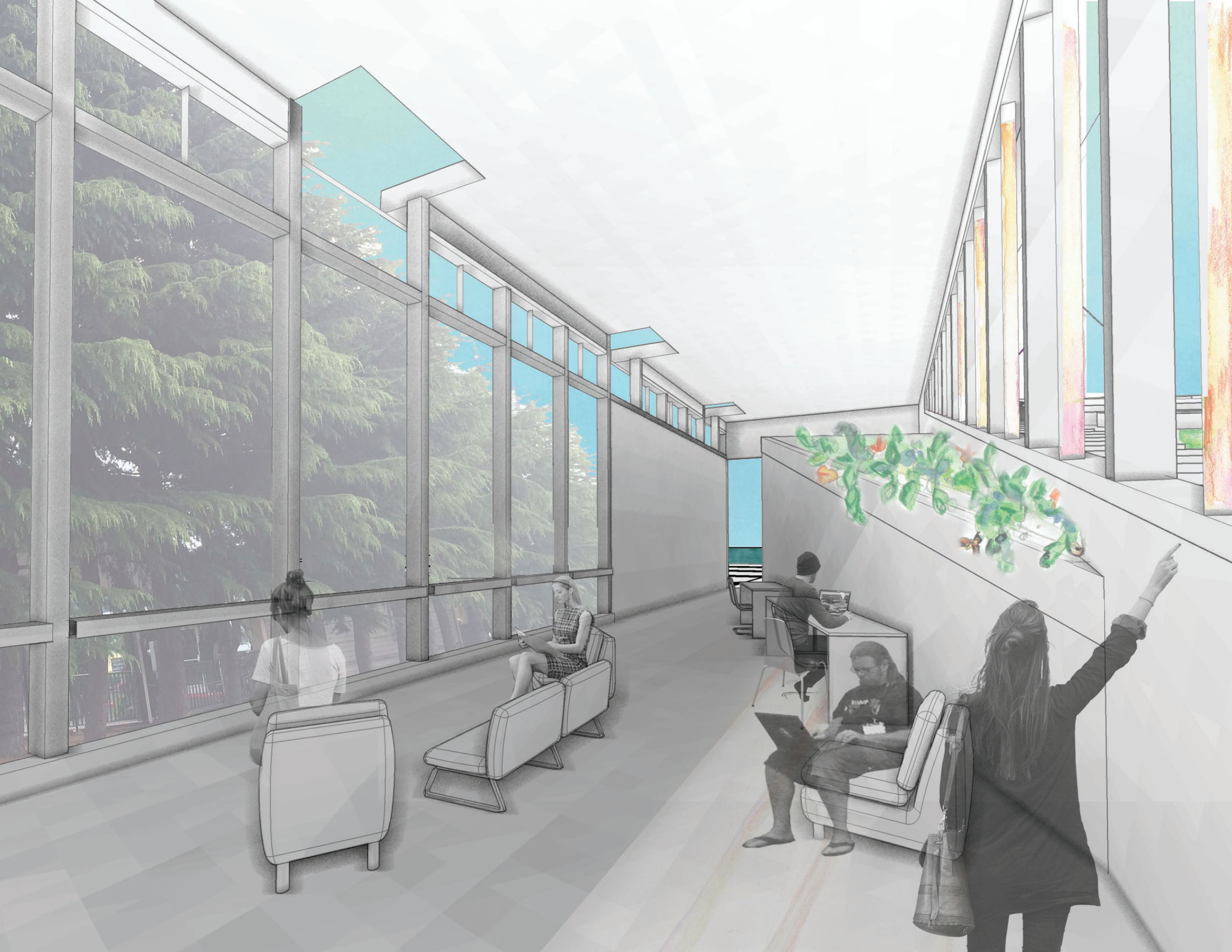
Figure 4.44 The sounds of water and scent of flowers, coming along with a breeze through the window at Saynatsalo Town Hall in Finland





The forest reading room is a dynamic space to read the latest magazines where light floods through the dichoric glass fins, with colored light changing and moving through the space. If the weather permits the windows are open, allowing a scent of the firs to flow through the space and depending if there are blooms on the vegetation on the top of the volume of the theater that continues into the space a sweet aroma fills the air.

Figure 4.45 Perspective of Forest Reading Room looking down towards water.




ARCHITECTURAL TERRAIN

More and more architecture has become our landscape- how can architecture functionally allow you to see the building as landscape, both in the interior and exterior- from above, below, within creating dy-namic interesting spaces that engage us.

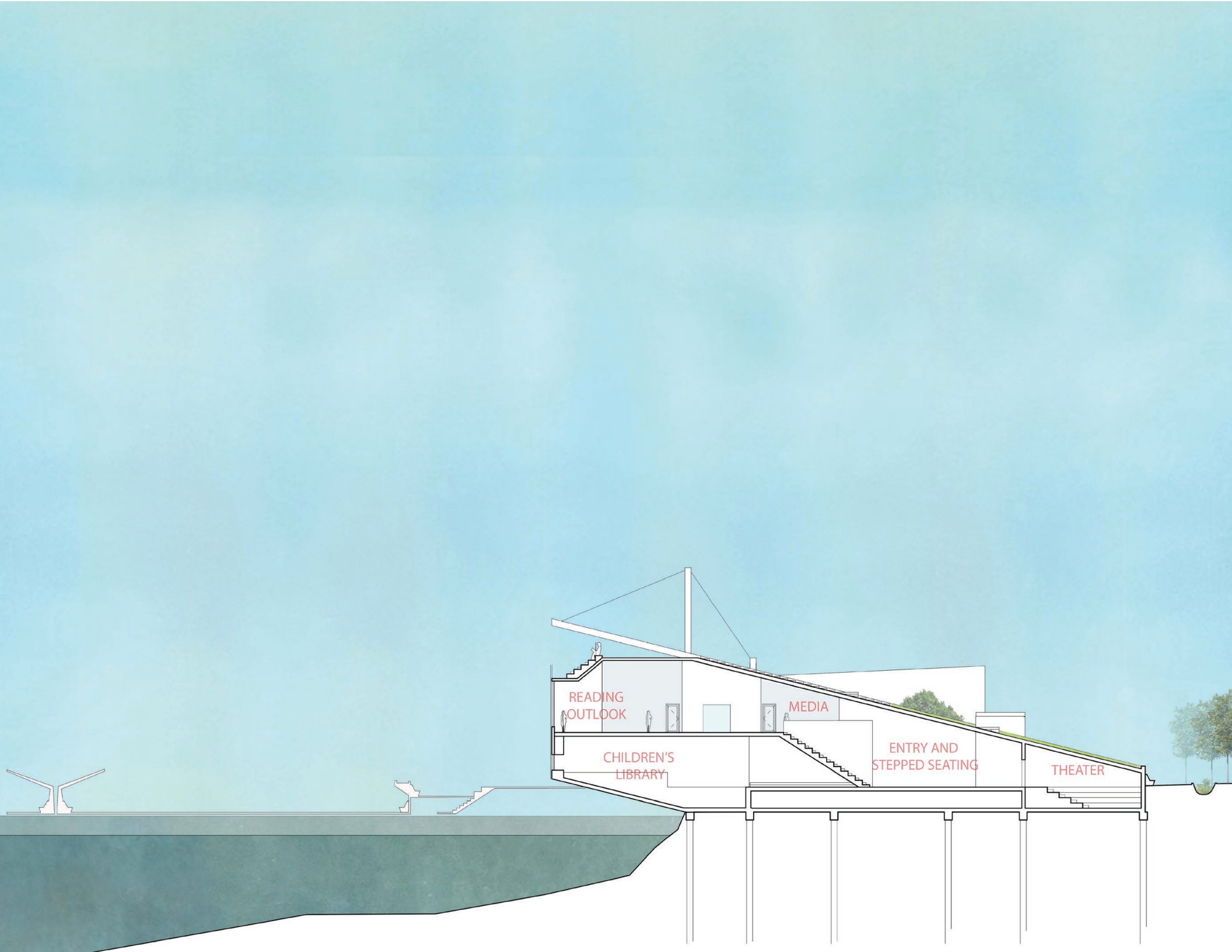
Figure 4.46 View of stepped seating and courtyard entry at the Museum of Occupations, Tallinn Estonia





The sloping section of the north building creates opportunities of grounding, and looking out- both within the building and to the outside. Stairs and sloped surfaces become elements to walk up, sit on, hide underneath with a good book. Seat and planters also provide cover for a seat along the wooden plank walkway on the water leading out to a small floating outdoor pavilion.

Figure 4.47 Building section through Northern wing looking south



READING
OUTLOOK

MEDIA

CHILDREN'S
LIBRARY

ENTRY AND
STEPPED SEATING


THEATER

VARIED SHELTER + ENCLOSURE

Varied levels and degrees of enclosure and nested volumes within spaces allow for a dynamic spaces, conditioned differently, that depending on your task or weather conditions allow for many options of engagement with the setting.

Figure 4.48 Varied seating and conditioned options at Goteborg Restaurant in Stockholm, Sweden.





Overhangs and protruding building elements such as the main entry and the niche on the west side of the southern wing create shelter- seating under those elements invites you to stay there more than pass through. The sunroom meeting's vertical surfaces can open up to create a direct connection or you can be out in the complete open on the deck.

Figure 4.49 Perspective looking towards entry of Library from Lake Union Park



TIME | CYCLES | RITUALS

Nature is dynamic, not static. When elements of time, natural cycles and changes are evident and reflected in and around our buildings, spaces are created engage us even it is a place that you go to on a regular basis. When the light through a skylight hits the corner of your desk, it can be an indicator that it's time for your coffee break.

Figure 4.50 Skylight at Louisiana Museum, Denmark.



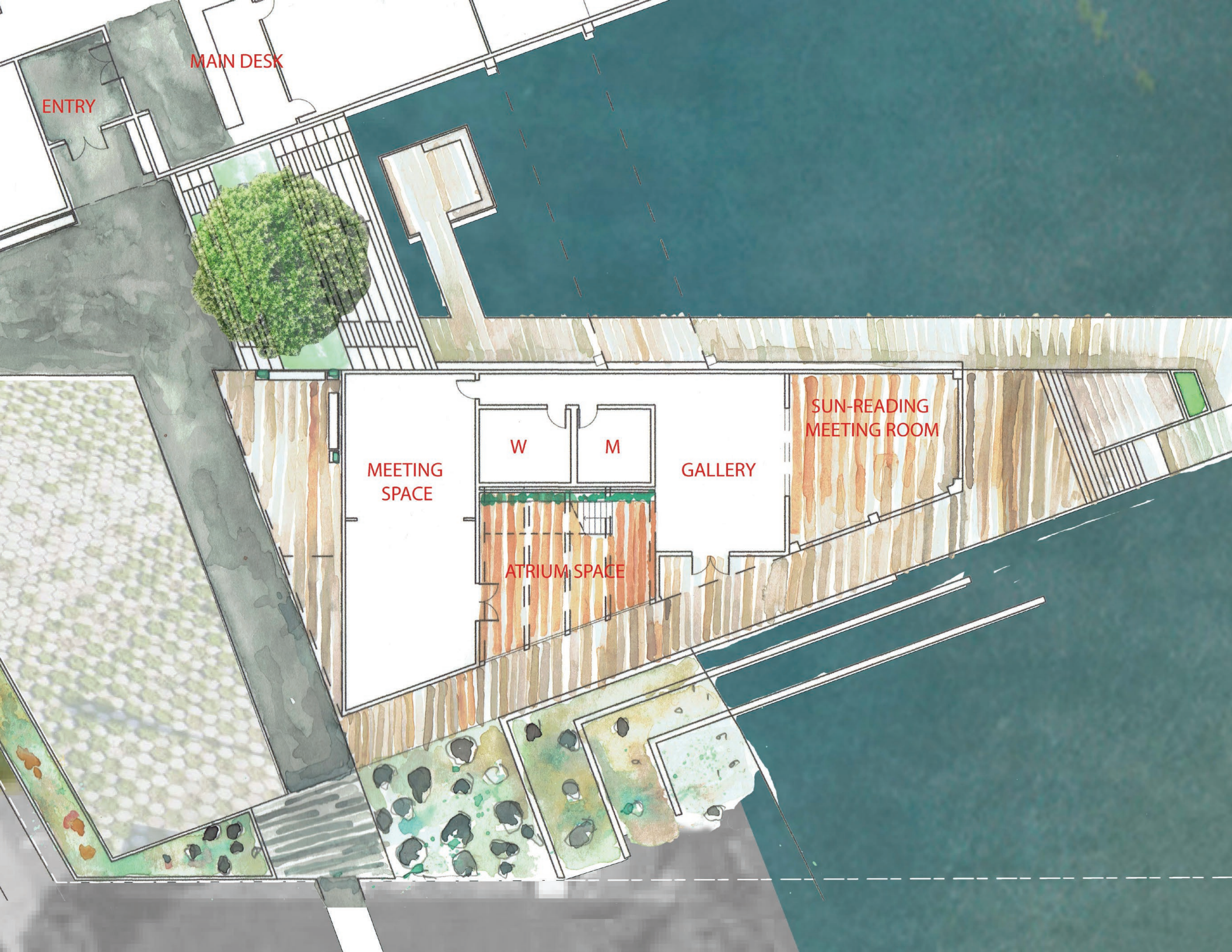
TRANSITIONS | GRADIENTS | EDGES

Combinations of defined, gradient and transitional boundaries and edges created a variation that can also be found in nature and give opportunities for blurring the edges of between the indoor and outdoor built environments in which we live.



The two approaches of TIME | CYCLES | RITUALS and TRANSITIONS | GRADIENTS | EDGES were reflected most strongly towards the south of the building. Throughout the design this is reflected in the use of materials, going from inside to outside, weathering differently depending on how much they are exposed to the elements. Although not as much lately, it does rain a lot in Seattle. A bioswale along the public walkways and parking lot edge not only helps treat and mitigate the stormwater runoff, but creates an ever dynamic natural habitat that you pass by while entering the library or reading outside.

Figure 4.52 Rendered plan view of first floor South Wing and entry



MAIN DESK

ENTRY

MEETING SPACE


W

M

GALLERY

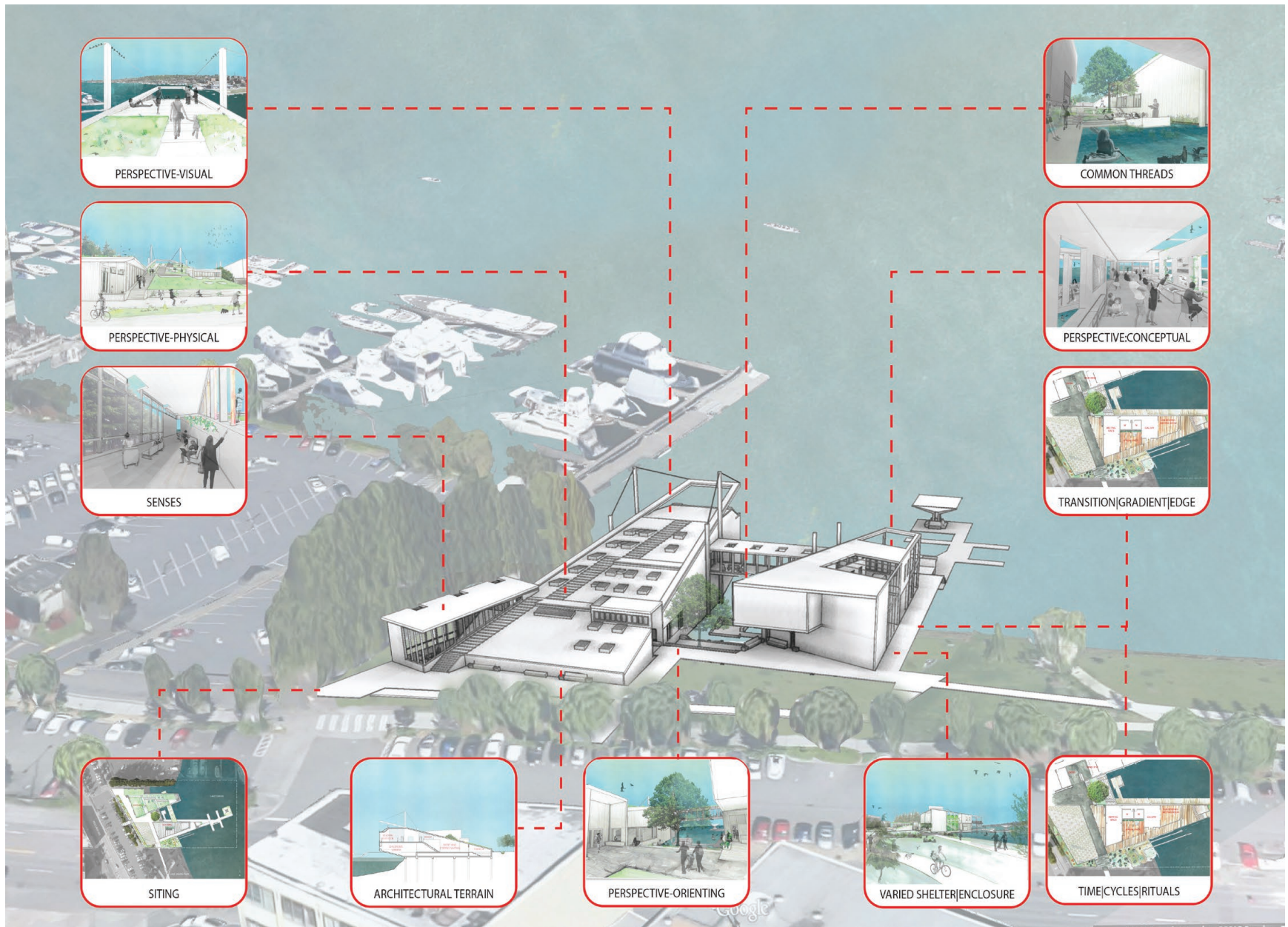
SUN-READING MEETING ROOM

ATRIUM SPACE



The previous pages outline more specific vignettes of how the evolving and developing components in my Architectural Framework for a Biophilic Design Approach, but zooming out a bit to an overview of the project, the importance of the larger overall forms and how they are connected stands out. Though not highlighted in the list of approaches, looking at flows of elements – whether people, water, vegetation, program shape the architectural forms (solids and voids) and elements depending on if it is about movement and affording the opportunity to slow down and sit. Both of these speeds can allow us to reconnect with nature and our context in different ways. Although not directly discussed in specific scenarios, all of these vignettes had elements of biophilic design patterns and elements discussed in the early section of this thesis and created a project schematic where those patterns could successfully be implemented further.

Figure 4.53 Project overview with components of biophilic design approaches highlighted



05 | CONCLUSIONS + REFLECTIONS

DESIGN METHODOLOGY REFLECTIONS

There have been three distinct parts to this thesis process:

RESEARCH: General Biophilia and Biophilic Design Concepts

EXPERIENCE + ANALYSIS: Lessons Learned for Design Implementation

DESIGN IMPLEMENTATION: Project Specific Translation

Yet, these three parts did not happen in isolation or entirely chronologically separately- in many ways they were always in process, with one informing and influencing the other, developing together. The design implementation, occurring at the end had the least amount of time dedicated to it but yet was extremely critical in fully understanding the first two parts. There were points where I got stuck in the design process and used my list of lessons learned, which developed into the “Components in an Architectural Framework for a Biophilic Design Approach”, to make decisions, evaluating if decisions were aligning with lessons learned, referencing projects for design approaches and referring back to research notes to make sure to stay rooted in the understanding of biophilia and biophilic design. I also continued to use my framework of analysis when visiting projects in Seattle for program research that helped inform design implementation strategies. This series of explorations is hopefully just one step in a further refinement of an architectural design approach that is influenced by biophilia and biophilic design.

TRAILMARKERS

“At one point after reaching daycamp buildings (Punstijärvi on the map), down a path that was worn into the groundcover but after 5 minutes or so I realized I hadn’t seen any markers in a while. To the distance I saw a blue marker- but those aren’t the ones I was following. At that point I realized I must have taken a wrong turn and went back the way I came until I once again found the comfort of the red markers. It got me thinking what a great comfort it was, that every once in a while you get confirmation that you are fact headed in the right direction. Wouldn’t it be nice to have that in life? Even with this trip, I often wonder am I doing the right things, going to the right places. In some ways it’s wonderful and a rare opportunity to have quite an open experiential plate, but it can also be quite daunting.

My hike continued and I came across one of the first wooden plank water crossings.

At that moment I had déjà vu... I don’t remember exactly when but I had a dream where I had been in a very similar place. It was one of those moments that hits you to the core. Perhaps life does have trailmarkers- not as obvious as the bright red ones, but little queues that you are in fact on the right track you just have to be paying attention and open to seeing them.” (Note: soon after returning from this trip to Sampi and the Arctic Circle, I found out that one of my relatives had gotten some ancestral genetic tests done- their maternal lineage, same as mine, indicated a rare DNA group found amongst Sami’s that currently live in and around the villages of Inari, Finland.)

This excerpt is taken from my blog post ” Trailmarkers. Pielpajärvi Wilderness Church, Inari, Finland.”and in many ways is a representation of this thesis process. I didn’t always know if I was going in the right path, but in the end the journey is one that I will stay with me and continue on. As much as thesis is about the journey, there is still a final goal to achieve. Although perhaps I wasn’t able to develop an architectural design as far as I would have liked, I did achieve the goal I set for myself. Through this thesis process, I ended up approached a design problem very differently, with new insight and perspective than I would have given the same scenario a year ago.



There are two quote's that I kept coming across during this whole thesis process and with which I'd like to conclude:

“We shape out buildings; thereafter they shape us” –Winston Churchill
&
“No Man Is An Island” – John Donne

Both of these quotes are get to the core of this thesis and the importance of biophilic design. I am just beginning to understand the symbiotic relationship between us and our built environment and how that understanding can inform design that “does more good”, both in shaping us and impacting more than just our island.

As Donne states, “No Man (or Woman) Is An Island”... and I could have not done this alone.

Thank you, I am grateful.

my family, you has instilled in me a life long passion for learning and travelling and have supported and put with all my crazy endeavors- who knows what is next.

my thesis committee, Gundula, Chris, Heather and Judith, along with your support and guidance each of your unique passions and specialties have inspired and informed me along the way, shaping this thesis to be what it is.

The many opportunities that the University of Washington, its programs and staff afforded me and shaped this thesis and my graduate school experience to be as rich as it was, including Integrated Design Lab, the Scan Design Foundation and Gehl-ScanDesign Master Studio, Architecture in Scandinavia Summer Program, and especially the Valle Scholarship and Scandinavian Exchange Program, without whom this thesis would not be what it is.

Prof. Peter Kahn, whose class gave me a new perspective and understanding of the world around us and in which he encouraged all of his students to write bravely- you have something valuable to add to the conversation and should do so.

Prof. Mehlika Inanici, whose Research Practice class challenged me and created the base of much of the research included here. Barbara Erwine who is balancing the science with the aesthetic and experiential, and through her Sensory Design class is teaching students to do the same.

Kate, without whose support and confidence in me I would have had a much more difficult time making it to the finish line.

My friends who supported me and helped me along this not always easy path and former thesis students that assured me there is a light at the end of the tunnel, especially Jena, Gabbi and Justin.

The whole project team of the Willow School Health, Wellness and Nutrition Center, which sparked my interest in the topic of biophilic design and gave me the direction that brought me to where I am today.

And Sean whose support and encouragement knows no bounds, I couldn't have done it without you.

Finally, all the cafes across the globe who not only fueled the momentum behind this thesis, but made me stop, sit and appreciate and observe the world around me.

06 | LIST OF FIGURES

Photographs by author unless otherwise noted

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